# MACRO FACTORS IN OIL FUTURES RETURNS[1]

## Yannick Le Pen[2], Benoît Sévi[3]

**ABSTRACT.** We investigate the macro factors that can explain the monthly oil futures return for the NYMEX WTI futures contract for the time period 1993:11 to 2010:03. We build a new database of 187 real and nominal macroeconomic variables from developed and emerging countries and resort to the large factor approximate model to extract 9 factors from this dataset. We then regress crude oil return on several combinations of these factors. Our best model explains around 38% of the variability of oil futures return. More interestingly, the factor which has the largest influence on crude oil price is related to real variables from emerging countries. This result confirms the latest finding in the literature that the recent evolution in oil price is attributable to change in supply and demand conditions and not to the large increase in trading activity from speculators.

*JEL* Classification: C22; C32; G15; E17.
Keywords: Crude Oil Futures; Large Approximate Factor Models; Macro Determinants.

**RÉSUMÉ.** Nous évaluons l'importance des variables macroéconomiques des économies développées et émergentes dans la détermination des rendements du contrat futures WTI échangé sur le NYMEX pour la période allant de novembre 1993 à mars 2010. À cette fin, nous construisons une nouvelle base de données mensuelles de 187 variables macroéconomiques, réelles et nominales, de pays développés et émergents. Le modèle à facteurs approximés nous permet d'extraire 9 facteurs représentant un pourcentage significatif de l'information contenue dans cette base. Nous considérons un grand nombre de spécifications à partir de cet ensemble de facteurs. Notre meilleur modèle explique environ 38% de la variabilité des rendements du pétrole. De plus, le facteur ayant le pouvoir explicatif le plus élevé est lié aux variables réelles des pays émergents. Ce résultat confirme les dernières analyses académiques donnant aux modifications de l'offre et de la demande, dues notamment à la croissance des économies émergentes, une influence supérieure à celle des activités spéculatives dans la détermination du prix du pétrole.

Classification *JEL* : C22 ; C32 ; G15 ; E17.
Mots-clefs : Marché à terme du pétrole ; modèles à facteurs approximés ; déterminants macroéconomiques.

---

2. Université de Paris Dauphine, LEDa-CGEMP, Place du Maréchal de Lattre de Tassigny, 75775 Paris Cedex 16 and Chaire Economie du Climat, Email: yannick.le_pen@dauphine.fr.

3. Corresponding author: Benoît Sévi, Aix-Marseille School of Economics. Château La Farge, Route des Milles, 13290 Aix-en-Provence Les Milles, France, Email: benoit.sevi@univ-amu.fr.

## 1.  INTRODUCTION

Crude oil is by far the most traded commodity around the world and the evolution of its price is of utmost importance for almost all economies.  The large increase in the trading activity of financial agents on the crude oil market has led the financial press to consider these speculators as responsible for the dramatic increase in price of the late 2000s.[4] Recent academic literature has examined the possible role for speculation in shaping the price of oil.  In particular, Büyükşahin *et al.*  (2009), Hamilton (2009), Kilian (2009), Büyükşahin and Harris (2011), Parsons (2010), Kaufmann (2011) and Tang and Xiong (2011) report empirical findings that lead to consider the dramatic increase of trading activity in the NYMEX WTI futures contract as a minor factor in the 2008 price peak formation.  These authors show that among traders, the category of speculators has grown spectacularly but resorting to causality analysis, they do not identify any effect going from speculation to price.  Further analysis in, for instance, Hamilton (2009) attributes the 2008 oil price increase to what is called a "demand shock" which may have its origin in Asia and more particularly in China.[5]

These results lead to a fundamental question:  how is crude oil price determined if not by speculation?[6] Indeed, if the increasing presence of funds, bankers and swaps dealers, among others, in the futures market did not cause the crude oil price increase in 2008, one may wonder what are the determinants of the oil price which is a critical input in almost all our macroeconomic models.  This question has been partially answered in Kilian and Vega (2011) who do not find evidence of an impact of macroeconomic announcements on daily price changes in the oil spot market.  Because the authors only consider the spot market and U.S. macroeconomic news, their findings are doubtful or at least incomplete.  Indeed, macroeconomic news may well have an impact on longer maturity futures contracts and U.S. news may well be only part of the story.  We partly extend their analysis in searching for macroeconomic determinants of oil return.

This article tries to answer two empirical questions.  First, how useful is a large set of international real and nominal variables in explaining crude oil return? To handle these variables, we resort to the large factor approximate model which allows to sum up the informational content of these variables by a reduced number of factors.  Hence our second question: how can we interpret the factors that have the best explanatory power? To address these two questions, we gather an alternative database to the widely-used, but mainly focused on the U.S. economy, Stock and Watson (2002b) dataset.  Our aim is to take into account macroeconomic and financial variables that are more likely to influence the WTI

---

4. Zagaglia (2010) provides references of press articles supporting this view.

5. A recent model exploiting the literature on limits-to-arbitrage (Acharya *et al.*, 2011) shows how the hedging component and the speculative behavior of agents can influence commodity prices.  An empirical examination of their model using available stocks for oil and gas support their theoretical developments.  In what follows, we also consider stocks in the analysis but do not retain the specification using this variable as it doesn't improve the explanatory power.

6. The standard analysis of macro factors for crude oil returns is in, for instance, Brown and Yücel (2002) or Lescaroux and Mignon (2008).  Discussion in these papers leads to consider variables such as those related to demand and supply, some real variables and other monetary aggregates.