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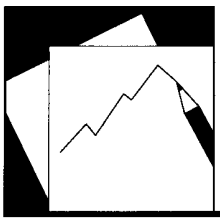

IMF Working Paper

A Barrel of Oil or a Bottle of Wine: How Do Global Growth Dynamics Affect Commodity Prices?

Serhan Cevik and Tahsin Saadi Sedik

INTERNATIONAL MONETARY FUND

 WP/11/1

IMF Working Paper

Middle East and Central Asia Department

A Barrel of Oil or a Bottle of Wine: How Do Global Growth Dynamics Affect Commodity Prices?

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January 2011

Abstract

This paper investigates the causes of extreme fluctuations in commodity prices from 1990 to 2010. Analyzing two very distinct commodities—crude oil and fine wine, we find that macroeconomic factors are the main determinants of commodity prices. Although supply constraints have the expected effect, aggregate demand growth is the key factor. The empirical results show that while advanced economies account for more than half of global consumption, emerging economies make up the bulk of the incremental change in demand, thereby having a greater weight in commodity price formation. The results also show that the shift in the composition of aggregate commodity demand is a recent phenomenon.

JEL Classification Numbers: Q11; Q39; Q41; Q43

Keywords: Commodity prices; Oil; Wine; Comovement; Global growth; Emerging economies

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[1] We would like to thank Paul Cashin, Joshua Charap, Reda Cherif, Katerina Kalcheva, Joannes Mongardini, David O. Robinson, Abdelhak Senhadji and Fatih Yilmaz for their insightful comments and suggestions. We are also grateful for the cooperation of Liv-ex Fine Wine Exchange. Responsibility for remaining errors and omission lies with the authors.

Contents Page

I. INTRODUCTION

Over the past decade, the world economy experienced an unprecedented boom-bust cycle with extreme fluctuations in commodity prices. The dynamics of commodity price cycles are of continuing interest to policymakers and market participants, given their significant impact on economic and financial developments. Commodity prices have long exhibited boom-and-bust patterns with high and varying volatility in nominal and real terms.[2] Over the past ten years, commodity prices went through a prolonged, broad-based upsurge and then a deep slump in the aftermath of the global financial crisis. This paper explores empirically the causes of extreme fluctuations in commodity prices over January 1990 to June 2010 and seeks to identify the relative contribution of advanced and emerging market economies to the changes in commodity prices through a model that incorporates both supply- and demand-side variables at global scale.

Analyzing two very distinct commodities—crude oil and fine wine—helps to identify common determinants of commodity prices. The spot price of crude oil, as measured by the monthly average of Brent and West Texas Intermediate, surged from $20 per barrel in January 2002 to $134 in July 2008, surpassing its 1980 record high in constant prices. Similarly, fine wine prices—measured by the Liv-ex Fine Wine Investable Index—increased by 243 percent over the same period. Triggered by the credit market turbulence, the sudden downturn in global economic activity lowered crude oil and fine wine prices by 70 percent and 42 percent, respectively, in the second half of 2008. The post-crisis recovery, however, brought about a renewed surge in crude oil and fine wine prices, which increased by 86 percent and 62 percent between January 2009 and June 2010 (Figure 1). The statistical behavior of crude oil and fine wine prices has shown remarkable similarity, with a correlation of over 90 percent during the sample period.[3] This comovement raises important questions regarding the underlying determinants of two very different commodities, with implications for other industrial and agricultural commodity prices.

Is it possible to find a common model to capture the macroeconomic determinants of both crude oil and fine wine prices? Traditionally, the literature provided microeconomic developments as the main determinants of commodity price formation, but these factors cannot explain large fluctuations in crude oil prices over the past decade (Killian, 2009). The recent literature has provided three competing theories to explain the pervasive increase

