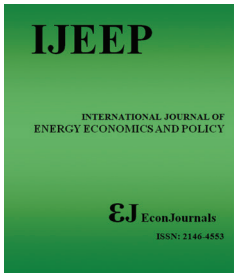

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The Indirect Effects of Oil Price on Consumption through Assets

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ABSTRACT

This research considers how oil price can indirectly affect consumption through asset prices of stock and house. Using the theory of consumption wealth effect, this research shows that, unexpectedly, a rise in oil price would lead to increase in consumption. The research uses the data of three OECD countries of France, Canada and the United States from quarter 1st 1997 to quarter 3rd 2017 and vector autoregression model. Empirical results prove that a positive shock to oil price has a positive indirect effect on consumptions of France and Canada via both asset prices. The indirect effect of oil price on US consumption only exists through stock price. The duration of indirect effect of oil price on consumption depends on dependency of consumption to asset prices in each country.

Keywords: Oil Price, Consumption Wealth Effect, Asset Prices
JEL Classifications: Q43

1. INTRODUCTION

Asset prices are important variables of interest to economists, especially in the face of positive shocks in oil prices (Bjørnland, 2009; El-Sharif et al., 2005). One way in which asset prices can affect the economy is through consumption. Stock and real estates are two important assets that are of interest to researchers because of their impact on consumption. For example, Ludwig and Sløk (2004) discovered that the long-run effect of a rise in stock price is higher for countries whose financial system is market-based than those are bank-based.

Campbell and Cocco (2007) also found that increasing house prices can affect consumption through increasing households' wealth or decreasing borrowing restrictions. They also discovered a relationship between regional house price and regional consumption growth. Recently, Di Maggio et al. (2020) examined how changes in stock market returns responded by consumption with employing data on households' stock holdings in Sweden.

Ciarlone (2011) found the existence of both housing wealth effect and financial wealth effect with larger impact of house price on consumption in 17 emerging economies. The studies of (Carroll et al., 2011; Case et al., 2011) for the US and Pichette and Tremblay (2003) for Canada obtained similar results in which the effect of house price on consumption was more than the stock price. Also, Dong et al. (2017) investigated the impact of housing price on consumption in 35 major Chinese cities. They found that both financial markets and housing are integral to explain the relationship between housing price and consumption.

Shen et al. (2015) found that the influence of the stock market on consumption was greater in OECD countries, although they acknowledged that the role of house price has increased in recent

years. The impact of oil prices on the stock market has been considered in some research (Dagher and El Hariri, 2013; Jammazi and Aloui, 2010; Naifar and Al Dohaiman, 2013; Narayan and Narayan, 2010; Razmi et al., 2015, 2016, 2017; Singhal et al., 2019; Soytas and Oran, 2011; Tursoy and Faisal, 2018; Zhu et al., 2011).

To be more specific, some research shows a positive relationship between oil price and stock market returns. For instance, Alamgir and Amin (2021) found a positive relationship between stock market index and world oil price in the 4 selected South Asian countries between 1997 and 2018. They also showed that the response of the index of the stock market to oil price shocks is asymmetric. Likewise, Anyalechi et al. (2019) examined the stock market's responsiveness to oil price fluctuations in Nigeria between 1994 and 2016. They found that oil price changes have had insignificant but positive effect on stock market returns both in long and short run.

Also, Alquist et al. (2020) studied the response of the US equity, bond futures, and exchange rate returns to shocks of oil price. In most sectors, although before the 2007/2008 crisis, higher oil prices were associated with decreasing in equity prices, after this crisis higher oil prices, higher equity process. Also, positive oil price shocks led to a depreciation of the US dollar in comparison to a range of other currencies but had only a mild effect on bond future returns.

