

Atukeren, Erdal

**Article**

## Oil Price Shocks and the Swiss Economy: A Causal Investigation

Aussenwirtschaft

**Provided in Cooperation with:**

University of St.Gallen, School of Economics and Political Science, Swiss Institute for International Economics and Applied Economics Research

*Suggested Citation:* Atukeren, Erdal (2005) : Oil Price Shocks and the Swiss Economy: A Causal Investigation, Aussenwirtschaft, ISSN 0004-8216, Universität St.Gallen, Schweizerisches Institut für Aussenwirtschaft und Angewandte Wirtschaftsforschung (SIAW-HSG), St.Gallen, Vol. 60, Iss. 2, pp. 151-168

This Version is available at:

<https://hdl.handle.net/10419/231076>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

## **Oil Price Shocks and the Swiss Economy: A Causal Investigation**

Erdal Atukeren\*

Swiss Institute for Business Cycle Research (KOF / ETH Zürich)

This paper investigates the causal linkages between oil price increases and economic activity in Switzerland. The results from Granger-causality tests indicate that oil price shocks lead to a deterioration in the general macroeconomic environment. However, imports shrink more than the decline in exports, i.e., net exports increase, which reduces the overall negative effect on GDP. Furthermore, shocks to the U.S. dollar price of oil are found to contain more information than the shocks measured in Swiss francs – possibly reflecting the effects of increased uncertainty or a negative world economic environment associated with sharp increases in oil prices.

*Keywords:* oil price shocks, open economy macroeconomics, Granger-causality

*JEL-Codes:* Q43, C22

### **1 Introduction**

The relationship between oil prices and economic activity received increased attention by academic economists as well as the general public since the 1973–1974 oil crises. The empirical observation that oil price increases preceded most of the recessions in the USA (e.g., HAMILTON 1983) led to an increasing number of studies elaborating on the effects of changes in oil prices on economic activity. Nevertheless, the number of studies investigating the effects of oil price shocks on small open industrial economies without oil resources has been rather small. This paper attempts to provide a perspective towards filling this gap by undertaking a detailed examination of the effects of oil price shocks on the Swiss economy. In doing so, we first review some of the theoretical issues in the economics of oil prices in *Section 2* of this paper. In *Section 3*, we examine the existence (or lack thereof) of Granger-causal relationships between two measures of oil price shocks and a large number of Swiss macroeconomic variables. *Section 4* concludes.

---

\* Earlier work on the topic of this paper was presented at the Swiss National Bank and at the ECO-MOD (International Conference on Policy Modelling) 2003 meetings in Istanbul. I would like to thank, without implicating, the participants of these sessions for their useful comments. Also, the views expressed in this paper are solely the author's and do not necessarily reflect those of KOF/ETH Zürich.

## 2 A Review of Theoretical Issues<sup>1</sup>

### 2.1 Transmission Mechanisms

In a neoclassical production function framework, where energy enters as a factor of production, an oil price shock constitutes a supply-side shock. Hence, firms in an economy respond to an increase in oil prices by reducing the use of oil or oil products. Thus, *ceteris paribus*, output declines. Given the same level of capital and labour, it indeed appears as if there is a decline in productivity – a fact generally observed after oil price shocks. Furthermore, an increase in the oil price leads to an increase in the general price level (at least contemporaneously). This reduces the money supply in real terms if the Central Bank does not increase the nominal money supply. The reason for the Central Bank not to increase the money supply could be that it is sticking to a price stability rule or the shock is perceived to be only temporary. The short-term result is an increase in the real interest rate. If the shock persists and the monetary authority continues not to accommodate the shock, then interest rates might move further up and depress aggregate demand (see PIERCE and ENZLER 1974). Furthermore, a war (e.g., the Gulf war of 1991 or the War on Iraq in 2003) or concerns about the future security of oil supply routes (as experienced in 2004/2005) may be the cause of the oil price shock, possibly leading to a decline in consumer confidence and depressing the investment environment. In such cases, an oil price shock may also bring about a negative demand-side shock. The size of the decline in GDP and the accompanying increase in unemployment may be higher if there are wage rigidities. However, the monetary authority may counteract this by accommodative policy to keep the nominal GDP at least unchanged.

