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Does the nature of oil shocks matter?

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The nature of oil shocks and the global economy ☆

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Motivation

- Assessing the nature of oil price shocks between 1970 & 2006

- Discussing the design of economic policies according to the nature of oil price shocks

Outline

- A brief overview of our methods, data & results
- A brief review of the literature
- Data
- Identification strategy
- Main results and their robustness checks
- Out-of-sample simulations: what has been the nature of oil shocks since 2006?
- Policy recommendations

A brief overview of our methods, data & results

- Identification strategy: very simple!
  - We draw on… an AS/AD model!
- Methods
  - Break tests *à la* Qu-Perron (‘07), TVP analysis, cyclical correlations, VAR
- Data
  - Own measure of global economic activity for net oil-consuming countries
- Main results
  - Oil price shocks were *mainly* supply-driven between 1970 & 1992, and *mainly* demand-driven between 1992 & 2006
  - The 2008 oil price shock was *mainly* demand-driven

A brief review of the literature

- *Oil and the macroeconomy since the '70s*
  - Hamilton ('83): oil shocks are a factor of US recessions between 1949 and 1972, less so after
  - 4 explanations for a more muted impact of oil on the macroeconomy
    - Non-linear reaction of macro variables to oil shocks
    - Lower energy intensity of industrialized countries
    - Changes in economic policies
    - Changes in the nature of oil shocks

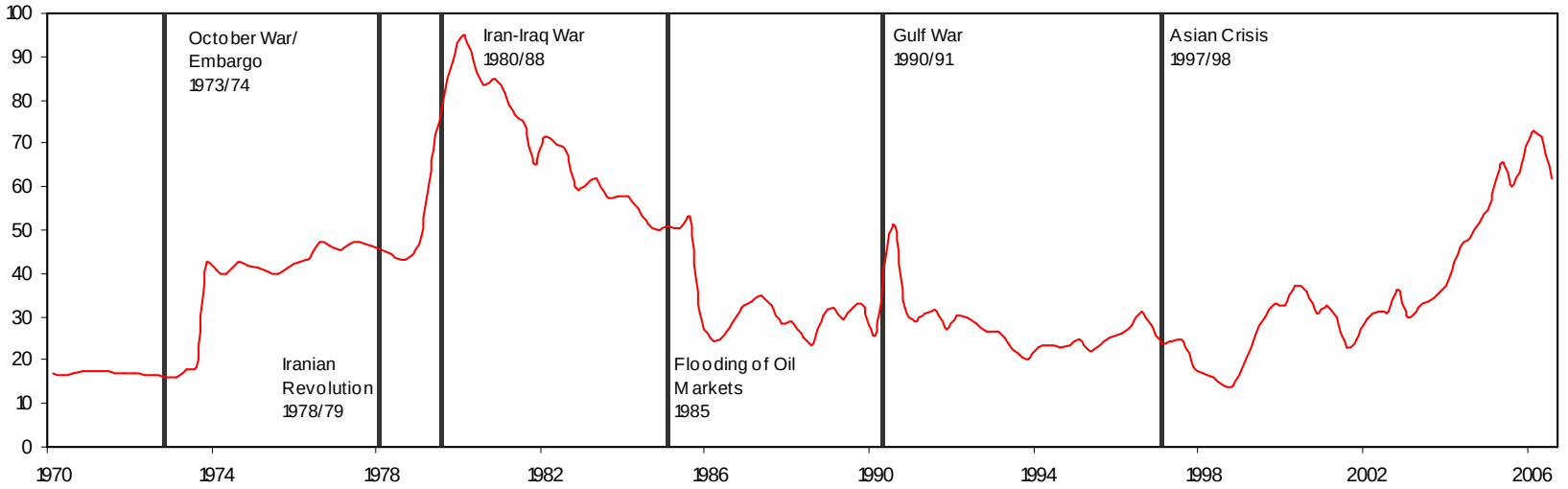
A brief review of the literature (cont.)

