Dynamic relationship between cds premia volatility and oil shocks: do oil shocks matter

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Outline

Part 1:
Motivation.

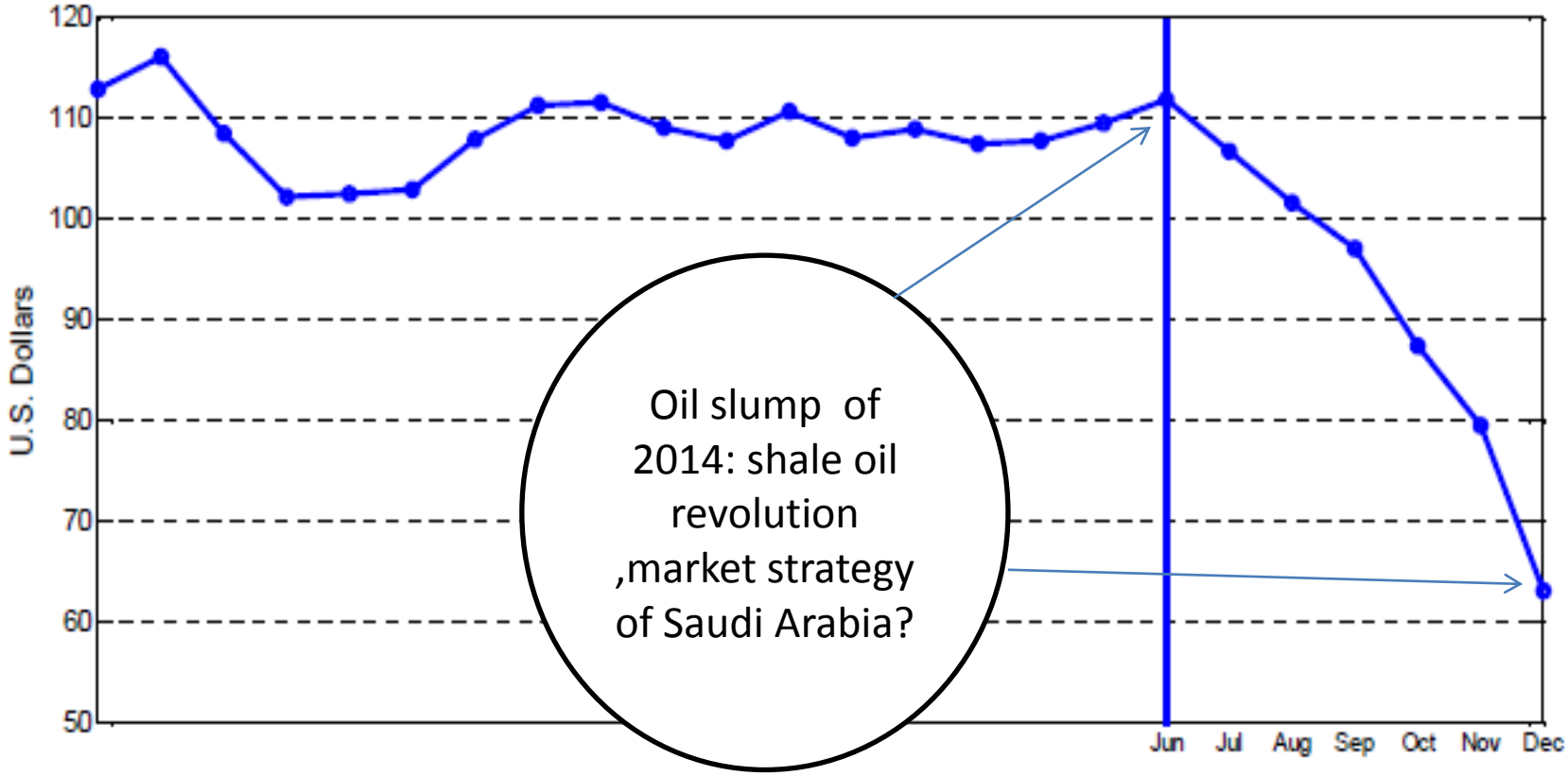
Part 2:
Objectives and Related Litterature.

Part 3: Methodology.

Chapitre 4: Results.