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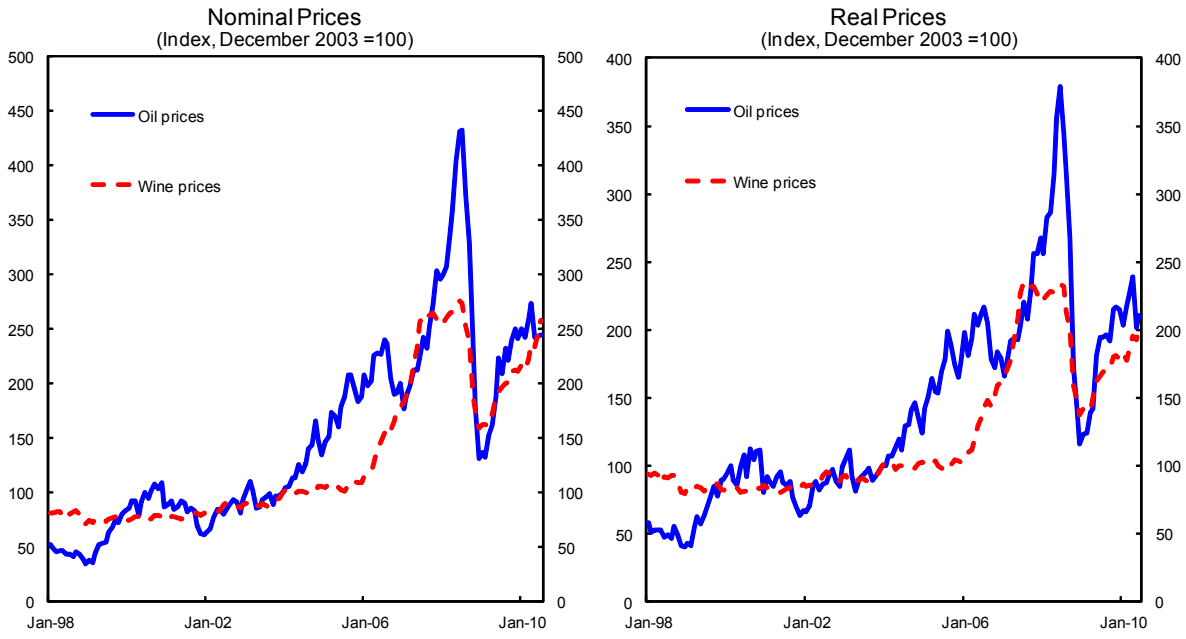
[2] Cashin and McDermott (2002) provides an overview of the empirical behavior of industrial commodity prices since 1862, finding a downward trend in real commodity prices until 1999 and a ratcheting up in the volatility of price fluctuations.

[3] We also found, in some specifications, cointegration between the logarithm of real oil and fine wine prices, but the relationship does not appear to be robust. Nevertheless, cointegration is not a necessary condition for the market integration. For example, non-stationary transaction costs could make a cointegrating relationship undetectable.

in agricultural and industrial commodity prices, as outlined by Frankel and Rose (2009): (i) global demand growth; (ii) destabilizing financial speculation; and (iii) accommodative monetary policy. Notwithstanding the continuing debate over the nature of price volatility, a plethora of recent studies has emphasized macroeconomic factors as the main determinants of crude oil prices over the last decade (Belke, Bordon, and Hendricks, 2010; Hamilton, 2009; Kilian, 2009; Thomas, Mühleisen and Pant, 2010; and Wirl, 2008). On the other hand, most empirical research tends to explain the formation of wine prices with supply-side factors such as climatic conditions, grape quality, age effects, and external quality ratings (Cardebat and Figuet, 2004; Gergaud, 1999; Jones and Storchmann, 2001; and Lecocq and Visser, 2006). However, our empirical findings show that global macroeconomic variables also account for the bulk of the variation in fine wine prices, similar to the behavior of crude oil prices, over the sample period.

This paper makes three contributions to the literature on the behavior of agricultural and industrial commodity prices. First, we explicitly divide global demand into two separate components—emanating from advanced and emerging market economies. To the authors' knowledge, this is the first attempt to empirically separate the underlying determinants of the shifts in the composition of crude oil and fine wine demand. Second, unlike most studies, we use GDP-weighted monthly data, which contain more information than quarterly and annual series given the swift adjustment of commodity prices to shocks. Accordingly, monthly data permit better investigation of the effect of the underlying

Figure 1. Crude Oil and Fine Wine Prices



Source: Liv-ex, DataStream.

macroeconomic developments and their relative weight in determining (nominal and real) crude oil and fine wine prices. Although there is a trade-off to the extent that monthly data of economic activity are not comprehensive.[4] Third, we introduce a measure of global excess liquidity—defined as the difference between broad money growth and estimates for money demand in the G-4 economies—to capture the impact of monetary developments on commodity price formation.

We find robust and statistically significant evidence of the linkages between macroeconomic factors and the behavior of commodity prices. Supply constraints have the expected, but limited effect influence on the pricing process. On the other hand, we find that aggregate demand growth, especially in emerging market economies, is the key determinant of the changes in both crude oil and fine wine prices. The econometric results also show that the structural shift in the composition of aggregate commodity demand is a recent phenomenon. We also demonstrate that global liquidity conditions influence the dynamics of crude oil and fine wine prices. Even though this impact does not necessarily imply financial speculation in price formation, global excess liquidity—associated with low real interest rates—is likely to have magnified the price pressures stemming from supply-demand imbalances.

The remainder of the paper is structured as follows. Sections II and III describe recent developments in the oil and wine markets, respectively. Section IV provides an overview of data used in the analysis. Section V outlines our methodology for modeling crude oil and fine wine prices, while Section VI focuses on interpreting results and identifies the key determinants of price fluctuations. Section VII offers concluding remarks.