Although there is no consensus regarding the relationship between oil price and stock price, the results of many studies show that the stock price increases following oil price shock; for example, El-Sharif et al. (2005) for the United Kingdom and Bjørnland (2009) for Norway found a positive relationship between crude oil price and stock price. Some empirical research about that are also Agarwalla et al. (2021), which showed that the international crude oil price affects dramatically the Indian stock price. Moreover, Park and Ratti (2008) compared the responses of the stock price to oil price shocks for the US and 13 European countries. Last but not least, Bastianin and Manera (2018) investigated the effect of oil price shocks on the volatility of the US stock market. They analyzed the structural oil market shocks in three parts (i.e., aggregate demand, oil supply, and oil-specific demand shocks). They showed that oil price shocks caused by aggregate and oil-specific demand significantly affect volatility; however, the impact of supply-side shock is trivial. They found that this response is positive for Norway but negative for other countries except the US. However, there is a gap in the literature considering the response of house prices to oil price shock. Following oil price shock, policymakers have tried to influence consumption to reduce the inflationary effects of higher oil prices. Therefore, it is expected that consumption would decrease after oil price shock due to anti-inflationary policies and a rising interest rate. The effectiveness of the policy depends on the impact of oil prices on asset prices. Contrary to economic expectations, this research proposes a new assumption that a positive shock to oil price will increase consumption at least for a short period of time. This impact works similarly to the wealth effect theory.

According to Ando and Modigliani (1963) and Friedman (1957) in addition to income, consumption also depends on the present values of assets through an influence called the wealth effect. The wealth effect of Ando-Modigliani's consumption can be considered through the following process (William, 2005).

$$C = \alpha_0 \, y^L + \alpha_1 \, a \tag{1}$$

Where C indicates consumption, y^L shows labor income and a is real value of the assets.

They assumed that the current value of the earnings, PV, is derived from the current value of labor income and the current value of property income y_t^p

$$PV_0 = \sum_0^T \frac{y_t^p}{(1+r)^t} + \sum_0^T \frac{y_t^L}{(1+r)^t} \tag{2}$$

Where r shows interest rate. Ando-Modigliani believed that if an asset enters the financial market, a long-term gain is equal to the real value of the assets:

$$\sum_0^T \frac{y_t^p}{(1+r)^t} = a_0 \tag{3}$$

Labor income is also divided into two parts of income from work in the current and future periods

$$\sum_{t=00}^T y_0^L + \sum_1^T \frac{y_t^L}{(1+r)^t} \tag{4}$$

By placing the relation (4) in (2), we have

$$PV_0 = a_0 + y_0^L + \sum_{t=1}^T \frac{y_0^L}{(1+r)^t} \tag{5}$$

The third part of the relationship (5) is expected and related to the future if we consider the average earnings expected from the sale of labor

$$y_0^e = \frac{\sum_{t=1}^T \frac{y_t^L}{(1+r)^t}}{T-1} \tag{6}$$

$$\sum_{t=1}^T \frac{y_t^L}{(1+r)^t} = (T-1)\, y_0^e \tag{7}$$

$$PV_0 = a_0 + y_0^L + (T-1)\, y_0^e \tag{8}$$

Ando-Modigliani consider expected earnings are a function of current income

$$y_0^e = \beta \, y_0^L \tag{9}$$

By placing (9) in (8)

$$PV_0 = a_0 + \left[1 + \beta(T-1)\right] y_0^L \tag{10}$$

On the other hand, according to the stated statement

$$C_t=k.PV_t \quad (11)$$

Place 10 in 11

$$C_t = ka_0 + k\left[1+\beta(T-1)\right]y_{0\,t}^{L} \quad (12)$$

Relationship (12) shows that with increasing wealth (a_0), the consumption of individuals increases. It also has an effect on the consumption of theoretically (MPS) MIT- Penn- SSRC Can be expressed. Assets can be defined as follows

$$A=K+R+B \quad (13)$$

In which A is the nominal value of assets, R is the value of the stock held by the central bank, and B is government bonds purchased by the people

$$\frac{A}{P}=a=\frac{K}{P}+\frac{R}{P}+\frac{B}{P} \quad (14)$$

Where a is the actual amount of assets and p stands for prices. If we assume that all government bonds are very long-term and have standard annual revenues of $ 1, then the total value of bonds outstanding is equivalent to the result of dividing the number of bonds into interest rates. Therefore,

$$B=\frac{b}{r} \quad (15)$$

By putting 14 in 15

$$a=k+\frac{R}{P}+\frac{b}{rp} \quad (16)$$

This factor of real wealth, according to (1), affects the consumption of individuals

$$C=C(y-t(y),\frac{A}{P}) \quad (17)$$

Where $t(y)$ shows tax function.