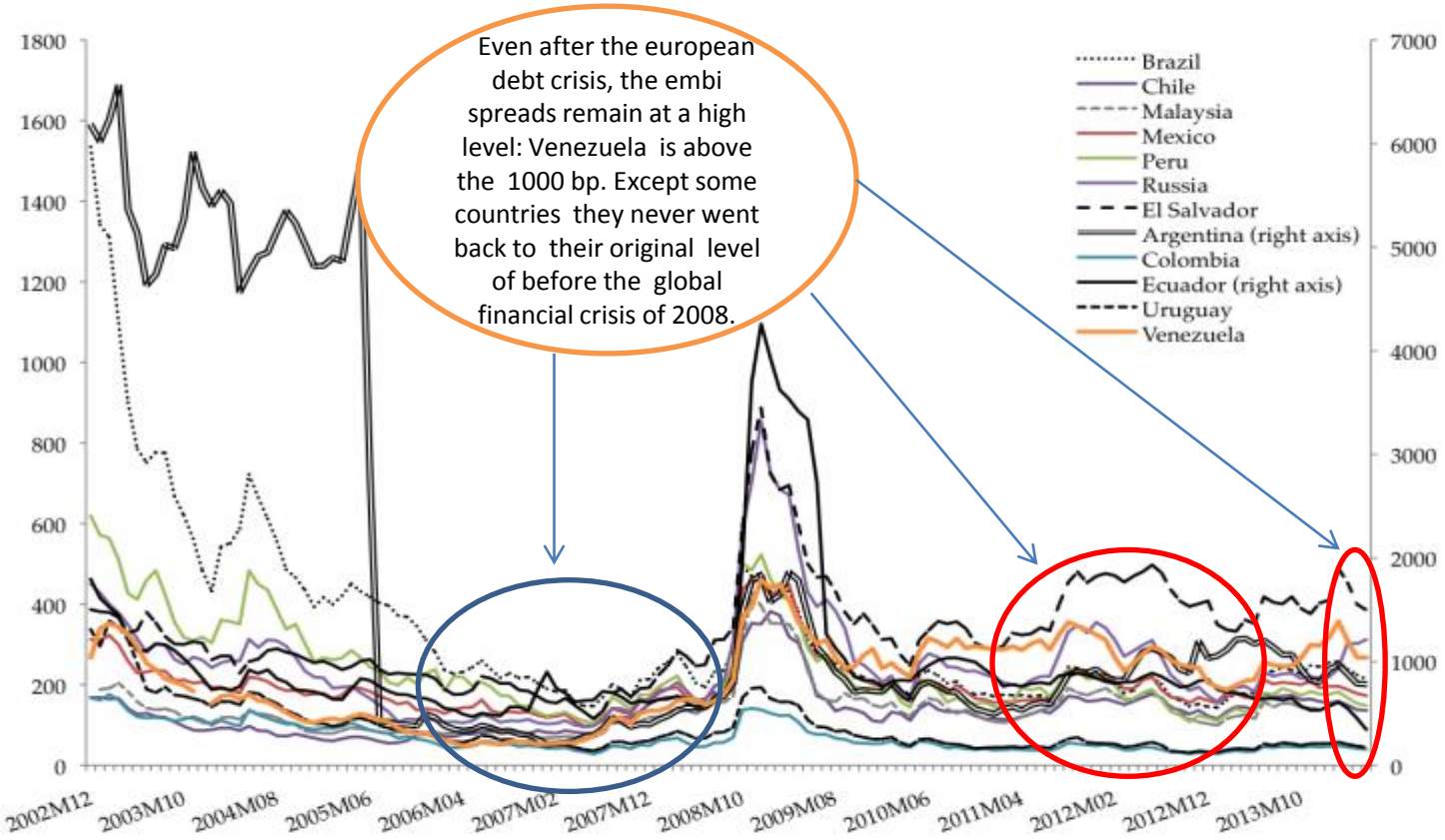
Chapitre 5: Discussions and policy recommendation.

Motivations



Source: CEPR

Motivations



Source : Dauvin,2014

Objectives and Questions

- The oil slump of 2014 had contributed to question the solvency of oil rich countries with the defaulting case of Venezuela .

- Is the appearance of extreme events on oil market have any effect on the incertitude surrounding the solvency of oil rich countries ?

- Is there a difference among countries in the perception of the credit risk that resource-rich country face in the debt market?

- Does the Uncertainty about their solvency affect the price of oil?

- Do oil shocks have the same importance from one country to another on the solvency (volatility of spreads) of oil exporting countries?

Hypothesis

- Hypothesis 1: Oil shocks have different effects on sovereign credit default swaps spreads of oil rich countries.
- Hypothesis 2: The incertitude around the solvency of oil rich countries has an effect on oil prices and contribute to adress the question of solvency of oil rich countries.
- Hypothesis 3: The slump of 2014 and the european debt crisis had affected the relationship between oil shocks and sovereign cds spreads volatility of oil rich countries.

Related litterature

- Hilscher and Nosbusch (2010) find that the terms of exchange and its volatility affect the sovereign risk.
- Longstaff and Al (2011) study the effects of global factors on sovereign credit risk but do not include the role of natural resources.
- Hooper (2014) examines the effect oil reserves of sovereign spreads in a few couple of oil rich countries at a monthly basis.
- Hooper and Chuffart (2019) study the nonlinear effect of oil prices on Venezuela and Russia sovereign cds spreads by using a markow-switching model.
- Syed and Al (2017) study the directional predictability between the oil volatility index and the oil sovereign cds spreads.
- Bourie and Al (2018) study the dependence between the oil price quantiles and the spreads of the sovereign cds of the oil-exporting countries.
- None of these studies tried to go beyond the price or the reserves of oil in order to catch the role of oil markets fundamentals.

Methodology

- Cubic spline interpolation (to solve the mismatching between daily frequence of sovereign cds spreads and the monthly frequence of data related to the oil market).

- Testing symmetric and asymmetric conditional volatility modelling on the sample .

- Structural Vector Autoregressive modelling (SVAR).

Data.