II. Developments in the Oil Market

Compared to the pace of growth in world oil demand, crude oil supply expanded at a steady, but slower rate over 1990–2008. Global crude oil supply increased at an average annual rate of about 1.5 percent from 66 million barrels per day (mbpd) in 1990 to 85 mbpd in 2008. The Organization of Petroleum Exporting Countries (OPEC) maintained a faster rate of growth in crude oil extraction—2.3 percent a year, compared to an annual increase of 0.6 percent in non-OPEC supply. Similarly, average global crude oil consumption grew from 67 mbpd in 1990 to 77 mbpd in 2000 and 86 mbpd in 2008 (Figure 2). Furthermore, the composition of crude oil consumption has shifted from advanced to emerging market economies, as the crude oil demand of non-OECD countries surged 52 percent between 1990 and 2008, compared with an increase of 14 percent in OECD countries. In other words, emerging market economies made the greatest contribution to the upsurge in global crude oil

[4] We also ran the same set of regressions with quarterly real GDP series. The results were not as robust as for monthly data and therefore they are not reported. Similar results were obtained by Frankel and Rose (2009) for annual data.

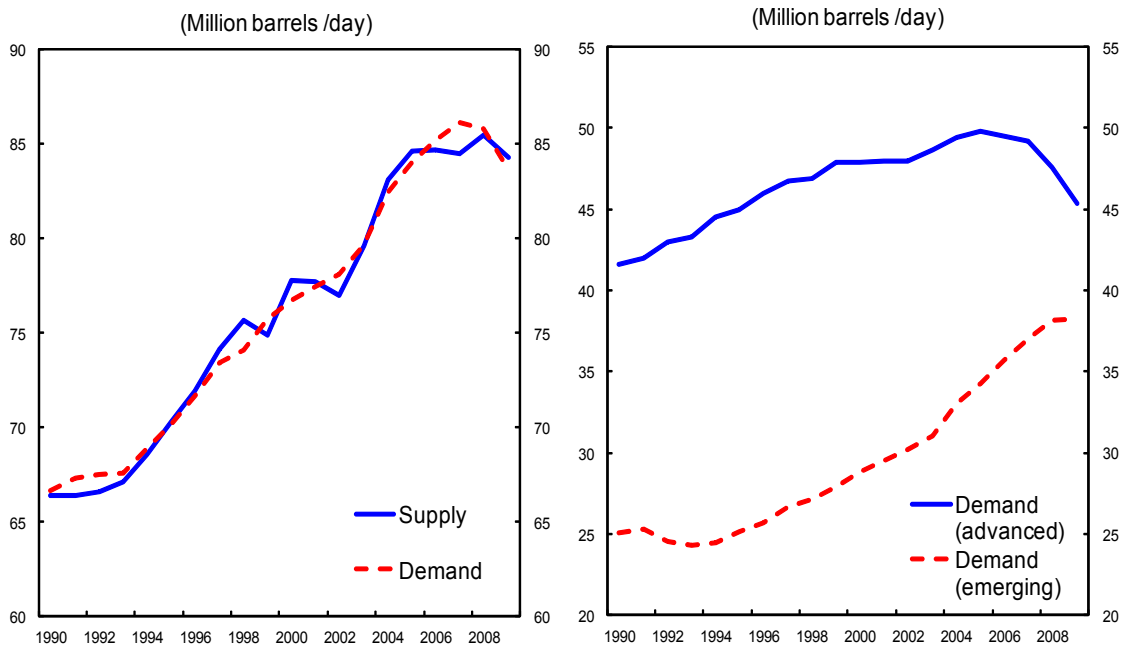
demand, accounting for 69 percent of the increase in world oil consumption between 1990 and 2008 and more than 100 percent of the change in global crude oil demand since 2000 as oil consumption in OECD countries declined during that period.

Energy-intensive growth in emerging economies contributed to the increase in global crude oil demand. Energy intensity—energy consumption per unit of output—indicates how much energy an economy uses to produce its goods and services in a given year. From 1950 to the early 1970s, total primary energy consumption and real GDP increased at almost the same annual rate. In contrast, from the mid-1970s to 2008, the relationship between energy consumption and real GDP growth changed dramatically, with energy use expanding at less than one-third the previous average rate while output growth continuing at its historical rate. This structural shift in the relationship between output growth and energy consumption resulted in a sustained decline in energy intensity in advanced economies. On the other hand, greater specialization of relatively energy-intensive industrial sectors and higher per capita income growth raising personal energy consumption kept hydrocarbon use per unit of output in emerging market economies at an elevated level. Consequently, this structural shift toward faster-growing and less price-responsive emerging market economies has dominated global aggregate oil demand, especially over the past decade.[5] Accordingly, despite the decline in crude oil demand in advanced economies—reflecting the more efficient use of energy, the price of crude oil increased by almost six fold in nominal terms from $20 per barrel in January 2002 to $134 in July 2008.

