The impact of oil fluctuations on stock returns and their volatility in Latin American stock markets

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Abstract

This study analyzes the effects of Brent Oil Price in stock markets of seven countries of Latin America. The main objective was to perform a panel data analysis on the relationship of each stock index to changes in oil prices. The sample was taken on a weekly basis covering the period January 2000 to June 2010. First, it was showed the presence of asymmetric effects and found that the decline in oil prices raises the stock performance. The increase in oil prices shows no defined behavior in the stock indexes. Additionally, independent variables were added as exchange rates against the U.S. dollar for each currency of the countries studied and the Dow Jones index of U.S. stock market, both variables showed positive effect on stock indexes in Latin American markets. There were considered seven countries in the study (Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela), since the development of financial markets in the region is very limited. Six of them have the same behavior expressed above, only Venezuela was different: none of the changes in oil prices affects the index stock. Second, we decided to test if the asymmetry of oil price changes impacts oil volatility for each of the studied countries. We found that each country showed different result about volatility, under T-ARCH models of analysis, those differences provide evidence of oil price fluctuations as a factor of risk for international country investment of the region.

Keywords: Latin American Stock Markets, Oil Prices, T-ARCH

INTRODUCTION

In this study, we decide to test the macroeconomic influence of Oil Price in the Latin-American stock markets in order to identify the increase or decrease effect that the change of this variable has on the particular stock index of each country.

The countries considered on the study were: Argentina, Brazil, Mexico, Chile, Colombia, Perú and Venezuela for the period of January 2000 to June 2010. The aim of this concern is because the historical reference that Latin-American has about the dependence or reactive economical response of the country to the Oil price.

The purpose of this study is to analyze the differential impact on the stock market changes in oil prices. Most Latin American countries are associated with different market mineral resources that are often of great importance to the economy, the export sector and therefore the stock markets. Within the sample of countries considered there are some oil producers but even the no producers receive the impact of changes in oil prices through its impact on costs.

We decide to use the Brent Oil price since the market price leaders, Brent and WTI (West Texas Intermediate), show a positive correlation; we also recognize the tendency of other oil prices in the region to follow them.

This study is following valuation perspective in an attempt to explain the intrinsic value of the stock market and assess to what extent of financial and macroeconomic information may be useful to identify the behavior of the Stock Index of the seven Latino-American countries, for the specify period, so the information is used as Panel Data.

The variables tested are: the dependent one is the Stock Market Index of each country and the independent variables are macroeconomic references. The macroeconomic references are: Brent Oil Prices, the Dow Jones Index (as the world indicator of behavior of the zone, because of the United State influence) and the Exchange rate per dollar (from the local currency of each country).

After the asymmetric effects were analyzed under T-ARCH models, the study provides evidence of how the fluctuations of oil prices impact on oil volatility.

THEORETICAL FRAMEWORK

There are several studies that seek to discover the kind of influence that exists between the stock and oil markets, due mainly to the great influence that the oil price has on economic indicators. Whether the country is a producer and exporter of oil or is a net importer, in whatever the situation regarding the type of black gold used in the industrialized world have led to most of the planet is highly dependent on market hydrocarbons. Thus one of the major questions to be addressed is the kind of influence, if any exists, oil prices with financial markets in general but especially with the stock market.

Chen et al. (1986), Ferson and Harvey (1994b) and Huang et al. (1996) find that the return generated by oil futures have no impact on indices such as S&P 500 and there is no gain in considering the risk caused by fluctuating oil prices on stock markets. Through the study of stock markets in U.S., Canada, Japan and the United Kingdom show that all markets initially respond negatively to oil price shocks.
After that use a valuation model cash flow finding evidence that rates of U.S. and Canadian oil shock completely assimilated through dividends. By contrast, the stock markets of Japan and the UK show greater variation as a result of oil shock can be explained by changes in dividends.