- The 5 years maturity spreads of the credit defaults swaps (cds) of our 6 countries of our sample have been extracted from bloomberg.
- The supply of oil have been extracted from the site of the international energy agency (iea).
- The demand of oil have been proxied by the index of Lutz kilian that can been extracted from his website.

- The stocks of the oil market are the ratio between the total stocks of OCDE countries reported to the stocks of the United states. This variable will represent the demand for precautionary or speculative purpose.

-The deflated price of oil is obtained by dividing the price extracted from the site of international energy agency by the index of inflation.
- Our sample encompasses three of the main oil rich countries in the world (Saudi Arabia, Venezuela, Russia), and three among the small one (Norway high diversified economy) and Qatar and Kazakhstan.

Conditional Volatility modelling

* Garch(p,q) of Bollerslev (1996)

$$y_t = c + u_t \qquad u_{it} = \sigma_{i,t}\varepsilon_{it} \qquad \varepsilon_{it} \rightarrow \text{Loi elliptique ;}$$

$$\sigma^2{}_t = V(y_t|F_{t-1}) = \alpha_0 + \sum_{k=1}^{q} \alpha_k a^2_{t-k} + \sum_{h=1}^{p} \beta_h \sigma_{t-h}{}^2$$

$$\sum_{i=1}^{q} \alpha_i + \sum_{i=1}^{p} \beta_h \leq 1 \qquad \alpha_0 \geq 0, \alpha_k \geq 0, \beta_h \geq 0$$

Selection criteria of the best fitted model being given by the Akaike criteria Aic=2k-2lnL.

Conditional volatility modelling

- The GJR-GARCH(p,q) of Jagannatan and Runkle (1993).

$$\sigma_t^2 = \alpha_{i,0} + \alpha_{i,1} a_{t-1}^2 + \gamma_i I_{i,t-1} a_{i,t-1}^2 + \beta \sigma_{t-1}^2$$

- The EGARCH(p,q) of Nelson (1991).

$$\ln(\sigma_{i,t}^2) = \alpha_{i,0} + \sum_{i=1}^{q} \alpha_i \left(\varphi z_{t-i} + \gamma[|z_{t-i}| - E|z_{t-i}|\right) + \sum_{j=1}^{p} \beta_j \ln \sigma_{t-j}^2$$

$$z_{t-i} = \frac{\varepsilon_{t-i}}{\sigma_{t-i}}$$

- The FIGARCH(p,d, q) model of Baillie and Al (1996).

$$\sigma_t^2 = \alpha_0 + \left[1 - (1 - \beta(L))^{-1}(1 - \varphi(L))(1 - L)^d\right] a_t^2 + \beta \sigma_{t-1}^2$$

Structural VAR

$$Y_t = A_1^* Y_{t-1} + A_2^* Y_{t-2} + \cdots \ldots \ldots A^*{}_p Y_{t-p} + u_t$$

$$Y_t = \begin{pmatrix} Y_{1t} \\ \vdots \\ \vdots \\ Y_{kt} \end{pmatrix}$$

$$AY_t = A_1^* Y_{t-1} + A_2^* Y_{t-2} + \cdots \ldots \ldots A^*{}_p Y_{t-p} + u_t$$

$$Y_t = A^{-1} A_1^* Y_{t-1} + A^{-1} A_2^* Y_{t-2} + \cdots \ldots \ldots A^{-1} A^*{}_p Y_{t-p} + A^{-1} u_t$$

Structural VAR

$$Y_t = BY_{t-1} + BY_{t-2} + \cdots \ldots \ldots BY_{t-p} + \varepsilon_t$$

$$B = A^{-1}A_1^*$$

$$E\left[\varepsilon_t \varepsilon_t'\right] = A^{-1}DA^{-1}$$

$$\varepsilon_t = \begin{bmatrix} a_{11} & \cdots & a_{1k} \\ \vdots & \ddots & \vdots \\ a_{k1} & \cdots & a_{kk} \end{bmatrix} u_t$$

x

Structural VAR

The first row deals with the supply innovation ,second to the demand innovation , speculative demand innovation,residual innovation and cds premia innovation

$$\begin{bmatrix} \varepsilon_t^{\Delta production\ mondiale\ de\ petrole} \\ \varepsilon_t^{activité\ économique\ réelle\ globale} \\ \varepsilon_t^{\Delta\ du\ ratio\ des\ stocks\ OCDE/USA} \\ \varepsilon_t^{\Delta\ des\ prix\ du\ pétrole} \\ \varepsilon_t^{volatilité\ des\ CDS-5Y} \end{bmatrix} = \begin{bmatrix} a_{11} & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{bmatrix} \times \begin{bmatrix} u_t^{choc\ lie\ a\ l'offre} \\ u_t^{choc\ lié\ à\ la\ demande} \\ u_t^{choc\ spéculatif} \\ u_t^{\Delta\ choc\ résiduel} \\ u_t^{choc\ de\ volatilité\ des\ CDS} \end{bmatrix}$$

Results of best fitted conditional volatility modelling.