For a small open economy without oil resources, the effects of the oil price shock on the foreign trade sector provide an additional important channel of transmission. First, an oil price shock leads to some transfer of income from non-oil producing countries to oil producing countries. The net effect on global demand is, however, likely to be negative since the increase in the demand for imports due to higher incomes in the oil-exporting countries normally would not make up for the reduction in total demand in (industrialised) oil-importing countries. Hence, the reduced purchasing power in their main export markets (non-oil producing industrial

---

1 More comprehensive and detailed reviews of the literature and the critical issues can be found in BROWN and YÜCEL (2002), HAMILTON (2003), and JONES, LEIBY and PAIK (2004), among others.

countries) leads to a decline in the exports for a small open economy without oil resources. Nevertheless, since a significant part of total demand is satisfied by imports in a small open economy, imports will also shrink as a reaction to an increase in import prices as well as the reduction in domestic demand components. If the shrinkage in imports is more than the decline in exports, the country ends up with an increase in its net exports. As a result, the net effect of the oil price shock on real GDP may be found to be only small. In such a case, examining how the individual components of GDP react to the shock rather than evaluating just the total impact on real GDP growth becomes more important for understanding the oil – macroeconomy relationship. For example, the response of investment in machinery and equipment to oil price shocks is an important issue since it can affect the economy's long-term growth path – a point which deserves further attention.

## **2.2 Some current issues in the oil prices – macroeconomy literature**

As noted by HAMILTON (1983), oil price increases precede most recessions, but large decreases in oil prices are generally not followed by booms in economic activity. This observation brings into one's mind the question of whether the effects of oil price changes on the economy are asymmetric. TATOM (1988), MORK (1989, 1994), and HAMILTON (1988, 1996) discuss this possible asymmetry and provide some evidence for it. HAMILTON (1988) argues that decreases and increases in oil prices affect the economy in a similar way, but adjusting to changing prices is costly: the net effect being about zero in the former case and negative in the latter. Other explanations for the asymmetry are the role of the monetary authority, the adverse effects of uncertainty on the investment environment (FEDERER 1996), an embedded energy-output ratio in the capital stock (ATKESON and KEHOE 1999), and an asymmetric response of refined petroleum products' prices (especially gasoline) to changing crude oil prices (BACON 1991; HUNTINGTON 1998).

Furthermore, it is observed that oil price shocks of the late 1990s and early 2000s had less measured effects on the economy than those of the 1970s and early 1980s. In addition, only a weak pass-through from oil prices to core inflation is found (e.g., HUNT, ISARD and LAXTON 2001). In general, a number of facts, such as a decline in the ratio of energy consumption to GDP and the existence of a strong economic expansion in

the late 1990s, support a weaker relationship between oil price increases and economic performance.

Challenging the view that the relationship between oil prices and the economy is weakening, HAMILTON (2003) argues that the observed weakening of the relationship between oil price changes and economic activity since the mid-1980s could be due to the existence of both positive (increases) and negative (decreases) oil price shocks during this period. HAMILTON, then, demonstrates that when there are both positive and negative oil price shocks, price changes that do not represent shocks, and those price changes which occur only as corrections after a positive or negative shock, the overall impact of oil price changes on macroeconomic performance might be statistically found to be weak. To correct for this bias, HAMILTON (1996, 2003) uses a filter and introduces the 'net oil price' concept. Accordingly, a positive oil price shock is said to occur if the current oil price is above the maximum of the oil price in the preceding 12 months. Using this measure, HAMILTON (2003) shows that the relationship between oil prices and macroeconomic performance indeed has not weakened since the mid-1980s.