- Changes in the nature of oil shocks
  - Purely supply shocks in the ‘70s and purely demand shocks afterwards?
    - Most contributions argue that oil price shocks are supply- & demand-driven
    - The supply vs. demand contributions are contradictory
      - 1973/74 oil shock: supply-driven?
        - » Kilian (‘09): 15%; Baumeister & Peersman (‘08): 25%; Nobili (‘09): 60%
      - Oil shocks in the ‘70s and ‘80s: mainly supply-driven (Hamilton, ‘83, ‘96, ‘09); mainly demand-driven (Kilian, ‘02, ‘09)
      - Oil shocks in the ‘90s and early 2000s: mainly demand-driven (Hamilton, ‘09, Kilian, ‘08a,b,’09)

Data

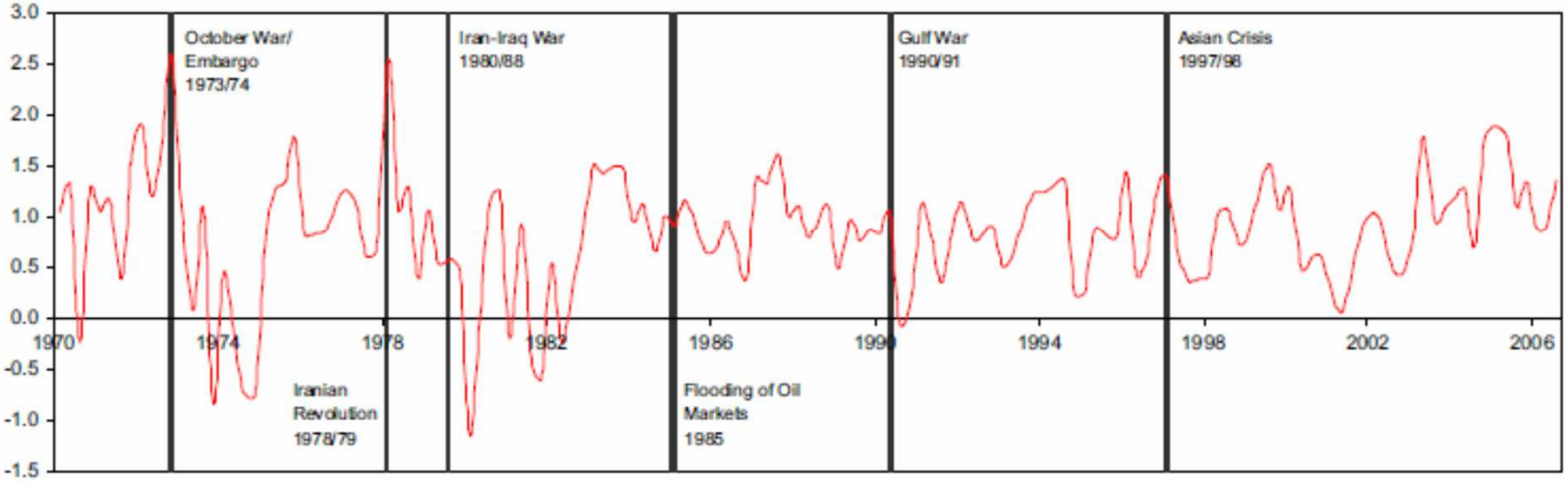
- Original series: measure economic performance of *net* oil consuming countries
  - 16 countries, 61% of world oil consumption ’70-’06
  - quarterly real GDP, weighted by share of oil consumption
  - 26% world production of oil in 1970/19% in 2006
- Real price of oil
  - Theoretically consistent
  - Best measure of shock’s magnitude & duration

Real price of oil (US $)



