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Macroeconomic effects of oil price shocks in Brazil and in the United States ☆

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HIGHLIGHTS

- We find that output growth volatility in the US has been decreasing over time.
- The contribution of oil price shocks to such volatility has also been decreasing.
- In Brazil, oil shocks do not seem to have a clear impact on growth.
- They account for a small fraction of the Brazilian inflation and output volatility.
- Counterfactuals show US output would be 10% less volatile with Brazil's oil import share.

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ABSTRACT

This paper studies the effects of oil price shocks in the last 30 years on the Brazilian and American inflation rate and rhythm of economic activity. The Brazilian and the United States economies are interesting polar cases, since they had a completely different path on the oil import dependence rate. While the oil import dependence rate has increase sharply in the United States (US), it has decreased substantially in Brazil. We found that output growth volatility in the United States has been decreasing over time as well as the contribution of oil price shocks to such volatility, despite the increase in oil import dependence. Inflation volatility has also been decreasing but oil price shocks are accounting for a larger fraction of this volatility in the US. In Brazil, such shocks do not seem to have a clear impact on output growth and they account for a very small fraction of the Brazilian inflation and output growth rate volatility. We finally run some counterfactual experiments to analyze how real output growth in the United States would had been if net oil import share in the United States behaved similarly to what was observed in Brazil. We conclude that output level would be roughly the same, however, it would be about 10% less volatile if the US had the actual Brazilian oil import share.

1. Introduction

Sharp increases in the price of oil and other energy products are referred in the literature as classical examples of negative supply shocks (e.g. [1,2]). Increases in the price of oil lead to increases in the cost of production, which in general decrease the rhythm of economic activity and increase inflation. The response of nominal wages and monetary policies can amplify the shocks.[1] There is a plethora of studies addressing several channels through which oil shocks can affect the economy, ranging from effects on the stock market returns (e.g. [4,5]) to labor market implications (e.g. [6]). In an important article, Hamilton [7] argues that nine out of 10 North-American recessions after the World War II until mid-1970s were preceded by sharp increases in oil prices. Early studies documented and tried to explain the inverse relationship between increases in the oil price and aggregate economic activity (among those, see [8,9]). In addition, he shows that such correlation between oil prices and output does not represent a statistical coincidence. In

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[1] If wages increase after a negative shock, then inflation will increase further. A contractionary monetary policy would then increase unemployment further. On the other hand, a loose monetary policy would increase inflation. See [3] for more on oil shocks and monetary policy.

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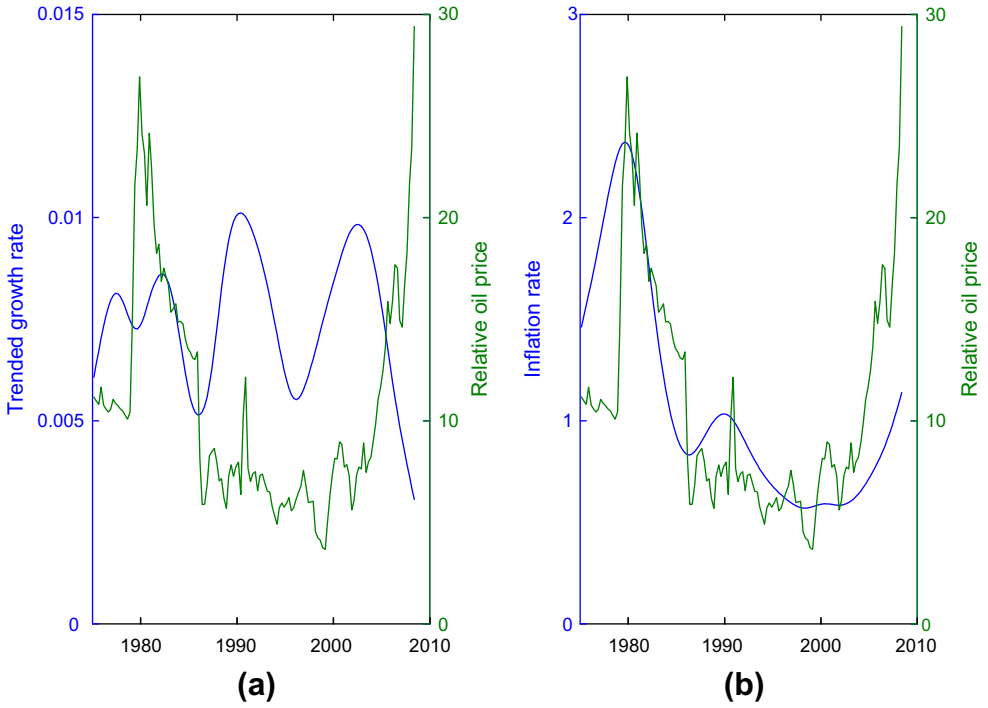