Jones and Kaul (1996) provide evidence that returns on the capital market in the United States, Canada and the UK are sensitive to reverse the negative impacts of oil prices. They generate a test to determine if stock markets are rational, defined as fully conforming to the impact of oil shock on dividends. Jones and Kaul (1992; 1996), find that oil price. In particular, their first study examines the effect of oil prices on stock prices. They detect significant effects of oil prices on aggregate real stock returns, including a lagged effect, in the period from 1947 to 1991. Their work has a macroeconomic focus, using quarterly data and employing the Producer Price Index for fuels to proxy the oil price index. In the second study they use quarterly data to test whether the reaction of international stock markets to oil shocks can be justified by current and future changes in real cash flows and hence the changes in expected returns. Using a standard cash-flow dividend valuation model they find that the reaction of Canadian and U.S. stock prices to oil price shocks can be completely accounted for the impact of these shocks on the real cash flows.

Sadorsky (1999) studied the impact of oil price shocks in stock returns by estimating VAR in which includes industrial production and interest rates on short-term. The oil shocks study separates positive from negative and contrary to Huang (1996) the oil price shocks if they affect stock returns. The study shows that positive shocks are much more important than negatives that may not even evident effect.

Basher and Sadorsky (2004) using a multifactorial model of arbitration found robust evidence that the risks associated with changes in oil prices impact the performance of stock markets in emerging countries.

Rogoff (2006) argues that higher oil consumption countries are less vulnerable to shocks than they were in the past due in part to increased energy efficiency, however, believes that the recession caused by oil shocks cannot be considered unrepeatable.

Martin Agren (2006) performed an empirical study on the effects caused by the volatility of oil prices in the stock market. The model used (asymmetric BEKK model) includes a parameterization of the conditional covariance between changes in oil prices and stock returns. Concluded that the shocks of the market itself d values related to factors other than uncertainty are more important than the effects of oil shocks.

Basher and Sadorsky (2004) using a multifactorial model of arbitration found robust evidence that the risks associated with changes in oil prices impact the performance of stock markets in emerging countries. Sadorsky Basher use a multifactorial international model of risk factors applying conditional and unconditional risk factors to investigate the relationship between oil price risk and yields of emerging stock markets finding strong evidence of impact of oil prices to

returns. The evidence showed that emerging countries are subject to greater influence in the oil market as more intensive use of energy than advanced economies mainly because of the greater efficiency achieved in the past 40 years.
According to Alexei Goriaev and Zabotkin (2006) the sensitivity of the Russian stock market oil prices are very modest, the coefficient for the RTSI is significantly positive only in 29% of the regressions predominantly in three years. This result does not deny the importance of the price of oil plays in the Russian economy. Probably, its influence on the stock market is expressed in a gradual adjustment of expectations of oil prices at the long term so that the volatility of oil prices is of secondary importance relative to fluctuations in emerging markets.

According to Arouri and Fouquau (2009) stock markets in Qatar, Oman and United Arab Emirates (UAE) react positively to growth in oil prices. In contrast to Bahrain, Kuwait and Saudi Arabia found that price changes do not affect stock market returns. Because they are a major player in the oil market should be sensitive to commodity shocks, are given the task of examining linear and nonlinear relationships using the specified bandwidth provided by e-views. According to the results obtained by these authors appears that there is no consistent result for all countries of the Gulf Cooperation Council (GCC for its acronym in English), however, some items show that the relationship between oil and economic activity is not completely linear and rising oil prices tend to have a greater impact than price declines Hamilton (2003), Zhang (2008), Lardic and Mignon (2006, 2008) and Cologni and Way (2009).

The most important group of producers is the GCC countries since they produce about 20% of the world's oil, controls 36% of oil exports and have 47% of proven reserves. Oil exports largely determine the income of the government budget. Though, oil determines government spending so aggregate demand in these countries. For that reason, one could expect oil prices affect the stock markets in a direct relationship especially in the countries of the GCC, namely Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates (UAE). In fact, for countries that are net exporters of oil price fluctuations should increase corporate profits, production and price levels. However, unlike the net exporters where the expected relationship between oil prices and the stock market is negative whenever the oil price increase has a negative impact on future cash flows. The mechanism of transmission of oil price shock on the stock market of GCC is ambiguous and the full impact of price shocks on the stock market depends on which of the negative or positive (the positive impact of oil price increases companies and economies of the GCC countries, the negative impact domestic inflation and imported). Arouri and Fouquau (2009)

For other countries (Bahrain, Kuwait, and Saudi Arabia) the overall effects of oil price changes on stock market returns is negligible. The lack of relationship between oil prices and the stock market in these three nations dependent on oil seems counter-intuitive. Anyway, some other studies show that the relationship between oil and economic activity is not completely linear and there is some evidence of nonlinearity between these two variables. Arouri and Fouquau (2009)

According to Ramos and Veiga (2010) there is no consistent evidence that can serve as a basis to assert a decisive influence on oil prices in world stock markets. They analyzed the exposure of a large sample of stock markets to oil price fluctuations. According to these authors the strong fluctuations of these prices rising stock market depreciates but drops does not necessarily increase the performance of the stock market. The negative impact caused oil prices in the stock market only applies to developed nations, on the contrary the stock markets of developing nations not sensitive to price changes.