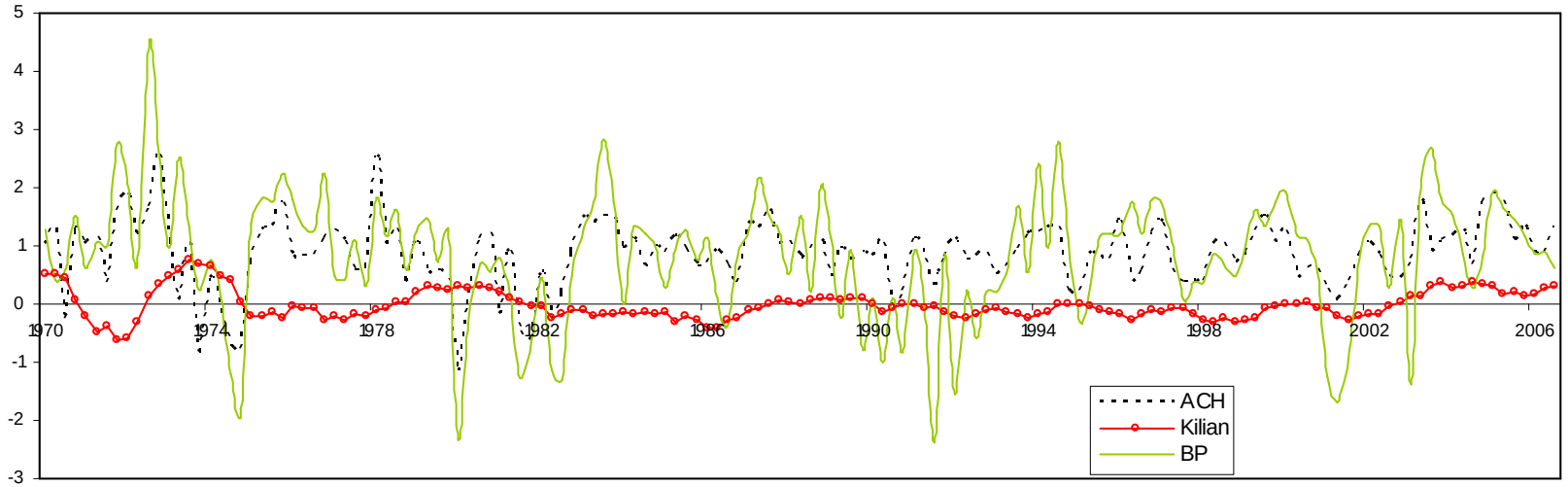
Real GDP of *net* oil consumers

(Percentage change, quarter-over-quarter)



Data (cont.)

Figure 2 – Different indexes of global real economic activity



Note: ACH stands for the authors' index; Kilian for Kilian's, and BP for Baumeister and Peersman's
Sources: Christiane Baumeister, Lutz Kilian's personal webpage

Corr. Coeffct between indexes of global real eco activity: +0.62 (ACH-BP); -0.16 (ACH-Kilian); -0.01 (BP-Kilian)
Corr. Coeffct between the real price of oil and indexes of global real eco activity: 0 (ACH & BP), >0 (Kilian)

Identification strategy

- AS/AD model:

Market-based

	Oil production	Oil price	Global output
Supply-driven shock	< 0	> 0	< 0
Demand-driven shock	> 0	> 0	≥ 0

- Draws on Smith ('09)
- Consistent with DSGE models with endogenous oil price formation process (Nakov & Pescatori, '10, Nakov & Nuño, '11)
  - the nature of an oil price shock can be identified by the co-movement between oil prices & output:
    - oil price and output co-movement is positive in the case of an endogenous demand shock and *negative* in the case of an *exogenous* supply shock

Main results

Table 1
Testing structural break in the oil prices – macroeconomy relation.