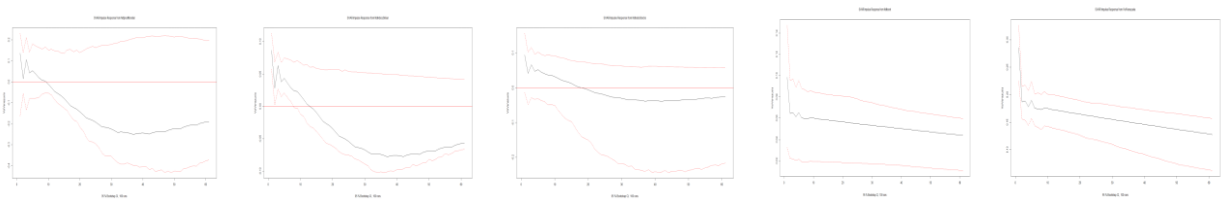
	Panel Avril 2010-Mars2017			Depel. Avril 2010-Mai 2014			Depel. Juin 2014-Mars 2017		
	Normal	Student	Ged.	Normal	Student	Ged.	Normal	Student	Ged.
Garch(1,1)									
Oil	-7.08	-7.08	-7.07	-7.40	-7.44	-7.44	-6.427	-6.48	-6.49
Arabic	-	-9.97	-5.44	-7.64	-10.99	-5.52	-	-8.51	-4.475
Venezuela	-4.96	-5.30	-5.56	-4.97	-5.39	-5.45	-5.005	-5.176	-5.251
Nigeria	-5.45	-6.65	-	-5.45	-5.96	-	-5.590	-8.57	-8.990
Russia	-5.56	-5.72	-5.81	-5.46	-5.69	-5.88	-5.70	-5.78	-5.78
Qatar	-6.14	-7.61	-5.78	-6.15	-7.61	-	-6.15	-7.59	-8.64
Kazakhstan	-5.98	-6.55	-4.56	-5.58	-5.76	-	-6.61	-7.47	-4.898
EGarch(1,1)									
Oil	-7.08	-7.08	-7.07	-7.40	-7.44	-7.44	-6.471	-6.49	-6.51
Arabic	-6.15	-9.54	-10.05	-6.97	-10.55	-11.47	-5.97	-8.14	-8.76
Venezuela	-4.95	-5.32	-5.57	-4.95	-5.42	-5.46	-5.00	-5.15	-5.23
Nigeria	-5.45	-6.70	-7.66	-5.49	-6.11	-	-5.56	-8.178	-9.045
Russia	-5.57	-5.75	-5.83	-5.48	-5.72	-5.91	-5.75	-5.80	-5.82
Qatar	-6.14	-7.55	-8.85	-6.14	-7.56	-8.50	-6.20	-7.50	-
Kazakhstan	-5.89	-6.39	-	-5.604	-5.76	-	-6.61	-7.47	-4.89
Gjr-Garch(1,1)									
Oil	-7.08	-7.07	-7.08	-7.42	-7.44	-7.45	-6.45	-6.48	-6.50
Arabic	-6.57	-9.97	-4.03	-7.72	-10.98	-5.48	-5.96	-8.51	-3.67
Venezuela	-4.97	-5.29	-5.56	-4.97	-5.58	-5.45	-5.02	-5.18	-5.25
Nigeria	-5.45	-6.65	-7.47	-5.45	-5.97	-6.47	-5.58	-8.57	-9.15
Russia	-5.57	-5.75	-5.82	-5.479	-5.708	-5.88	-5.72	-5.78	-5.79
Qatar	-6.16	-7.29	-8.89	-6.15	-7.50	-	-6.19	-7.59	-8.68
Kazakhstan	-5.89	-6.55	-4.07	-	-5.76	-	-6.63	-7.46	-4.65
FIGarch(1,1)									
Oil	-7.02	-7.06	-7.07	-7.42	-7.45	-7.44	-6.42	-6.47	-6.49
Arabic	-6.66	-9.97	-5.58	-7.44	-10.98	-5.47	-5.86	-8.50	-5.71
Venezuela	-4.95	-5.29	-5.36	-4.96	-5.58	-5.44	-4.99	-5.17	-5.22
Nigeria	-5.45	-6.64	-	-5.45	-5.97	-6.47	-5.40	-8.55	-9.263
Russia	-5.56	-5.72	-5.80	-5.46	-5.68	-5.87	-5.696	-5.77	-5.785
Qatar	-6.10	-7.61	-	-6.12	-7.61	-8.09	-6.149	-7.58	-8.405
Kazakhstan	-5.98	-6.55	-4.75	-5.58	-5.76	-6.04	-6.618	-7.45	-4.59

Analysis of the impulse response function of cds spreads volatility of Norway to the different shocks before and after the oil slump of 2014.

Graphique des fonctions de réponses impulsionnelles

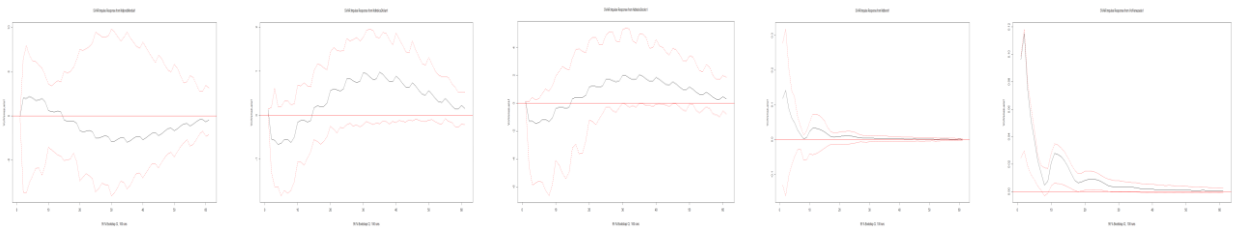
Pays : Venezuela sur la période 2010-2017.