While the global financial crisis triggered a reversal in crude oil prices, the post-crisis recovery has led to a renewed surge. The credit market turbulence led to a collapse in global economic activity and consequently world oil demand. Crude oil prices declined 70 percent from the peak in July 2008 to $41 per barrel by the end of that year. OPEC countries restrained production in an attempt to rebalance the crude oil market amid the sudden fall in consumption. As global demand for crude oil shrank by 3 percent from 86 mbpd in 2007 to 84 mbpd in 2009, mainly because of the contraction in advanced economies, global crude oil production declined 1.4 percent from 85 mbpd in 2008 to 84 mbpd in 2009. Coupled with tighter oil supply, the recovery in emerging market economies helped boost crude oil prices by about 75 percent from January 2009 to a range of $70 to $80 per barrel during the first half of 2010.

[5] Demand sensitivity to higher prices is in general low—and it is lower in emerging economies than in advanced economies. This could be partly explained by price subsidies on domestic consumption in emerging markets. Although industrial countries have largely eliminated energy subsidies, developing countries continue to use price controls (Arze del Granado, Coady, and Gillingham, 2010). Such subsidies, however, keep prices below the full economic cost and lead to higher levels of consumption. Furthermore, price distortions may also discourage the adoption of efficient technologies, which further exacerbates the excessive energy demand.

Figure 2. Global Crude Oil Supply and Demand



Source: EIA

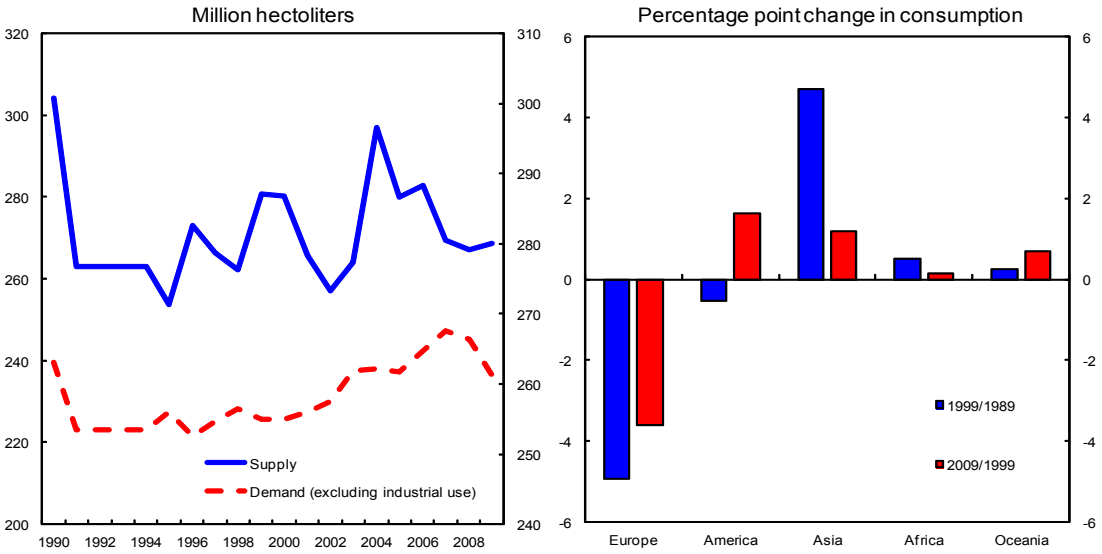
III. Developments in the Wine Market

Global wine consumption expanded over the past decade, amid a limited increase in production. Worldwide areas planted with vines receded by 1.6 percent from an average of 7,971 thousand hectares in the 1990s to 7,823 thousand hectares in the 2000s. Nevertheless, grape output expanded by 14 percent from 573 million quintals to 653 million quintals over the same period; and global wine production recorded an increase of 1.5 percent from 269 million hectoliters to 273 million hectoliters. On the other hand, global wine consumption—excluding industrial use—increased by 5 percent from an average of 226 million hectoliters in the 1990s to 245 million hectoliters in 2008, and then dropped 4 percent to 237 million hectoliters in 2009. Similar to the changing dynamics of global energy demand over the past decade, the wine market has experienced structural changes, especially on the demand side.

Fine wine prices are sensitive to macroeconomic shocks, just like crude oil and other commodity prices. Global wine trade has increased rapidly over the past decade, as rising income levels, especially in emerging economies, have spurred consumption and greater interest in investment grade wine as an alternative asset for portfolio diversification. While per capita wine consumption has been declining in mature markets such as France and Italy from 73 liters and 62 liters a year per person, respectively, in 1990 to 51 liters and 44 liters in 2008, wine consumption in emerging countries has grown from a very low base and hence accounted for the bulk of growth in global demand for high quality, investment grade wine. At the same time, fine wine prices increased by 269 percent in dollar terms between January

2000 and July 2008. The global financial turmoil and the ensuing recession in economic activity has had an adverse impact on global wine demand, prompting a 42 percent drop in fine wine prices in the second half of 2008. From the beginning of 2009 until June 2010, the Liv-ex Fine Wine Investable Index rose by 62 percent, close to its pre-crisis level, outperforming global equity and commodity market indices.

Figure 3. Global Wine Production and Consumption



Source: OIV, staff calculations.