Oil demand shocks $P_t = \alpha_y + \beta_y Y_{t-1}$			
Maximum number of breaks allowed[a]	4 breaks		
SupLR test: 0 vs. 1	22.42***		
SupSEQ test: 1 vs. 2	22.70***		
SupSEQ test: 2 vs. 3	15.69		
Estimated break dates	**1979Q4**	**1988Q3**	
90% interval confidence	1974Q4–1983Q1	1983Q2–1992Q1	
OLS estimates	α	β_y	Sigma resid.
1st regime	5.48	0.46	461
2nd regime	−3.19	0.06	94
3rd regime	−8.83**	12.67***	188
Oil supply shocks $Y_t = \alpha_p + \beta_p P_{t-1}$			
Maximum number of breaks allowed[a]	4 breaks		
SupLR test: 0 vs. 1	39.75***		
SupSEQ test: 1 vs. 2	18.39**		
SupSEQ test: 2 vs. 3	20.04		
Estimated break dates	**1987Q3**	**1993Q3**	
90% interval confidence	1984Q3–1987Q4	1993Q2–1994Q1	
OLS estimates	α	β_p	Sigma resid.
1st regime	0.83***	−0.01	0.53
2nd regime	0.79***	−0.01***	0.03
3rd regime	0.92***	0.01*	0.19

[a] Given the minimal length criteria of a regime (set at 20% of the total length of the sample) and the location of the breaks from the global optimization with 3 breaks there is no more place to insert additional breaks that satisfy the minimal length requirement. Numbers in parentheses are standard errors.

* Means significant at 10%. The pattern is similar with more lags.

** Means significant at 5%. The pattern is similar with more lags.

*** Means significant at 1%. The pattern is similar with more lags.

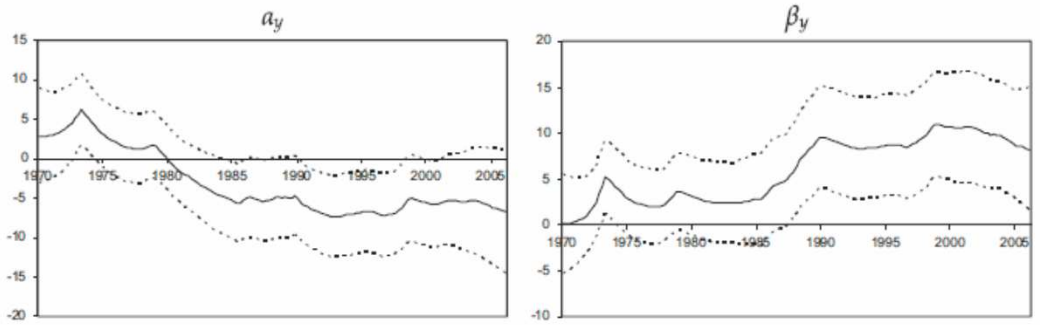


Fig. 4. TVP estimation (with one SE bands). Demand-driven process: $P_t = \alpha_{yt} + \beta_{yt} \cdot Y_{t-1}$.

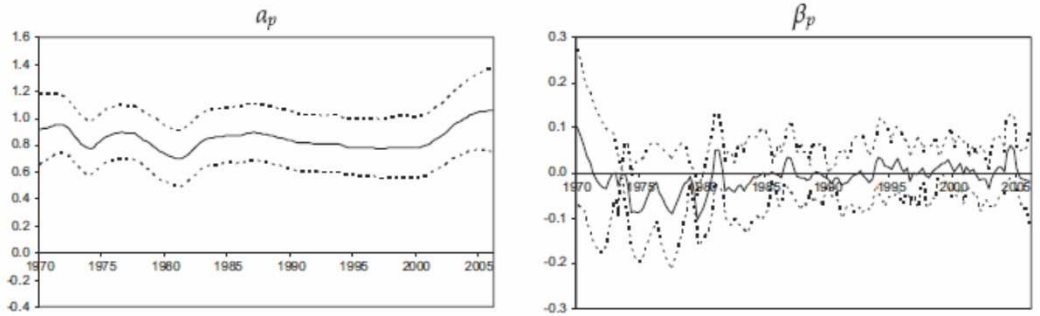


Fig. 5. TVP estimation (with one SE bands). Supply-driven process: $Y_t = \alpha_{pt} + \beta_{pt} \cdot P_{t-1}$.