This depends on the extent and duration of the positive response of house price and stock price to positive oil price shock. The greater the influence of positive shock to oil price to these variables, the greater consumption increases. Thus, policymakers face new challenges concerning the consumption policies. This study aims to examine the hypothesis that, following oil price shock, consumption increases through the wealth effect. To the best of our knowledge, no research has considered the effect of an oil price shock on consumption through the wealth effect. Most studies mainly focused on the effect of monetary policy on consumption through the wealth effect (Elbourne, 2008; Fry-McKibbin et al., 2010). This research newly considers how oil price shock can increase consumption through stock price and house price for 4 of the OECD countries (France, Canada and US). Besides, there is a gap in the literature investigating response of house prices to oil price shock.

The remainder of this paper is organized as follows. Section 2 discusses the data and methodology, Section 3 discusses the empirical results, and Section 4 provides concluding remarks and policy implications.

2. MODEL AND METHODOLOGY

This study covers quarterly data from 1997: Q1 until 2017: Q3. Data are collected from (FRED, 2018; OECD, 2018). y_t represents the vector of variables: y_t=[*i3 oil cp fc sp hp ne*], where *i3*, *oil*, *cp*, *fc*, *sp*, *hp* and *ne* stand for long term interest rate, Brent oil price, consumer price index, household final consumption expenditure, stock price index, house price index, and nominal effective exchange rate, respectively. The study uses a vector autoregression model with seasonally adjusted logarithm form of level, except *int*. This study considers the short-run effect of oil price shock on household consumption through asset prices using vector autoregression (VAR), in which one variable is a function of its own lags and the lags of other variables. Structural VAR (SVAR) and vector autoregression are employed in policy analysis-based studies. The results of impulse responses in these models show how one variable responds to the shocks of other variables. A VECM model that is established on long-run limitations cannot help to fulfill the objectives of this study since this research results rely on short-run dynamics between variables. In structural VAR models, one has to impose contemporaneous restrictions on structural errors before obtaining impulse responses. Therefore, the results of impulse responses depend on the validity of the restrictions Farzanegan and Markwardt (2009). Imposing a wrong relationship between all variables regarding the economic situations of a country makes the results of structural vector Autoregression unreliable. There are some debates on the use of VAR in the first difference and VAR in levels among cointegrated variables. Using stationary variables are necessary for interpreting coefficients of the model, while level variables give more accurate impulse response and variance decomposition functions. The loss of long-run information in VAR in the first difference makes this model inappropriate for impulse response function (Brooks, 2019; Farzanegan, 2011). Furthermore, according to Sims et al. (1990), differencing to remove the non-stationary variable is not a good idea when there is uncertainty about the number of unit roots or a linear combination of cointegrate coefficients. The level variables are generally used in policy analysis-based studies; for example, (Bernanke and Mihov, 1997, 1998; Bhattacharyya and Sensarma 2008; Bjørnland and Jacobsen, 2013; Farzanegan and Markwardt, 2009; Shibamoto and Shizume, 2014) used level variables.

Vector Autoregression can be defined by equation 18.

$$y_t=\sum_{i=1}^{p}A_i y_{t-i}+\sum B_J X_{t-j}+\varepsilon_t\ ,\ t=1,2,\ldots,n \quad (18)$$

endogenous variables are represented by vector of yt, and exogenous variables is shown by xt vector. All the variables of this study are endogenous as y_t = [*i3 oil cp fc sp hp ne*].