IV. DATA

We use monthly variables to identify the common determinants of crude oil and fine wine prices. The period covered under the study is mainly dictated by data availability. Wine production data are available only from 1998 onward. As a result, we estimate the determinants of real crude oil and fine wine prices over 1998–2010. For crude oil prices, however, we also estimate the equations for the whole period (1990–2010) and the sub-period 1990–97. The dollar-denominated price of crude oil is based on the monthly average of Brent and West Texas Intermediate. Unlike crude oil, wine is a heterogeneous product derived from grapes of various varieties grown in different regions and therefore there is no "global wine price" comparable to the price of crude oil. For that reason, we make use of the Liv-ex Fine Wine Investable Index—a composite monthly price index consisting of Bordeaux red wines from twenty-four leading chateaux and chosen on the basis of their Robert Parker rating scores.[6] This transaction price-weighted index is denominated in sterling

[6] The index consists of Bordeaux red wines that have scored 95 points or above on Robert Parker's rating system, which is based on a 50-100 point quality scale, ranging from numerical ratings of 50–59 for wine "deemed to be unacceptable" to 96–100 for "an extraordinary wine of profound and complex character displaying all the attributes expected of a classic wine of its variety" vis-à-vis its peer group.

and calculated according to the mid-point between the highest bid price and lowest offer price for each component wine on the Liv-ex trading platform. We convert the sterling-denominated Liv-ex Fine Wine Investable Index into a dollar-based series, and deflate both nominal crude oil and fine wine prices with the U.S. consumer price index.

We use global macroeconomic variables and demonstrate their relative importance in commodity price formation. On the supply side, we use monthly global crude oil production data published by the U.S. Energy Information Administration (EIA), and wine production figures are taken from the *Organisation Internationale de la Vigne et du Vin* (OIV).[7] For the demand side, we constructed monthly industrial production series for advanced and emerging economies, which allow us to differentiate between the impact of advanced and emerging economies on crude oil and fine wine prices. High-frequency industrial production series are aggregated using GDP weights, covering 22 advanced economies and 35 emerging economies, representing 64 percent of world GDP and 29 percent, respectively. Using these aggregates has the advantage of distinguishing the sources of changes in global crude oil and fine wine demand. We also introduce global excess liquidity to capture the direct and indirect effects of global monetary developments. This indicator represents a broad measure of excess liquidity, defined as the difference between broad money growth and estimates for money demand in the G-4 economies (the euro area, Japan, the United Kingdom and the United States). While broad money growth is measured by the respective changes in M2, money demand is estimated from the potential growth rate and velocity over the long term. Trend velocity growth is calculated according to average velocity growth over the long run in the respective economies, except for the euro area, where it is based on the mid-value of the range for velocity growth as derived by the European Central Bank. The measure is then converted to a composite G-4 excess liquidity indicator using GDP weights.

V. Modeling Crude oil and Fine Wine Prices

Empirical literature on the behavior of commodity prices is long and diverse, with a greater focus on the influence of microeconomic factors. While supply bottlenecks were responsible for first oil shock in the 1970s, the recent boom-bust cycle cannot be explained without accounting for the changes in aggregate demand and global financial conditions. Using monthly data on a range of heterogeneous commodity prices and macro variables for the U.S. economy, Pindyck and Rotemberg (1990) found that the prices of unrelated commodities tend to move together, even after controlling for the effects of common macroeconomic shocks. Other studies, however, could not find strong evidence for "excess comovement" in commodity prices (Cashin, McDermott and Scott, 1999; Leybourne, Lloyd

[7] Global wine production is by definition available only on an annual basis. Therefore, for a given year, all months have the same production level in our estimations. We use a twelve-month lag in wine production to reflect the gap between production and marketing.

and Reed, 1994; and Palaskas and Varangis, 1991). Borensztein and Reinhart (1994), on the other hand, introduced "a broader view" of global demand including some transition economies and found significant results. But their approach was based on a problematic proxy, covering a small number of emerging market economies with annual GDP figures interpolated into a quarterly series. More recently, Kilian (2009) constructed a monthly measure of global economic activity based on an index of dry cargo single voyage freight rates. Although this index has a positive correlation with global economic growth, it could be susceptible to sector-specific shocks such as the changes in insurance premiums. Importantly, Kilian's worldwide economic activity index does not allow us to differentiate the sources of aggregate demand growth in the world economy. For that reason, we prefer a more comprehensive definition of global aggregate demand and to use monthly industrial production indices separately for advanced and emerging economies to analyze the impact of aggregate demand growth.

The empirical model is based on macroeconomic variables and delivers robust results for the behavior of both crude oil and fine wine prices. We investigate the determinants of crude oil and fine wine prices in real terms, using monthly data from January 1998 to April 2010.[8] Our econometric model can be summarized as follows:

$$P_t = \beta_0 + \beta_1 IPI_{t,advanced} + \beta_2 IPI_{t,emerging} + \beta_3 Prod_t + \beta_4 Exliquid_t + \varepsilon_t$$

where P_t is the real price of crude oil or fine wine at time *t*; $IPI_{advanced}$ is the industrial production index for advanced countries; $IPI_{emerging}$ is the industrial production index for emerging market economies; $Prod_t$ is the production of oil or wine; $Exliquid_t$ is the global excess liquidity; β_0 to β_4 are parameters to be estimated; and ε_t is the error term.