Main results (cont.)

Table 2
Cyclical correlations of crude oil prices with GDP.

	$j=-4$	$j=-3$	$j=-2$	$j=-1$	$j=0$	$j=1$	$j=2$	$j=3$	$j=4$
World GDP measure 1: net oil consumers									
Total sample	0.2447**	0.1763*	0.1084	0.0421	**−0.0865**	**−0.1898***	**−0.2526****	**−0.3131****	**−0.3444****
1970Q3–1992Q3	0.3245**	0.1679	**−0.0012**	**−0.1337**	**−0.3117****	**−0.4357****	**−0.4801****	**−0.4936****	**−0.4737****
1992Q4–2006Q4	0.0268	0.2199	0.4458**	0.5713**	0.5758**	0.5285**	0.4068**	0.2009	0.024
World GDP measure 2: gross oil consumers									
Total sample	0.2257**	0.1731*	0.123	0.0721	**−0.0436**	**−0.1481**	**−0.2166***	**−0.2832****	**−0.3267****
1970Q3–1992Q3	0.3242**	0.1733	0.0132	**−0.1121**	**−0.2832****	**−0.4081****	**−0.4532****	**−0.4704****	**−0.4576****
1992Q4 2006Q4	**−0.0417**	0.1886	0.4479**	0.6066**	0.6384**	0.5887**	0.4504**	0.2368	0.0379

* Means significant at 5%.
** Means significant at 1%.

Total sample: no instantaneous clear-cut result

1st sample: the cycle of oil prices leads countercyclically GDP cycle ⟹ **supply shock**

2nd sample: procyclicality ⟹ **demand shock**

At maximum co-movement,

1st sample: 1-point increase in oil price leads to -3.5% of GDP

2nd sample: 1% GDP increase leads to +13.7% increase in the price of oil

• Main results (cont.)