REFERENCE FRAMEWORK

The stock market is one of the most important sources for enterprises to raise money. This allows businesses to be publicly traded, or raise additional capital for expansion by selling shares of ownership of the company in a public market. The liquidity that an exchange provides affords investors the ability to quickly and easily sell securities.

The stock exchanges are organized markets that help finance this pipeline is conducted in a free, efficient, competitive, equitable and transparent manner, following certain rules agreed in advance by all market participants.

1. Argentina Stock Exchange. The Bolsa de Comercio de Buenos Aires (BCBA) was founded on July 10, 1854. It is the main stock market and financial center of Argentina, the basic transactions are: stock, bonds, currencies and futures. Its´main performance indicator is: Merval which corresponds to the 15 most traded shares of around 134 companies listed.

2. Brazil Stock Exchange. The Bovespa, Bolsa de Valores de São Paulo is the third largest stock exchange and important in the world, the second American and the first to hold this position in Latin America. It was established on 1890 and since 1996 it function as a civil partnership. Its´main performance indicator is: Bovespa's main index of Bovespa Index (Ibovespa), which represents the 80% of the total traded shares of around 500 companies listed.

3. Mexico Stock Exchange. The Bolsa Mexicana de Valores, S.A.B. de CV is a financial institution that operates by grant from the Department of Finance, in conformity with the Law on Securities Market.
There are several types of indexes, among which are: IPC ®, INMEX ®, IMC30 ®, IDIPC ®, IRT ® and LIVES ®. The main stock index is the CPI or the Price and Quotations Index, which represent the 35 most traded shares of around 80 companies listed.

4. Chile Stock Exchange. The Santiago Stock Exchange was founded on November 27, 1893. It is the main trading center of Chile. There are several types of indicators, among which are: General Index of Stock Prices (IGPA) created in 1958 and composed of a majority of the shares and annual review. Selective Price Index (ipsa) which corresponds to the 40 most traded shares, established in 1977 and is reviewed annually andINTER-10 comprises the top 10 companies listed ADRs IPSA.

5. Colombia Stock Exchange. The Bolsa de Valores de Colombia (BVC), established on July 3, 2001, is the only market for shares and other securities of Colombia, organized through the bag structure. Previously operated three separate stock - Bolsa de Bogotá (1928), Bolsa de Medellín (1961) and Bolsa de Occidente (Cali, 1983) - which merged to create the CSE. Its´performance indicator is IGBC or Indice de la Bolsa de Valores de Colombia is the main index of Bogotá Stock Exchange consisting of the 30 most actively traded shares of the market, of around 88 companies listed.

6. Perú Stock Exchange. The Bolsa de Valores de Lima (BVL) is a corporation that is primarily intended to facilitate the trading of listed securities. Its´performance indicators are: The IGBVL (Indice General Bolsa de Valores) is a value-weighted index that tracks the performance of the largest and most actively traded stocks on the Lima Exchange.[1]. Other indices are ISBVL (Indice Selectivo Bolsa de Valores) and ISP-15 (Indice Selectivo Peru-15). There are around 250 companies listed.

7. Venezuela Stock Exchange. The Bolsa de valores de Caracas (BVC) was established in 1947. BVC merged with a competitor in 1974 to become the only securities exchange operating in Venezuela. The BVC is a private exchange, providing operations for the purchase and authorized sale of securities according to the Capital Marketing Laws of Venezuela. Its´ performance indicator is measured by the Indice Bursátil Caracas, consisting of the 17 most actively traded shares of the market, of around 60 companies listed.