3. EMPIRICAL RESULTS

Before proceeding, it is essential to find the order of integration of variables. This study uses the Augmented Dickey Fuller (ADF)

Table 1: Unit root test

	Canada		France		United State	
	Intercept	Trend and intercept	Intercept	Trend and intercept	Intercept	Trend and intercept
lcp	–1.18	–1.04	–1.18	0.55	–1.80	–0.46
Δ *lcp*	–7.83	–7.93	–6.19	–6.31	–6.71	–6.88
lfc	–2.09	–1.23	–2.07	–0.23	–2.00	–1.99
Δ *lfc*	–7.25	–7.47	–4.19	–6.60	–4.90	–5.23
lhp	1.05	–1.62	–2.12	–2.31	–2.07	v2.34
Δ *lhp*	–5.04	–5.03	–3.31	–4.09	–2.27	–2.25
li3	–1.31	–2.80	–0.39	–1.95	–1.40	–3.45
Δ *li3*	–8.32	–8.24	–2.49	–2.88	–7.31	–7.27
lne	–1.43	–1.66	–2.49	–2.48	–2.60	–2.62
Δ *lne*	–6.87	–6.86	–6.03	–5.99	–6.02	–5.98
loil	–1.63	–1.92	–1.61	–2.11	–1.63	–1.92
Δ *loil*	–6.50	–6.56	–6.50	–6.46	–6.37	–6.42
lsp	–2.01	–3.44	–2.46	–2.68	–2.22	–3.40
Δ *lsp*	–6.98	–6.94	–5.65	–5.62	–6.06	–6.01

Δ Denotes the first difference operator. *lcp*: Log consumer prices-all items, *lfc*: Final household consumption expenditure of households, *lhp*: Log house price indices, *li3* log long- term interest, *lne*: Log effective exchange rate, nominal broad indices, *loil*: Log crude oil, *lsp*: log share prices. critical values at 5% for the intercept, intercept and trend and none respectively are –2.89 and –3.47

test that is based on Dickey and Fuller (1979) for testing stationary of variables. Table 1 shows the results of the Stationary test for variables in levels and in the first difference. All variables are integrated in order 1 in all countries.

The results of Vector Autoregression and Johansen cointegration may not correctly indicate reality if incorrect lag length is chosen (Hall, 1991). Choosing the best lag for Vector Autoregression and cointegration test, the study uses the minimum lag length with no serial correlation in error terms. Therefore, the degree of freedom will not be affected. While various information criteria have been introduced for finding lag length, Cheung and Lai (1993) showed that employing information criteria for selecting optimal lag may be inadequate in the existence of moving average error terms. This study uses VAR lag selection with no serial correlation in reseals based on Hall (1989) and Johansen (1992). A similar procedure has been employed by (Ibrahim, 2006; Ziaei, 2018). The study chooses lag 2 for US and Canada and lag 3 for France. Table 2 shows the serial correlation LM test. Null Hypothesis of no serial correlation is rejected until lag 5 for all countries at stated lag chosen. Table 3 shows the result of the cointegration test that is based on two statistics, trace statistics and maximal Eigen statistics of (Johansen and Juselius, 1990). r indicates the null hypothesis that indicates the number of the cointegrated equation. The existence of a cointegration vector is shown in Table 3 for all countries, so the study can proceed to use level Variables in Vector Autoregression for finding impulse responses.

Figure 1 shows the results of the Impulse response of domestic variables to oil price and household consumption to domestic variables and oil price. Reaching these responses, Cholesky orders are as follows: oil price, consumer price index, interest rate, house price, nominal effective exchange rate, stock price, and household consumption. Although different Cholesky orders are used, and the results are not much different from each other. Following the oil price shock, household consumption increases in all countries. Canada's household consumption shows the longest significant response for six periods to oil price shock, while this response is

Table 2: Serial correlation LM test

Lags	Canada		France		US	
	LM-Stat	Prob	LM-Stat	Prob	LM-Stat	Prob
1	52.27187	0.3481	61.37014	0.1105	66.00383	0.0529
2	57.95072	0.1786	57.59298	0.1872	56.59941	0.2125
3	46.87973	0.5595	53.10329	0.3190	30.48235	0.9825
4	30.99232	0.9792	50.07970	0.4303	65.17795	0.0608
5	54.58959	0.2705	44.79945	0.6440	42.69566	0.7252