We deal with the seasonality patterns and the nonstationarity evident in some of the variables by using twelve–month differences, rather than first differences. As shown in Appendix Table I, the unit root hypothesis could not be rejected for some of the variables in logarithms, but all variables in growth rate were found to be stationary.[9] Some independent variables could be endogenous to price movements.

[8] The equation is also estimated for nominal crude oil and fine wine prices. The results, available upon request, are similar to our findings for real crude oil and fine wine prices, which are not surprising given the high correlation between real and nominal prices over the sample period.

[9] The global excess liquidity variable is stationary and therefore is included in the equations in level.

In other words, the fluctuations in crude oil and wine prices could influence their demand and production.[10] Consequently, some of the right-hand side variables could be correlated with the disturbance term. To deal with this potential endogeneity issue, we also estimate the abovementioned equation using instrumental variables regression, namely the Generalized Method of Moments (GMM).[11] The GMM estimators also correct for potential bias that results from the fact that some of the explanatory variables are measured with error.

VI. INTERPRETING EMPIRICAL RESULTS

Demand is the dominant factor in determining the behavior of crude oil and fine wine prices while production constraints have the expected effect. The findings of our empirical analysis, summarized in Table 1A and 1B, are robust and statistically significant. The model fits the data very well and explains about two-third of the changes in crude oil and fine wine prices between January 1998 and June 2010, as measured by the adjusted R-square. This is a strong result, especially given that we use monthly data and no lagged dependent variables in the regressions. The econometric results show that supply constraints have the expected effect, but demand-side factors have the dominant effect on crude oil and fine wine prices over the sample period. These findings are consistent with Killian (2009) who found that aggregate demand shocks explain most of the movements in the real price of crude oil.

Supply variables have the correct sign, but are not significant in all specifications over the sample period. Crude oil production has the correct negative sign, but it is not statistically significant in all specifications. Decomposing crude oil production into OPEC and non-OPEC production gives similar results, even though the coefficient for OPEC production is smaller than the coefficient for non-OPEC production. This may reflect OPEC policy to change production in an attempt to stabilize international oil prices. On the other hand, the coefficient of wine production is significant in all specifications with the correct sign.

[10] Estimations may suffer from simultaneous equation bias, but it is well known that oil supply and demand are inelastic to price changes, at least in the short run (Hamilton, 2009). For fine wine, production is inelastic, mainly since the supply of these wines is fixed because regulations in France make it impossible for the wine producers used in the Liv-ex Fine Wine Investable Index to expand production. Wine demand, however, would still be sensitive to short-term price changes.

[11] Instrumental variables are the lagged values (up to four lags).

Aggregate demand growth, especially in emerging markets, is the most decisive factor in determining crude oil and fine wine prices. The coefficients of industrial production growth in advanced and emerging market economies are highly significant in all specifications for both crude oil and fine wine equations.[12] The coefficient of emerging-market industrial output growth is about three times as high as that of advanced economies in oil price regressions and almost five times more powerful in fine wine price regressions. The differences between these two coefficients are also statistically relevant.[13] Even though advanced economies account for more than half of global oil and wine consumption, the rate of aggregate demand growth emanating from emerging economies is the key factor influencing commodity prices. Emerging economies grew at an average of 6.4 percent per year—more than three times the rate of growth in advanced economies, thereby making up the bulk of the incremental change in global commodity demand. Furthermore, in the aftermath of the global financial crisis, there has been a further decoupling of growth between advanced and emerging economies. While average industrial output contracted by 10 percent in advanced economies between mid-2008 and end-2009, emerging economies continued to grow at an average of 1.4 percent over the same period, contributing to the strength of commodity prices even against the backdrop of intense credit market problems and recession in advanced economies.

The econometric results are consistent with crude oil and fine wine being superior goods, especially in emerging markets. First, although advanced economies still accounted for 53 percent of global oil demand in 2009, their share declined from 63 percent in 1999 and the share of emerging economies rose from 37 percent of world oil consumption to 47 percent over the same period. Second, with greater specialization in energy-intensive industrial sectors and increasing per capita energy consumption, oil demand from emerging economies grew by 37 percent, on a cumulative basis, between 1999 and 2009 while oil demand from advanced economies contracted by 5 percent over the same period. The available data suggest that global wine consumption followed similar trends, and hence, the results show a comparable sensitivity pattern. A one percent increase in the income level of emerging economies has higher wine demand content than in advanced economies. At this stage of development, emerging market economies tend to be more commodity-intensive per unit of income, but also consume less on a per capita basis compared with advanced economies. Therefore, higher income elasticity dominates the behavior of emerging-market commodity demand, along the lines of superior goods, making emerging economies the main source of marginal demand.