METODOLOGY AND RESULTS

We take an US investor that diversifies across Latin American stock markets. One factor is the United States market portfolio. Sensitivity to currency change rates are also considered. The final factor is oil prices. The basic model is:

$$r_{it} = \alpha_i + \beta_{US} r_t^{US} + \beta_{OIL} r_t^{OIL} + \beta_{CURRENCY} r_{it}^{CURRENCY} + u_{it} \qquad (1)$$

where the dependent variable is the log returns of the stock market country *i* at time *t*, and the independent variables are the log returns of the US stock market, oil and country *i* currency at time *t* respectively.

We collected weekly stock market close prices and exchange rate for seven Latin America countries and United States and Brent oil prices. Our sample goes from January 7th, 2000 through June 25th, 2010.

Descriptive statistics are presented in Table 1. Returns are expressed in U.S. dollars

		Mean	SD	Skewness	Kurtosis	Jarque-Bera
Stock Returns						
	Argentina	0.0002	0.0584	-2.0874	23.0062	9502.12
	Brasil	0.0026	0.0606	-0.7318	6.4240	315.45
	Chile	0.0023	0.0276	-1.4987	14.8929	3422.19
	Colombia	0.0043	0.0384	-1.0251	8.9125	890.93
	México	0.0023	0.0436	-0.5948	11.2086	1565.12
	Perú	0.0042	0.0404	-1.4690	21.1863	7720.76
	Venezuela	0.0011	0.0511	-4.8967	73.0869	113933.83
	US	-0.0002	0.0268	-1.0147	10.9911	1546.44
Exchange rate returns						
	Argentina	0.0000	0.0309	-9.6309	169.1573	636528.48
	Brasil	0.0013	0.0235	-0.7642	6.9624	410.33
	Chile	0.0006	0.0162	-1.0281	10.4868	1371.39
	Colombia	0.0011	0.0160	-0.7724	9.3454	970.29
	México	0.0004	0.0146	-2.3789	29.8628	16931.64
	Perú	0.0009	0.0072	-0.1320	10.2823	1208.07
	Venezuela	0.0003	0.0363	-13.3742	249.5729	1399436.40
Oil returns						
	BRENT	0.0022	0.0463	-0.6459	4.9816	127.29

Table 1.

Figure 1 depicts the oil price index and oil returns over the sample period.