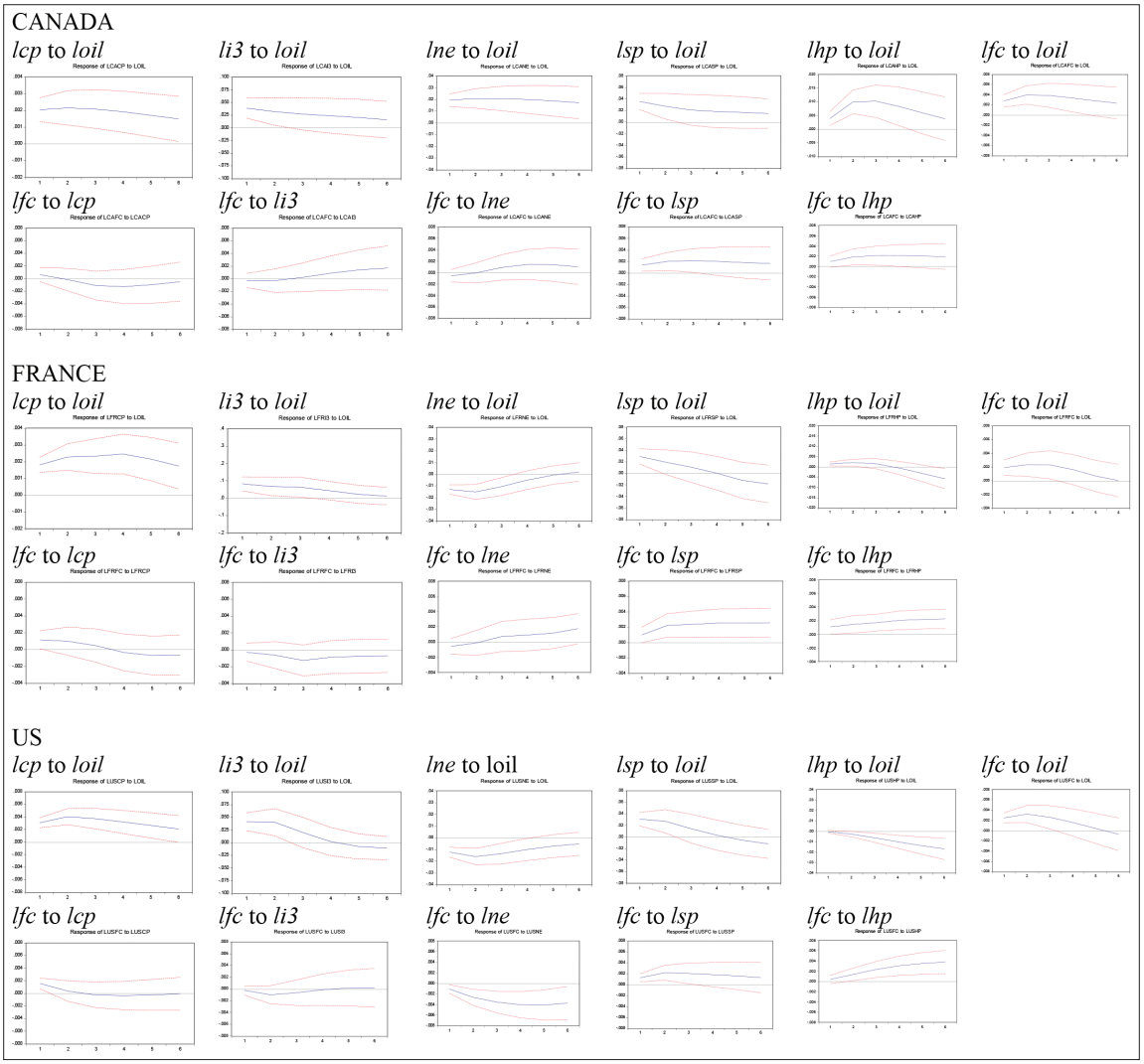
significant for three periods in other countries. In all countries, the consumer price index increases in response to positive oil price shock. The response of household consumption to positive consumer price shock is only significant for one period in France and the United States while it is insignificant in Canada. The response of the interest rate to the positive shock to oil price is positive and significant, while household consumption responds insignificantly to a positive shock to the interest rate in all countries. The exchange rate responds significantly and positively in Canada and significantly and negatively in US and France to the positive shock to oil price, while the response of exchange rate is negative in US. Household consumption responds insignificantly to the exchange rate in both Canada and France, so the exchange rate cannot be effective on household consumption in the two countries. A positive shock to oil price should lead to an increase in household consumption due to the response of consumer price index, interest rates, and exchange rates to the oil price, but the response of household consumption to exchange rate, interest rate, and consumer price is insignificant for all countries except for US, which its' response to a positive exchange rate shock is significantly positive. The responses to positive shocks in asset prices show that in all countries, rising stock prices and house prices increase household consumption.