### **3 Oil Prices and the Swiss Economy: An Investigation of Granger-Causality**

#### **3.1 Methodology**

In this section, we carry out an empirical investigation of the effects of shock increases in oil prices on the Swiss economy.<sup>2</sup> In doing so, we confine ourselves to the framework of Granger-causality tests.<sup>3</sup> According to GRANGER (1969), if the inclusion of past (lagged) values of a (weakly) stationary variable *X* still significantly contributes to the explanation of another (weakly) stationary variable *Y* in a regression of *Y* on its own past values and all other relevant information, then *X* is said to 'cause' *Y*. In what follows, we use the bivariate version of Granger's causality test, where *X* is a variable representing positive oil price shocks and *Y* is a macroeconomic variable, such as real GDP. The aim is to find out whether

---

2 In the rest of this paper, the terms "positive oil price shock" or simply "oil price shock" are meant as the price of a barrel of oil at a given quarter being higher than the highest price in the preceding four quarters. This definition is in line with HAMILTON (1996, 2003).

3 See also CUNADO and PEREZ DE GARCIA (2003) for an investigation of long-term relationships and Granger-causality between oil price shocks and macroeconomic performance (industrial production and inflation) for a number of European countries. Switzerland is not included in their sample.

oil price shocks 'cause' or explain significantly (in Granger's sense) other macroeconomic variables in Switzerland. The bivariate framework may sound restrictive at first, but it is justified in view of HSIAO's (1982) theorem that for a variable  $X$  to be a 'direct cause' of another variable  $Y$ ,  $X$  must cause  $Y$  in all settings: bi- and multivariate. Furthermore, according to HSIAO (1982), a stationary stochastic variable  $X$  should Granger-cause a distinct stochastic stationary variable  $Y$  also in a bivariate setting even if  $X$  is only an indirect cause of  $Y$  (e.g., via a linking variable  $Z$ ) in the absence of the linking variable. Therefore, the finding of ' $X$  causes  $Y$ ' in a bivariate setting is a necessary condition for  $X$  to be a direct or indirect cause of  $Y$ .<sup>4</sup>

There exist, however, a number of methodological problems in testing for Granger-causality. The main problem is how to choose the (optimal) number of lags for  $X$  and  $Y$  in the regression. We address this problem by following HSIAO's (1979, 1982) approach and using a statistical model selection criterion, namely SCHWARZ's (1978) *Bayesian Information Criterion* (SBIC). The SBIC is less concerned with whether a true model exists or not, and rather searches for the most probable model. The formula is:  $SBIC = (ESS/T) * T^{(k/T)}$ , where  $ESS$  is the error sum of squares from estimation of the model in question,  $T$  is the sample size, and  $k$  is the number of estimated parameters in the model. Our choice is also supported by MILLS and PRASAD's (1992) comparison of the performance of various statistical model selection criteria by means of Monte-Carlo studies (that is, when the true model is known). They suggest (pp. 221–222) that the SBIC criterion "... should probably be the first choice of applied researchers."

We also follow PENM and TERRELL (1984) and KANG (1989) to extend the use of BIC to specify subset autoregressions and subset transfer functions. The 'subset' approach allows for the suppression of insignificant lags between lag 1 and the maximum lag  $M$ , where  $M$  is chosen *a priori* ( $M > 1$ ), and leads to more efficient estimates. The exact methodology of testing for Granger-causality with a subset- and transfer-function-based approach is as follows. First, we fit the best univariate autoregressive specification for each macro variable by using the SBIC. The resulting SBIC

4 There could be another variable,  $Z$ , which causes both  $X$  and  $Y$ . The omission of  $Z$  may lead to the detection of Granger-causality between  $X$  and  $Y$ , when there is indeed no direct or indirect relationship. Whether such a case can be established between the oil price shocks defined in HAMILTON's sense and the Swiss macroeconomic variables examined in this paper is an interesting question. Also, note that even if the specification is extended into a multivariate framework, the omitted common cause problem might still remain. Therefore, we qualify our causal findings as *prima facie*.

values represent the best (strongest) case for non-causality. Second, we introduce the lagged values of the oil price variables on the best specifications for the macro variables. The maximum lag-length allowed both in the (first-stage) univariate specifications and in the (second-stage) transfer functions was eight quarters. That is, we constrain ourselves rather to the short-term, but still allow for enough passage of time for some dynamics to take place. If the best specification from the subset transfer function produces a lower SBIC value than the respective univariate specification, this leads to the conclusion that the oil price shock variable ‘Granger-causes’ the macro variable in question. The flexible subset autoregression/transfer function framework coupled with the use of a Bayesian model selection criterion is rather new in the oil price – macroeconomy literature although it is common in other contexts.