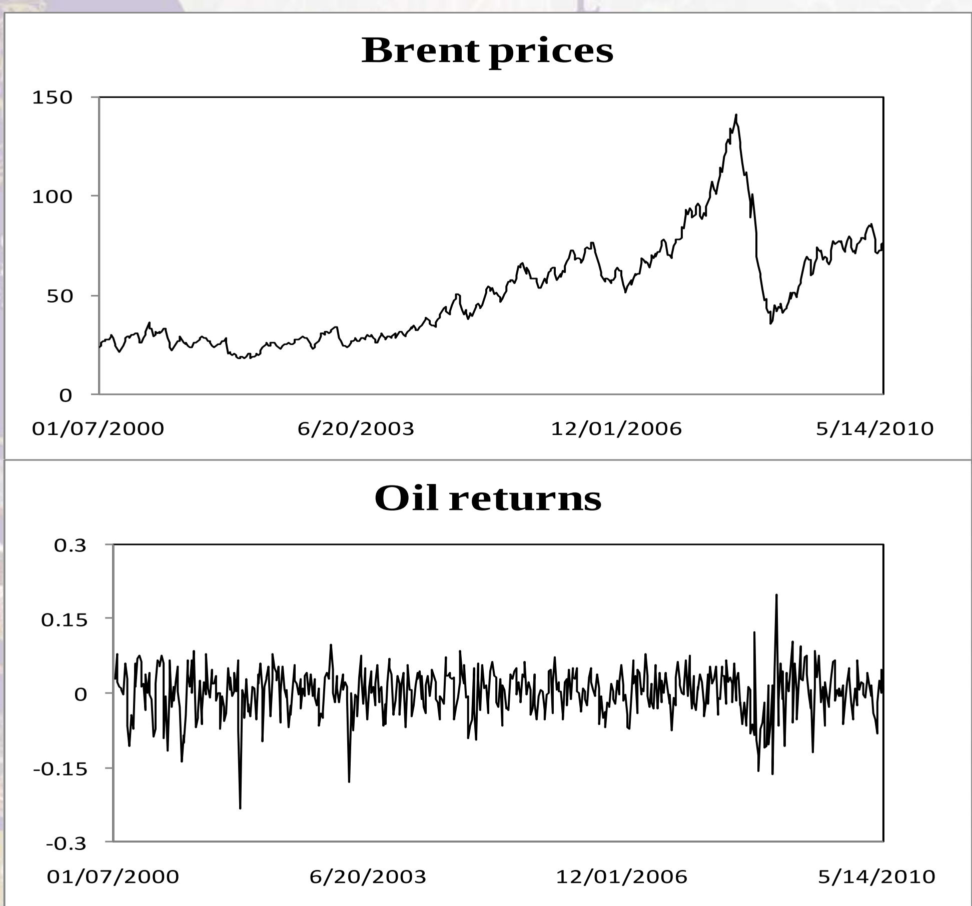

Figure 1. Oil price (first panel) and oil returns (second panel)

The estimation of the model (1) is presented in Table 2.

	Coefficient		Std. Error
US	0.5678	*	(0.0231)
OIL	0.1021	*	(0.0131)
CURRENCY	0.8981	*	(0.0273)
Constant	0.0018	*	(0.0006)
Observations	546		
# countries	7		
R-squared	0.3653		
Hausman Test statistic	1.4169		
p-value	0.7016		

Table 2. Coefficient estimation with standard error for model (1). Superscripts * and ** denote statistical significance at 5% and 10% levels respectively.

The second model considered asymmetries impact from the oil price fluctuations in Stock markets. Many works had studied these asymmetries in macroeconomy and found that increases in oil prices lead to reduce outputs while oil price drops do not necessarily lead to an increase in output.

The second model is:

$$r_{it} = \alpha_i + \beta_{US} r_t^{US} + \beta_{OIL+} D_t r_t^{OIL} \beta_{OIL-} (1 - D_t) r_t^{OIL} + \beta_{CURRENCY} r_{it}^{CURRENCY} + u_{it} \tag{2}$$

where D takes a value of one if the oil return is positive and zero if it is negative. The estimated model is presented in Table 3.

	Coefficient		Std. Error
US	0.5658	*	(0.0231)
OIL+	0.0453	**	(0.0271)
OIL-	0.1462	*	(0.0226)
CURRENCY	0.8957	*	(0.0273)
Constant	0.0036	*	(0.0010)
Observations	546		
# countries	7		
R-squared	0.3663		

Table 3. Coefficient estimation with standard error for model (2). Superscripts * and ** denote statistical significance at 5% and 10% levels respectively.

As can be seen, the asymmetry is confirmed. Oil returns only affect stock returns when the first are negative at a 5% statistical significance level. At a 10% the increase and decrease of oil returns affect stock returns but in a different way. Negative oil returns affect in greater levels. We also considered the volatility of the stock markets and the oil returns. The modeled considered is a Threshold GARCHX model as:

$$
\begin{aligned}
r_{it} &= \alpha_i + \beta_{USi} r_t^{US} + \beta_{OIL+i} D_t r_t^{OIL} \beta_{OIL-i} (1-D_t) r_t^{OIL} + \beta_{CURRENCYi} r_{it}^{CURRENCY} + u_{it} \\
u_{it} &= \sigma_{it} \varepsilon_{it} \qquad \varepsilon_{\mathrm{it}} \sim iid(0,1) \\
\sigma_{it}^2 &= \omega_{i0} + \omega_{i1} u_{it-1}^2 + \omega_{i2} \sigma_{it-1}^2 + \gamma_i u_{it-1}^2 I_{t-1} + \beta_i^{+} D_t \left(r_{t-1}^{OIL}\right)^2 + \beta_i^{-} (1-D_t) \left(r_{t-1}^{OIL}\right)^2 \qquad (3) \\
I_t &= \begin{cases} 1 & \text{if} \quad u_t < 0 \\ 0 & \text{if} \quad u_t \geq 0 \end{cases}
\end{aligned}
$$

Table IV presents the results for every country. As can be seen, the squared oil returns only affect stock returns volatility in all countries, except Mexico. The asymmetry effect of oil returns in volatility is confirmed in Chile and Perú when the oil returns are rising and with Venezuela when the oil return is decreasing.