In Canada, the response of price of both assets to oil price is positive and significant for six periods, and household consumption also has a permanent positive and significant response to a positive shock to the oil price. In France, the positive response of stock price and house price is only significant for one and two periods, respectively, so household consumption responds positively and

Table 3: Johansen cointegration test

	Null hypothesis	Trace	Maximal Eign	Trace critical value	Maximal Eign critical value
Canada	r=0	156.78	56.05	111.78	42.77
	r≤1	100.73	48.09	83.93	36.63
	r≤2	52.63	20.20	60.06	30.43
	r≤3	32.42	16.48	40.17	24.15
	r≤4	15.93	12.22	24.27	17.79
	r≤5	3.713	3.565	12.32	11.22
	r≤6	0.147	0.147	4.129	4.129
France	r=0	223.92	69.82	111.78	42.77
	r≤1	154.09	61.23	83.93	36.63
	r≤2	92.86	35.95	60.06	30.43
	r≤3	56.91	33.17	40.17	24.15
	r≤4	23.73	13.19	24.27	17.79
	r≤5	10.53	10.48	12.32	11.224
	r≤6	0.050	0.050	4.129	4.129
US	r=0	193.24	64.68	134.67	47.078
	r≤1	128.56	40.84	103.84	40.95
	r≤2	87.71	34.40	76.97	34.80
	r≤3	53.30	19.84	54.07	28.58
	r≤4	33.46	15.51	35.19	22.29
	r≤5	17.95	10.25	20.26	15.89
	r≤6	7.69	7.69	9.164	9.164

Figure 1: Response of domestic variables to oil price and household consumption to domestic variables



Variables are as follows, *lcp*: Log consumer prices-all items, *lfc*: Final household consumption expenditure of households, *lhp*: Log house price indices, *li3*: Log long- term interest, *lne*: Log effective exchange rate, nominal broad indices, *loil*: Log crude oil, *lsp*: Log share prices

significantly to oil price shock for a shorter period than Canada. In the US, a positive oil price shock leads to an increase in stock price and a decrease in house prices. A positive response to a positive shock to stock price and house price indicates that oil price increases will have an uncertain effect on household consumption due to asset prices since the direction of the response of house price to the oil price shock and household consumption to house price is not the same. The exchange rate responds negatively to the positive shock to the oil price, and the relation between household consumption and the exchange rate is negative. There will be an increase in household consumption resulting from lower exchange rates due to rising oil prices. Therefore, an increase in household consumption following oil price shock can be a result of the exchange rate and stock price. Apart from the US in other countries, asset prices will have an effective role in increasing short-run household consumption after a positive shock to the oil price.

4. CONCLUSION

Economic theory only focuses on the influence of monetary policy on consumption via the wealth effect, although any factor affecting asset prices can impact consumption. The economic literature shows that oil price can be an important factor influencing asset prices, so consumption may increase under positive oil price shock. However, the interest rate increases because of anti-inflationary policies. This study investigates the effect of the oil price shock on household consumption by affecting house price and stock price in 3 members of OECD. It also considers the reaction of the interest rate, domestic price, and exchange rate under a positive oil price shock with regard to their effect on consumption.

The results show that, under the positive oil price shock, an increase in household consumption occurs due to the wealth effect of the rising prices of both assets except in the US. The longer the positive and significant response of household consumption to the positive shock to asset prices, the longer the positive and significant response of household consumption to oil price shock. So, a positive oil price shock can increase household consumption through the wealth effect. An increase in household consumption in the US can occur by increasing the domestic exchange rate and stock price. Policymakers should also carefully control house prices and stock prices facing a positive shock to oil prices. Any increase in the price of these assets can lead to a longer-term increase in household consumption.

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