Fig. 1. Relative oil price versus growth of real GDP and Inflation in the United States (US). Panel (a): Hodrick–Prescott Trended growth rate of real GDP and relative oil price. Panel (b): Hodrick–Prescott Trended inflation rate and relative oil price. Relative oil price is the international oil price divided by the Consumer Price Index (CPI). *Source*: International Financial Statistics.

particular, he finds evidence of Granger causality between oil prices and output. Fig. 1 shows how the growth rate of real Gross Domestic Product (GDP) and the inflation rate are related to the relative international oil price in the United States.[2] Periods of low growth in real GDP and high inflation are preceded by high relative international oil price.

Price increases in oil have also been associated to the productivity slowdown in the 1970s. Table 1 relates the growth rates of total factor productivity (TFP) in the US and in Brazil to the real price of oil for selected 5 years sub-periods. The overall relation is significantly influenced by a period of unusually low growth in TFP in 1975–1980 (for the Brazilian case one can observe a lagged effect of the early 1970s oil crisis, as the TFP is only negatively affected at a later stage) which coincides with an odd high real price of oil (see also [10]). Olson [11] posits that the cost of energy corresponds to a small fraction of GDP and therefore oil price increases do not seem to account for this productivity slowdown.

One way to see whether the relationship between oil price and growth of output might not be just a coincidence is by performing a statistical regression of the real GDP growth rate on its lagged values[3] and lagged logarithmic changes in nominal oil prices, as suggested by [12]:

$$\text{growth} = \alpha + \sum_{j=1}^{4} \gamma_j \text{growth}_{t-j} + \sum_{j=1}^{4} \beta_j \text{oil}_{t-j}. \quad (1)$$

The OLS regression estimation of such relationship for the US economy (using quarterly data[4]) for the period from 1958 to 1980, shows that the parameters of the four lagged oil price variables are negative and statistically significant at 95% confidence level.[5] An *F*-test also rejects the null hypothesis of the joint estimate of the parameters of the lagged oil prices being all zero with a *p*-value of 0.0058.[6]

Table 1
Growth in total factor productivity and the real price of oil. *Source*: IMF–IFS (oil price); TFP from [41].

	Real oil price averages	USA TFP growth averages	Brazil TFP growth averages
1960–1965	20.14	1.94	2.47
1965–1970	19.38	0.07	2.75
1970–1975	27.79	−0.034	5.22
1975–1980	60.25	−1.22	0.19
1980–1985	69.93	1.16	−1.65
1985–1990	34.62	1.02	1.69
1990–1995	27.79	0.17	−0.34
1995–2000	24.07	1.48	0.01
2000–2005	35.59	1.72	3.27

Some studies (e.g. [13,14]), however, have shown that while in the 1970s oil price shocks lead to long periods of stagflation, recently the effects of such shocks on inflation and output have been mild in most of the economies. Blanchard and Gali [13] posit that there are four sources for such decline in the effects of oil shocks on the economy and they all played some role: (i) good luck (i.e., small concurrent adverse shocks); (ii) decline in the dependence of oil in production; (iii) more flexible labor markets; and (iv) improvements in monetary policy. The statistical significance of the parameters of Eq. (1) decreases as we use more recent data (see also [15]). We re-estimate Eq. (1) using data until the second

[2] The relative oil price corresponds to the international oil price divided by the Consumer Price Index (CPI). Appendix A has the description and source of all variables used in this paper.

[3] The lag length was determined based on AIC and BIC performance-based criteria.

[4] Data are from IMF-IFS (U.S. data and international oil price) and IPEA data (for Brazil).

[5] For the sake of space, we omit the estimated parameters and associated standard deviation.

[6] We found similar results for the Brazilian economy, using annual data from 1954 to 1980. We use annual data since there is not quarterly data for the Brazilian economy for a period before the first quarter of 1975. Given the annually time frequency, we use only one lag variable in Eq. (1) for the Brazilian case.