Choc d'offre | *Choc de demande* | *Choc spéculatif* | *choc résiduel* | *choc de volatilité des cds*

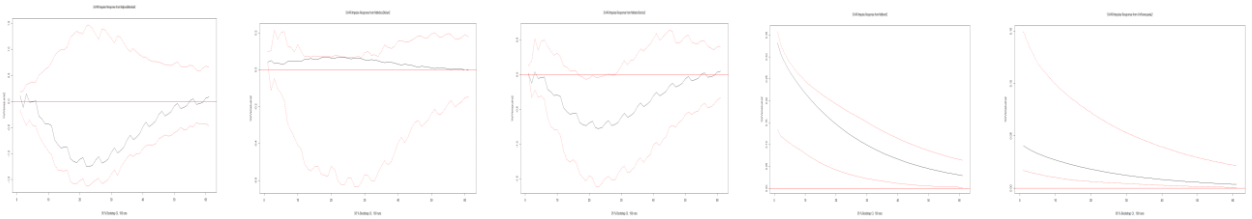


Pays : Venezuela sur la période 2010-2014.

Choc d'offre | *Choc de demande* | *Choc spéculatif* | *choc résiduel* | *choc de volatilité des cds*



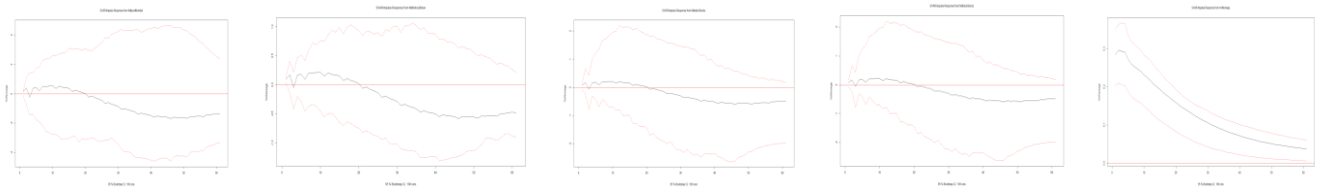
Pays : Venezuela sur la période 2014-2017.



Analysis of the impulse response function of cds premia volatility of Norway to the different shocks before and after the oil slump of 2014.

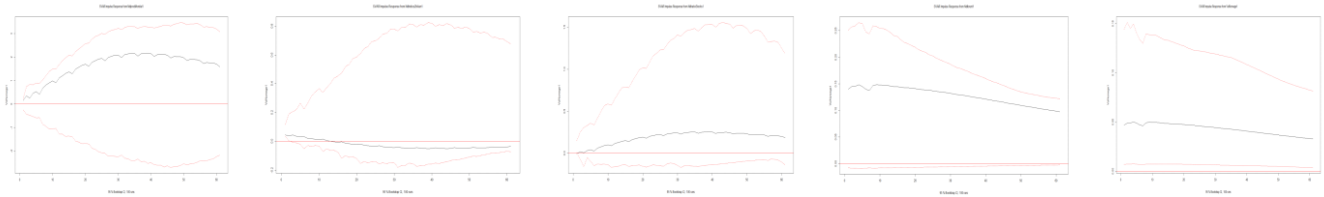
Pays : Norvège sur la période 2010-2017.

Choc d'offre *Choc de demande* *Choc spéculatif* *choc résiduel* *choc de volatilité des cds*



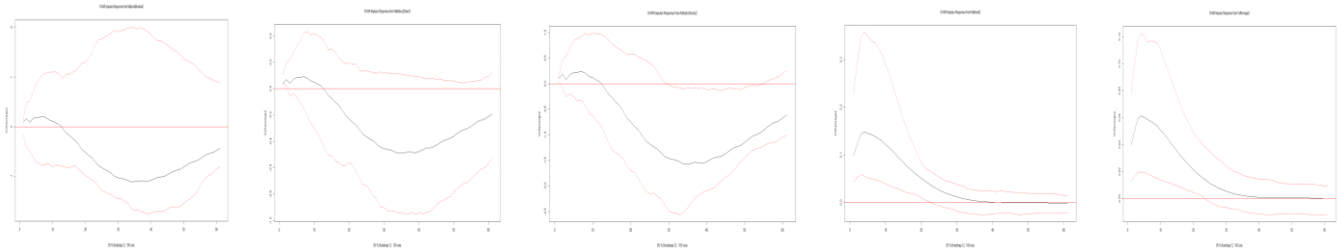
Pays : Norvège sur la période 2010-2014.

Choc d'offre *Choc de demande* *Choc spéculatif* *choc résiduel* *choc de volatilité des cds*



Pays : Norvège sur la période 2010-2014.