Total sample: no clear-cut conclusion

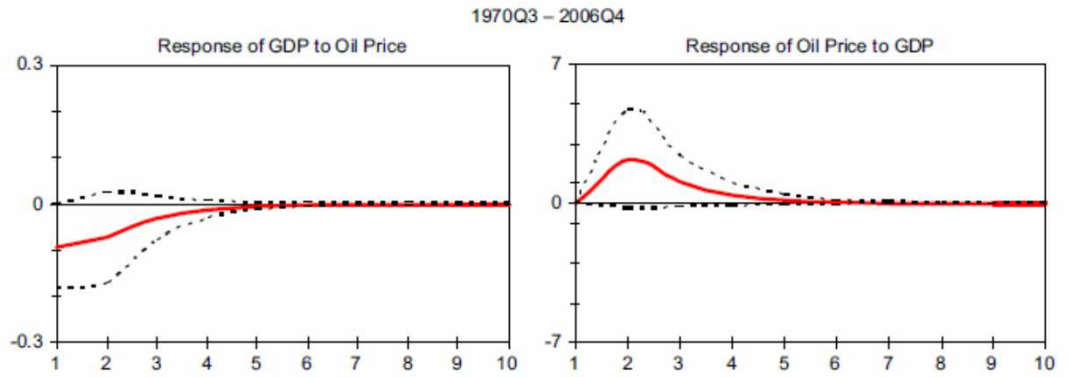
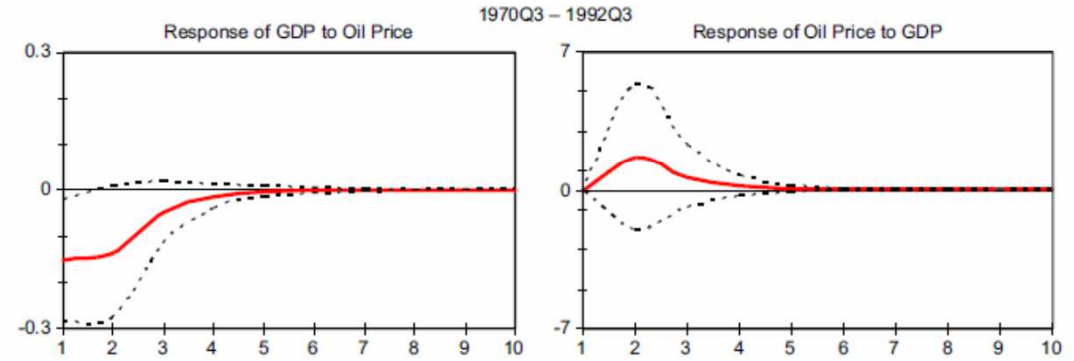
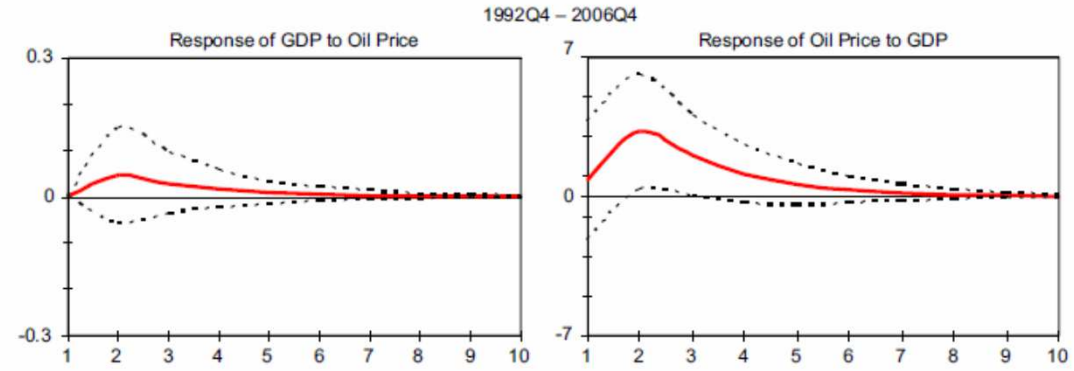


Fig. 8. Impulse response functions to GDP and oil price shocks. (with ± two SE bands).

1st sample: impulses consistent with a supply shock



2nd sample: impulses consistent with a demand shock



Robustness checks

- Use of a global economic activity for gross oil consuming countries
    - 20 countries, 67% of world oil consumption, 41% of world oil production in 1970-2006
- Use of different noise-to-variance ratios in TVP
- +/- 4 quarters' change in sample partitioning
- Use of Baxter-King filter in cyclical correlations
- Use of more lags in VARs

Out-of-sample: 2008 oil price shock

- Use of predicted variations based on VAR (estimated with actual data between 2007 & 2009);
- Use of predicted variations based on estimated coefficient of 1st, then 2nd sample VAR

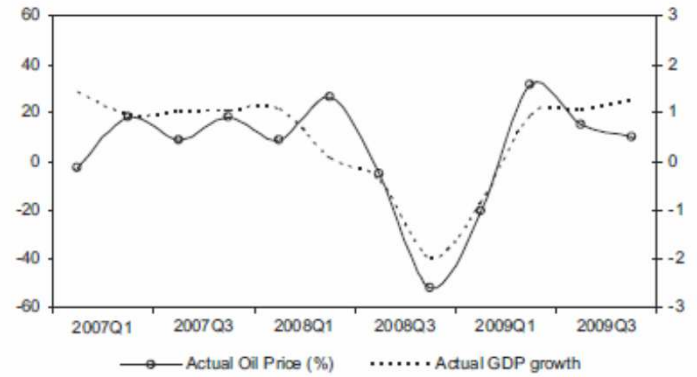
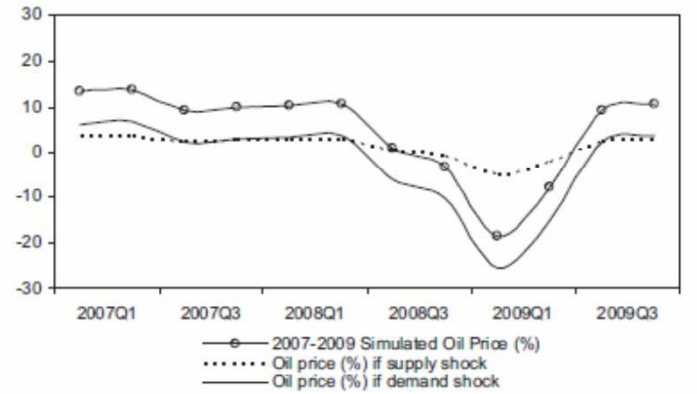