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[12] We also estimated the abovementioned equations with de-trended monthly data using Hodrick-Prescott (HP) filter (with $\lambda = 1400$) and found very similar results, which are available upon request. There are several methodological problems associated with filtering or smoothing (Saadi-Sedik and Petri, 2006).

[13] Wald tests results show that we can decisively reject the null hypothesis of coefficients being equal.

Global liquidity conditions influence the behavior of oil and wine prices through its effect on global demand. Global excess liquidity seems to have some role in crude oil and fine wine price fluctuations. Between 2000 and the first half of 2008, our measure of global excess liquidity increased by 71 percent, reinforcing the above-trend real GDP growth, especially in emerging market economies. With the rapid financialization of industrial and agricultural commodity markets in recent years, many commodity prices are more directly exposed to fast-moving capital flows and various macroeconomic shocks. In our view, the results do not necessarily imply financial speculation, and global excess liquidity associated with low real interest rates is likely to have magnified the price pressures stemming from supply-demand imbalances.

Table 1A--Results for Real Oil Prices (1998-2010)

	LS						GMM	
	eq. 1		eq. 2		eq. 3		eq. 4	
Variable	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.
Constant	-30.0	-5.5	-30.4	-6.0	-38.6	-5.0	-37.4	-3.5
IPI for advanced countries	1.4	2.3	1.5	2.5	2.0	3.2	2.0	2.4
IPI for emerging countries	5.6	6.6	5.8	6.9	5.7	6.7	5.3	4.3
Oil production			-1.2	-1.1	-0.5	-0.4	0.1	0.1
Excess liquidity					4.5	1.4	3.8	0.9
Adjusted R-squared	0.60		0.61		0.61		0.61	

Table 1B--Results for Real Wine Prices (1998-2010)

Variable	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.
Constant	-17.5	-8.7	-19.2	-9.2	-26.0	-6.4	-23.8	-3.9
IPI for advanced countries	0.5	2.1	0.5	2.4	1.0	3.0	0.8	1.8
IPI for emerging countries	3.3	9.0	3.5	9.2	3.5	8.8	3.4	9.5
Wine production			-1.0	-4.8	-0.6	-2.2	-0.7	-1.6
Excess liquidity					3.9	1.9	2.8	0.8
Adjusted R-squared	0.55		0.59		0.61		0.60	

Source: Authors' calculations.

Notes:

1/ The sample covers montly data from January 1998 to June 2010.

2/ All variables are year-on-year percentage changes with the exception of excess liquidity.

3/ All variables are stationary.

4/ Newey-West estimator were used to deal with both heteroskedasticity and autocorrelation.

Table 2--Results for Real Oil Prices (1990-2010)

	LS						GMM	
	eq. 1		eq. 2		eq. 3		eq. 4	
Variable	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.
Constant	-25.6	-9.0	-25.0	-8.5	-25.0	-8.1	-30.7	-6.6
IPI for advanced countries	1.9	5.2	2.1	4.7	2.6	5.4	2.0	2.9
IPI for emerging countries	4.4	8.9	4.4	8.9	4.0	7.8	4.8	6.7
Oil production			-0.9	-1.1	-0.8	-1.0	-0.2	-0.1
Excess liquidity					2.7	2.9	2.0	1.6
Adjusted R-squared	0.52		0.52		0.54		0.54	

Source: Authors' calculations.

Notes:
1/ The sample covers montly data from January 1990 to June 2010.
2/ All variables are year-on-year percentage changes with the exception of excess liquidity.
3/ All variables are stationary.
4/ Newey-West estimator were used to deal with both heteroskedasticity and autocorrelation.

Table 3--Results for Real Oil Prices (1990-1997)

	LS						GMM	
	eq. 1		eq. 2		eq. 3		eq. 4	
Variable	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.	Coef.	t-Stat.
Constant	-21.1	-4.7	-19.4	-4.5	-13.1	-2.3	-22.0	-3.2
IPI for advanced countries	1.5	2.2	2.5	2.7	2.1	2.3	3.3	2.9
IPI for emerging countries	2.7	4.1	2.5	4.1	2.2	3.7	3.1	3.8
Oil production			-2.0	-1.7	-2.2	-2.0	-3.7	-2.8
Excess liquidity					2.9	1.6	0.5	0.3
Adjusted R-squared	0.28		0.30		0.32		0.30	

Source: Authors' calculations.

Notes:
1/ The sample covers montly data from January 1990 to December 1997.
2/ All variables are year-on-year percentage changes with the exception of excess liquidity.
3/ All variables are stationary.
4/ Newey-West estimator were used to deal with both heteroskedasticity and autocorrelation.

For oil prices, the comparison of the period 1990–1997 with the entire sample suggests that the shift in aggregate commodity demand is a recent phenomenon. The differences between the coefficients of industrial production growth in advanced and emerging market economies are smaller for the whole period; and the coefficients are almost the same for the period 1990–1997. The ratio of average coefficients of emerging economies to advanced economies is 3.2 over 1998–2010; and it declines to 2 for the whole period (1990–2010) and to 1.1 for the period 1990–1997 (Table 4).