	Argentina			Brasil			Chile			Colombia		
Mean equation												
	Coef.		SE	Coef.		SE	Coef.		SE	Coef.		SE
Constant	0.002722		0.002637	-0.002479		0.001759	0.000832		0.001295	0.009138	*	0.001849
OIL+	0.127705		0.077711	0.104285	*	0.045365	0.063563	**	0.035047	-0.135581	*	0.048533
OIL-	0.265243	*	0.073677	0.030656		0.039898	0.023260		0.027531	0.169968	*	0.033536
US	0.819633	*	0.069613	0.659527	*	0.042427	0.326905	*	0.033316	0.449506	*	0.030858
Currency	0.645720	*	0.048019	1.742254	*	0.060205	0.819036	*	0.050339	1.118844	*	0.059312
Variance equation												
ω_0	-0.000012		0.000020	0.000009	*	0.000004	0.000011	*	0.000005	0.000103	*	0.000007
ω_1	0.148254	*	0.028015	-0.035620	*	0.015851	0.057237	**	0.031810	0.259629	*	0.060785
ω_2	0.841792	*	0.030612	0.985763	*	0.008092	0.934569	*	0.030815	0.646107	*	0.027590
γ	-0.063950	*	0.028055	0.092004	*	0.021721	-0.021694		0.025312	-0.045351		0.056959
$\beta+$	0.044891	**	0.024426	-0.006560	**	0.003463	-0.004874	*	0.001696	0.039855	*	0.011408
$\beta-$	0.064075	*	0.011583	0.000152	*	0.001976	0.001475		0.002321	-0.017437	*	0.003505

	México			Perú			Venezuela		
Mean equation									
	Coef.		SE	Coef.		SE	Coef.		SE
Constant	0.003740		0.002476	0.002690		0.001788	0.000096		0.002355
OIL+	0.038868		0.076448	0.071379		0.049750	0.003980		0.070846
OIL-	0.128068	**	0.067980	0.069880		0.049802	0.033366		0.047690
US	0.790486	*	0.054247	0.360866	*	0.045200	0.034620		0.043542
Currency	1.297551	*	0.091487	1.466386	*	0.114759	0.963298	*	0.028042
Variance equation									
ω_0	0.000521		0.000484	0.000121	*	0.000022	0.000621	*	0.000076
ω_1	0.088922		0.112993	0.455665	*	0.074850	0.424308	*	0.072117
ω_2	0.524302		0.421100	0.462040	*	0.038274	0.318737	*	0.071002
γ	-0.007594		0.113051	0.033904		0.097069	-0.443509	*	0.069255
$\beta+$	-0.022033		0.036498	0.063177	*	0.019577	0.023643		0.025299
$\beta-$	-0.005327		0.010174	-0.008584		0.009011	-0.024418	*	0.007728

Table IV. Coefficient estimation with standard error for equation 3. Superscripts * and ** denote statistical significance at 5% and 10% levels respectively.

CONCLUSIONS

We analyze seven Latin American stock markets over 2000-2007. The results show that stock markets are sensitive to the United States portfolio (Dow Jones) and currency rate changes consistent with the evidence observed in other markets (mainly of developed countries).

Oil price changes have an asymmetric effect on stock market returns. The squared oil returns affects stock returns volatility in all countries except Mexico, probably because there are other bigger influence to the Mexican stock market, like US indexes. The asymmetry effect of oil returns in volatility is confirmed in Chile and Perú when the oil returns are rising and, with Venezuela; when the oil returns are decreasing; this last could reflect the huge importance of the oil for the fiscal income (around 50% and aprox 30% of the PIB).

When oil prices rise, there is no effect on Latin American stock returns instead of the negative effect on the developed countries. When oil prices fall, there is a significant positive effect on the stock market indexes, according with the evidence in Ramos and Veiga (2010). The macroeconomic conditions of developed and emerging markets are different, since they are not driven by the same factors; but the effect when the oil price fall is the same in both.

This study also provides evidence of the price asymmetries in oil prices that can impact oil volatility; that is oil price spikes increase uncertainty about oil prices, while oil price drops reduce oil price volatility. The Results of the T-ARCH models suggest that oil price is a factor that creates downside risk for international portafolio diversification.

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