Choc d'offre *Choc de demande* *Choc spéculatif* *choc résiduel* *choc de volatilité des cds*



Analysis of the forecasted error variance decomposition (fevd) during the European debt crisis, before and after the 2014 oil slump.

Moving from left to the right of each 5 columns correspond to supply shock, demand shock ,speculative shock, residual shock and volatility shocks on cds premia

First Important contribution is in red color

Second important contribution in black

	During the European debt crisis					Après la crise de la dette et avant la chute de 2014					Après la chute de 2014				
Arabie															
1jour	21.65	**24.46**	**22.63**	14.98	16.25	10.19853	**9.291263**	13.01538	26,0246	41,470	1.7051	6.6451e-03	**1.9759**	0.4626	95.8495
5jours	29.75	**32.92**	**37.32**	4.36e-04	5.40e-04	69.54917	**16.909628**	13.53335	5.88e-03	1.97e-03	69.2587	2.2454e-05	**30.5631**	0.0172	0.1607
15jours	29.75	**32.92**	**37.32**	4.78e-04	2.52e-04	69.80917	**16.789050**	13.39844	2.88e-03	4.55e-04	78.1070	1.0576e-05	**21.0630**	0.0096	0.0298
30jours	29.75	**32.91**	**37.32**	3.15e-04	1.59e-04	69.65447	**16.867321**	13.47693	1.17e-03	1.04e-04	75.6321	9.0721e-06	**24.3549**	0.0031	0.0096
60jours	29.75	**32.92**	**37.32**	1.92e-04	9.18e-05	69.67730	**16.856417**	13.46541	8.0308e-04	6.45e-05	70.1855	1.1168e-05	**29.8041**	0.0026	0.0077
Venezuela															
1jour	**17.05**	21.49	24.970	23.873	12.601	21.754	22.887	**39.77153**	15.536	0.053	20.5693	2.9347	**0.2666**	75.8635	0.3656
5jours	**21.53**	23.89	28.65	16.89	9.02	18.113	24.033	**41.84783**	15.950	0.0547	18.9348	3.2329	**8.9966**	68.4808	0.3546
15jours	**29.302**	27.48	34.372	5.748	3.092	32.405	19.670	**36.948**	10.93	0.038	65.7529	0.6026	**28.1861**	5.4283	0.0299
30jours	**30.903**	28.05	35.329	3.725	1.989	57.496	13.555	**28.178**	0.769	0.0026	70.6823	0.2957	**27.9398**	1.0759	0.00604
60jours	**31.28**	28.22	35.556	3.225	1.705	59.293	13.093	**27.378**	0.232	0.0008	70.8482	0.2849	**27.9707**	0.8910	0.00504
Kazakhstan															
1jour	**17.01**	25.02	21.626	24.330	12.00	**21.75408**	22.88728	**39.77153**	15.5345956	0.0525	18.5756	6.5632	**0.5718**	41.7683	32.5208
5jours	**34.46**	28.937	36.246	0.232	0.118	**18.11335**	24.03338	**41.84783**	15.9506620	0.054	82.8896	0.5892	**15.6948**	0.4625	0.3637
15jours	**34.495**	29.048	36.262	0.125	0.068	**32.40534**	19.67038	**36.94836**	10.9380954	0.038	83.6808	0.5889	**15.5300**	0.1124	0.0877
30jours	**34.484**	29.057	36.257	0.129	0.071	**57.495**	13.555	**28.178**	0.7685134	0.0026	83.7635	0.5867	**15.5212**	0.0721	0.0563
60jours	**34.419**	29.141	36.270	0.108	0.06	**59.2937**	13.0939	**27.3788**	0.2325	0.0008	3.7693	0.5867	**15.5213**	0.0688	0.0537
Norvège															
1jour	**17.016**	25.020	21.626	24.330	12.005	**25.07707**	35.408	**19.187324**	19.890	0.436	**28.6848**	5.3037	31.2031	30.0007	4.8075
5jours	**34.465**	28.937	36.246	0.232	0.118	**96.81489**	1.238	**1.785063**	0.157	0.0036	**29.4764**	5.5928	36.5312	24.3073	4.0921
15jours	**34.495**	29.048	36.262	0.125	0.068	**97.45480**	0.9286	**1.525451**	0.0889	0.0021	**28.1895**	5.4095	41.3589	21.3878	3.6541
30jours	**34.484**	29.057	36.257	0.128	0.071	**97.92210**	0.7016	**1.331319**	0.043	0.0010	**30.4976**	6.0509	62.3103	0.9737	0.1672
60jours	**34.41**	29.141	36.270	0.108	0.060	**98.06737**	0.6353	**1.273329**	0.0234	0.0005	**30.9267**	6.1299	62.6569	0.2443	0.0419
Russie															
1jour	**17.051**	21.514	24.972	23.880	12.582	30.67845	21.716826	**41.843401**	5.68525255	0.0760661909	**18.3877**	5.9543	5.2297	69.9146	0.5135
5jours	**35.601**	27.392	35.880	0.711	0.4141	85.85777	2.730053	**10.926068**	0.47946574	0.0066476448	**16.5585**	6.1894	4.5913	72.1201	0.5405
15jours	**35.563**	27.441	35.916	0.6785	0.400	90.86659	1.749939	**7.284152**	0.09786121	0.0014581287	**11.6815**	6.7788	3.2551	77.7004	0.5839
30jours	**35.134**	28.057	36.394	0.261	0.151	87.12076	2.625583	**10.220694**	0.03247367	0.0004850012	**7.7558**	7.2795	2.1706	82.1752	0.6187
60jours	**17.052**	21.514	24.972	23.880	12.582						**6.0113**	7.4847	1.6945	84.1745	0.6347
Qatar															
1jour			24.977	23.885	12.5611	**22.91146**	**22.815861**	37.594505	16.64997737	2.819549e-02	**18.1385**	6.6944	5.3506	69.3521	0.4642
5jours	**17.054**	21.5209	34.412	3.289	1.800	**91.57602**	**5.994490**	2.387820	0.04159029	7.597530e-05	**12.2497**	7.4750	3.6563	76.1074	0.5113
15jours	**34.298**	26.1986	35.698	1.345	0.738	**91.93868**	**5.817721**	2.219223	0.02433249	4.366798e-05	**39.3739**	4.8413	8.8373	46.6329	0.3143
30jours	**34.911**	27.306	36.606	0.150	0.0818	**92.08758**	**5.736858**	2.156648	0.01887834	3.186707e-05	**57.6304**	2.8410	12.9071	26.4429	0.1783
60jours	**34.915**	28.245	24.97764	23.8856417	12.56119436	**92.15798**	**5.707688**	2.118854	0.01545249	2.579548e-05	**58.9581**	2.6946	13.1911	24.9875	0.1685
	17.05456	21.52096													