Fig. 10. Data.
Source: BP Statistical Review, Datastream, authors' calculations.



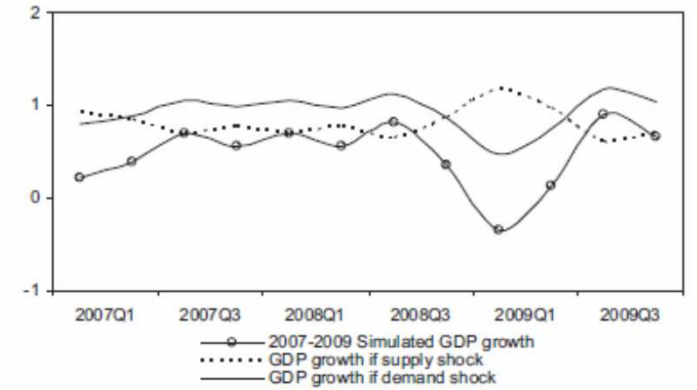
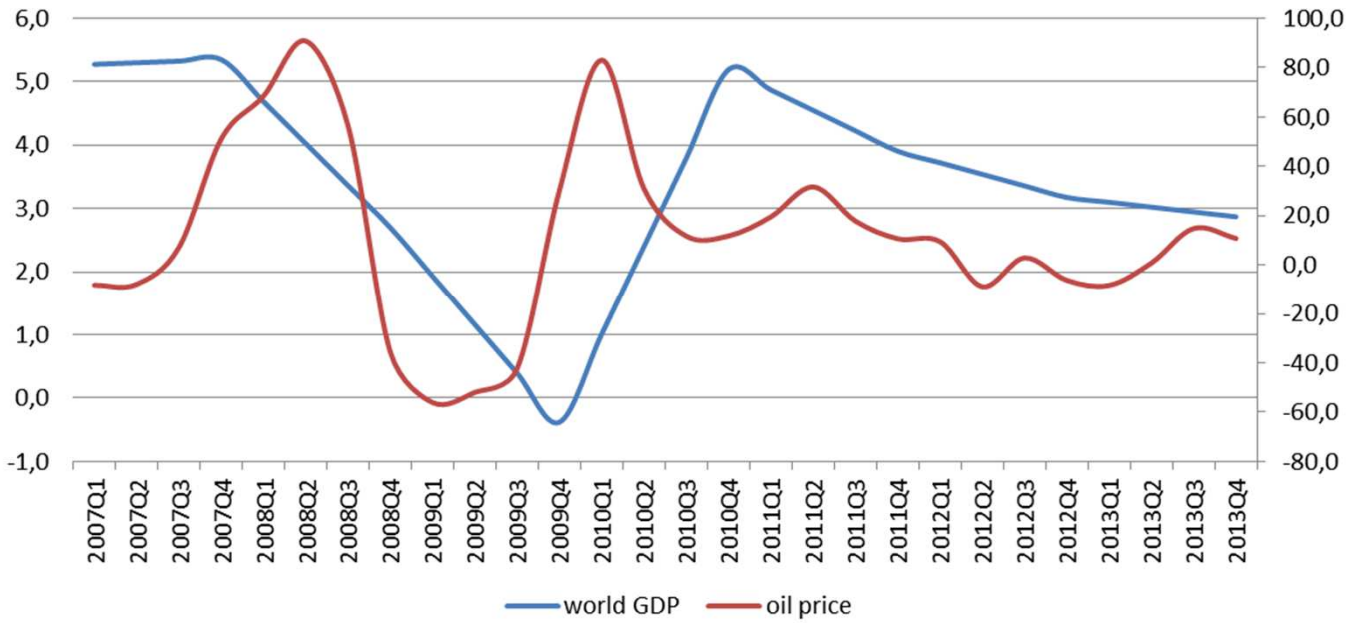