Table 4--Average Coefficients for Real Oil Prices

	1998-2010	1990-2010	1990-1997
IPI for advanced countries (β_1)	1.7	2.1	2.4
IPI for emerging countries (β_2)	5.6	4.4	2.6
Ratio: emerging to advanced (β_2/β_1)	3.2	2.0	1.1

Source: Authors' calculations.

VII. CONCLUSION

Cheers to the rise of commodity-intensive emerging market economies and the abundant global liquidity! In this paper, we empirically investigated the determinants of crude oil and fine wine prices, using the same set of broad macroeconomic indicators, and found that global fundamental factors dominate commodity price trends. The growth rate of global aggregate demand is the key determinant of the dramatic fluctuations in both crude oil and fine wine prices over the sample period. Although supply constraints have the expected sign, they have a limited effect on the pricing process. Our analysis also shows that while advanced economies account for more than half of global crude oil and wine consumption, emerging market economies make up the bulk of the incremental change in aggregate demand and therefore have a greater significance in determining price fluctuations. Furthermore, the results of our econometric analysis confirm that global liquidity conditions also has some influence on the evolution of crude oil and fine wine prices. Even though the impact does not necessarily imply financial speculation, global excess liquidity associated with low real interest rates is likely to have magnified the price pressures stemming from supply-demand imbalances.

The results show that the structural shift in the composition of aggregate commodity demand is a recent phenomenon. The composition of oil consumption has shifted away from advanced to emerging economies, as oil demand of non-OECD countries surged 52 percent between 1990 and 2008, compared with an increase of 14 percent in OECD countries. Put differently, emerging market economies accounted for 69 percent of the increase in world oil consumption between 1990 and 2008—and more than 100 percent of the change in global oil demand since 2000 because the crude oil consumption of OECD countries declined during that period.

Higher income elasticities of demand in emerging economies support commodity prices, but a sharp slowdown in emerging economies is the main risk. In the foreseeable future, given these structural changes in energy intensity and oil demand per increment of GDP in emerging economies, the low price elasticities of crude oil supply and demand are likely to keep oil prices highly sensitive to the changes in supply and demand. We observe similar trends in a wide range of other industrial and agricultural commodities, including wine, and expect emerging market economies to remain a key determinant of global aggregate commodity demand in the future. Although commodity-intensive industrialization and strong per capita income growth with increasing population and urbanization are likely to reinforce the upward shift in aggregate commodity demand, emerging market economies have introduced policy measures, including the rationalization of fuel subsidies, to improve energy efficiency and expand the exploration of alternative energy sources. In the near future, however, the main downside risk to commodity prices is a double-dip recession in the global economy. According to our estimations, a one standard deviation decline in industrial production growth in emerging market economies (or 4 percentage points) would induce a 22 percent decline in real crude oil prices and a 15 percent fall in real wine prices.

The next step is to estimate the impact of global macroeconomic variables on a broader set of industrial and agricultural commodities. The recent cycle has shown that many commodity prices move in the same direction at the same time—rising in tandem between 2003 and mid-2008 and collapsing simultaneously in the second half of 2008. This makes it difficult to ignore the influence of common macroeconomic factors, as confirmed by the results presented in this paper. Accordingly, we would like to extend our empirical analysis to a broader set of industrial and agricultural commodities, which could provide valuable insights to policymakers. Another interesting question, particularly from a financial viewpoint, is whether including commodities like fine wine in asset allocation would improve portfolio diversification. Our results suggest that although fine wine can be considered as an investable asset, its behavior is not significantly different than other commodities and therefore may fail to enhance portfolio diversification.

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Appendix Table I. Stationarity Tests

Phillips-Perron Test

	Level	Prob.*	Growth rate	Prob.*	Result
Real oil prices					
Without trend	-1.6	0.5	-17.9	0.00	I(1)
With trend	-5.01	0.0	-17.2	0.00	
Real wine prices					
Without trend	-0.85	0.8	-8.5	0.00	I(1)
With trend	-3.23	0.1	-9.2	0.00	
IPI advanced countries					
Without trend	-2.56	0.1	-8.1	0.00	I(1)
With trend	-3.73	0.0	-28.9	0.00	
IPI emerging countries					
Without trend	-0.62	0.9	-17.6	0.00	I(1)
With trend	-3.78	0.0	-15.8	0.00	
Oil production					
Without trend	-1.16	0.7	-4.9	0.00	I(1)
With trend	-2.59	0.3	-5.0	0.00	
Wine production					
Without trend	-2.99	0.0	-4.5	0.00	I(1)
With trend	-2.97	0.1	-4.6	0.00	
Excess liquidity					
Without trend	-4.17	0.0	--	--	I(0)
With trend	-4.73	0.0	--	--	

*MacKinnon (1996) one-sided p-values.