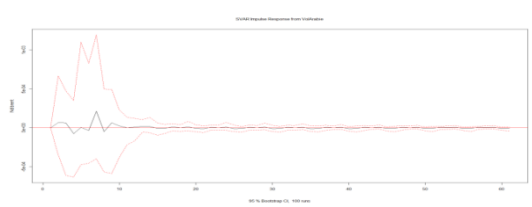
Analysis of the impulse response function of cds spreads volatility of Saudi Arabia, Venezuela and Kazakhstan on oil prices

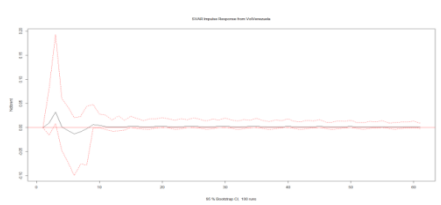
SAUDI ARADIA

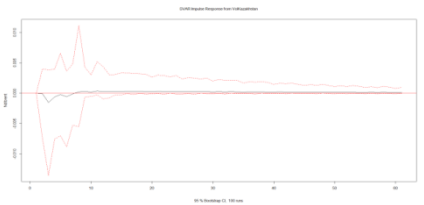
VENEZUELA

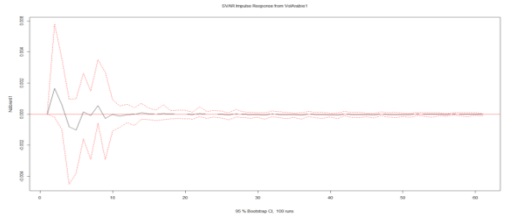
KAZAKHSTAN

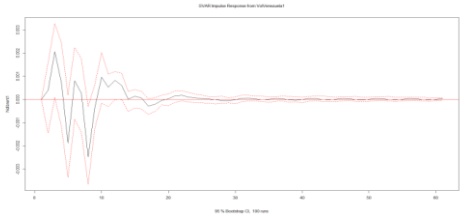
Full sample

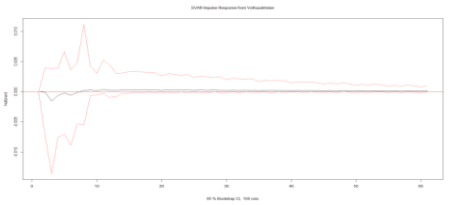


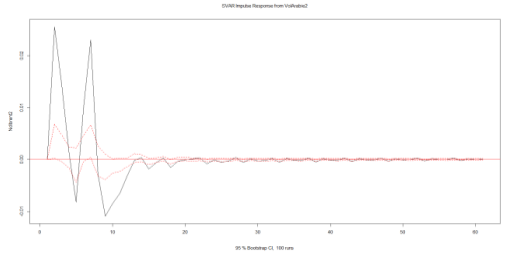


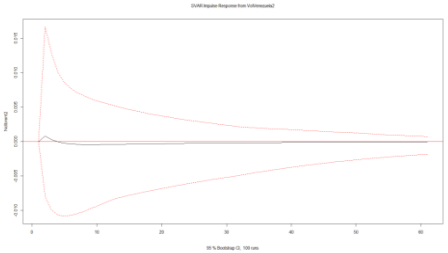


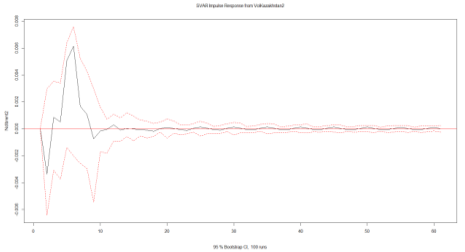












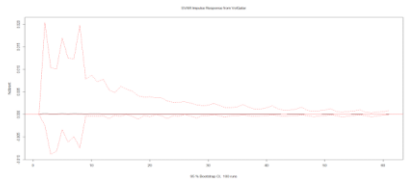
Analysis of the impulse response function of cds premia volatility of Saudi arabia, Venezuela and Kazakhstan on oil prices