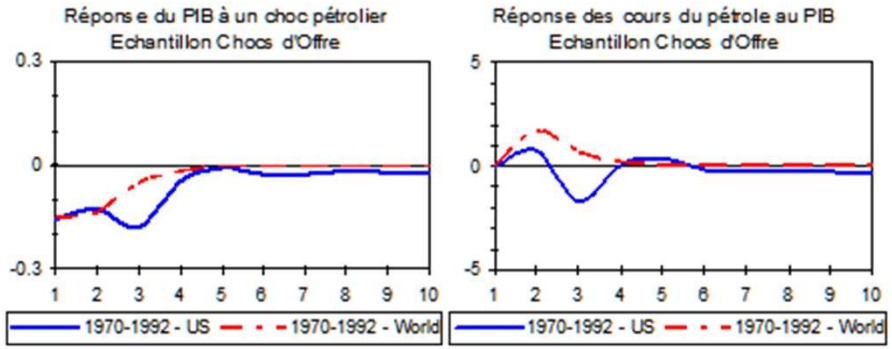
Fig. 11. Simulated oil price and global GDP.

What would the ID strategy tell us about the nature of recent oil movements?

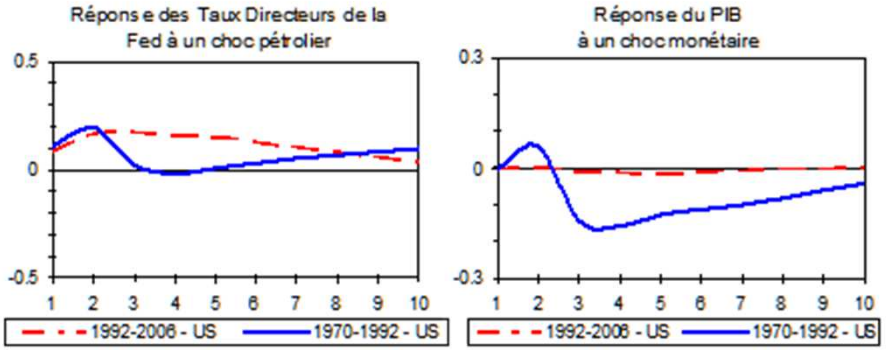


Correlation between world GDP and the price of oil = 0.23
Shocks to the price of oil have been *mainly* demand-driven. QED.

From global to national (US)



Has US monetary policy been ineffective since 1992, or has the dominant shock been demand-driven and lasting?



Source: Archanskaïa et al., Revue économique, '10

Conclusions

- The nature of oil price shocks has changed
- Recent muted impact of oil price shocks on global growth (Blanchard & Gali, ‘10, Kilian & Lewis, ‘11) is consistent with concomitant change in oil–macroeconomy relationship
- Supply-driven shocks are abrupt; demand-driven (endogenous) shocks are gradual: the nature of oil shocks matters!

Policy recommendations

	Nature of oil price shocks		
	Mainly supply-driven	Mainly demand driven	
		Co-movement btw domestic and global GDP	
		>0	<0
Policy response	Trade-off	No trade-off	Trade-off

- Requirements: good knowledge of the nature of oil price shocks **AND** good knowledge of the domestic contribution to a shock
- Information set of policymakers should thus include:
  - Co-movement between oil price and global GDP
  - Co-movement between domestic and global GDP