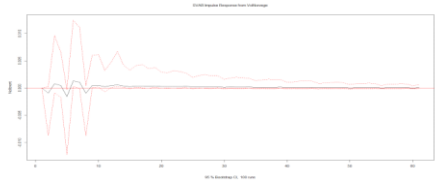
QATAR

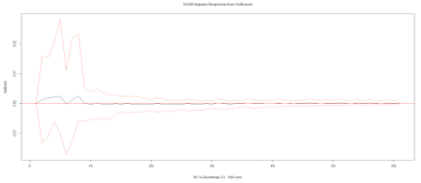
NORVEGE

RUSSIE

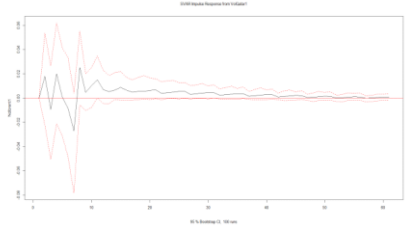
Période totale.

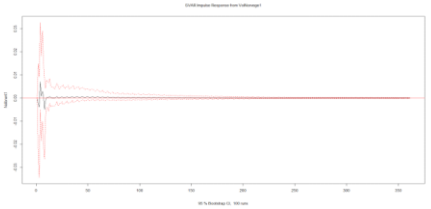


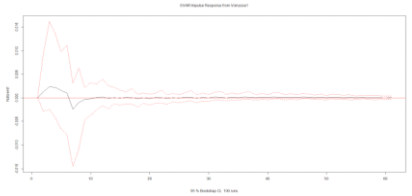




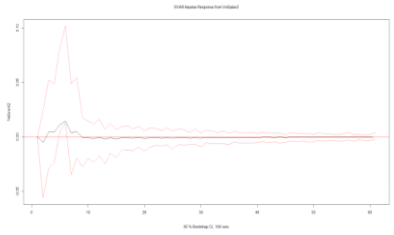
Pré-chute.

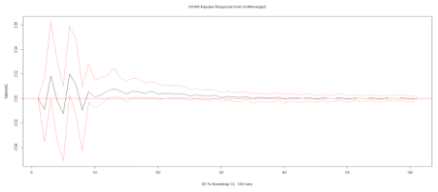


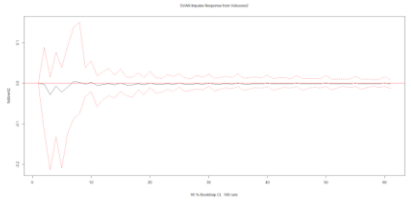




Post-chute







Conclusion and policy implication.

Conclusion

The sensitivity of cds spreads volatility to the oil prices shocks are different across countries.

The Big oil rich countries like Venezuela are sensitive to demand and speculative shocks .

- The sensitivity of cds spreads volatility have been exacerbated after the oil slump . The demand, the supply or speculative shocks have an effect that have not been necessary statistically significant. In the case of Norway only the residual shocks related to geopolitical matters in the oil market became statistically significant after the slump with the shock on volatility of cds spreads.
- The speculative shocks and demand shocks became statistically significant after the slump of 2014 in the case the Venezuela.

The contribution of the different shocks to cds spreads volatility are different according to the market into stress.

- During a period of stress on the debt market (European debt crisis) the speculative component of the oil shocks contribute the most to the variance of the cds spreads volatility followed by the supply component for all the countries. Without stress on debt and oil market the supply side shocks contribute the most to the variance of cds spreads volatility for all countries of our sample.
- And finally shock on the volatility of cds spreads volatility have statistically significant effect on the prices of oil. The effect is short living and differs across countries.

Policy implication

- Policymakers and risk managers must integrate the evolution of the fundamental factors of the oil market in the assessment of the cost of sovereign debt because the different sources of price variations are likely to increase the uncertainty about the solvency of the latter and therefore induce a high cost of borrowing. Because in most case the process of price discovery in the debt market goes from sovereign cds spreads to sovereign bond (Coudert and Gex ,2010). So the more volatile are sovereign cds, the more unstable will be the price of sovereign bonds.
- The countries concerned should also consider loans or repayments out of periods of stress in both the debt and oil markets.
- For importers, regular monitoring of the creditworthiness of exporting countries (the major exporters) should now be considered as a factor in raising the price of oil. In fact the need of revenues to repay debt or the interest can probably affect the supply of the oil in the market and so the prices . Due to the shale oil revolution in the USA and Canada, traditional exporters have no more market power than they used to be. So the only way for them to make more revenues is to push or cut-down the supply of oil making the prices more unstable.