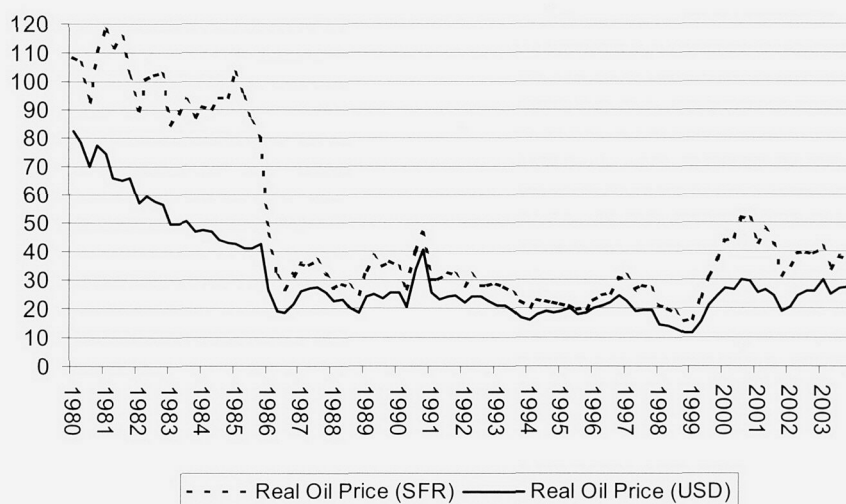
### 3.2 Data Description

Swiss macroeconomic (quarterly) data used in the analysis was taken from the databases of the Swiss Institute for Business Cycle Research (Konjunkturforschungsstelle [KOF], ETH Zürich) and cover the period from 1980q1 to 2003q4.<sup>5</sup> The list of macroeconomic variables included in the analysis and their corresponding abbreviations are given in the *Appendix*. Both the U.S. dollar and the Swiss franc price of the quarterly average values of a barrel of crude oil (Brent) are taken as the oil price series in our study. The former is deflated by the OECD price index and the latter by the GDP deflator for Switzerland (both at constant 2000 prices) to obtain the oil prices in real terms. *Figure 1* shows the resulting series.

---

5 It is important to note that Switzerland changed its system of national accounts (SNA) from the 1968 standard to the SNA 1993 (or, the European SNA 1995) at the end of 2003. Swiss macroeconomic data for the components of GDP based on the new SNA 1993 were initially available only from 1990 onwards. The data between 1980 and 1989 may be subject to further revisions, especially at quarterly frequency. The data set used in this paper is available from the author upon request.

**Figure 1** The Price of a Barrel of Brent Crude Oil in U.S. Dollars and Swiss Francs



Source: Figure by the author.

The motivation for taking the price of a barrel of oil both in international (U.S. dollar) and in local currency terms (Swiss francs) is as follows. On the one hand, denoting the oil price in Swiss francs includes an exchange rate effect. This amounts to evaluating the combined effects of oil price and exchange rate changes on the economy. A period of strong or appreciating exchange rates may smooth the increases in the U.S. dollar price of oil in terms of the domestic currency. In the opposite case, a sharp depreciation of the domestic currency makes also the oil more expensive in local currency terms – showing up as an oil price shock when there is perhaps no change in the U.S. dollar price of oil. Nevertheless, the price of a barrel of oil in local currency terms is probably what matters for the residents of the country. Furthermore, for exporting sectors using oil as an input, the price of oil in local currency terms may be of prime importance. On the other hand, the shocks to the oil prices in U.S. dollars also send signals to the markets, producers, and consumers as ‘news’. Hence, they may set expectations which, in turn, lead to the postponement or cancellation of investment projects or consumption decisions. These effects might be underestimated if only the local currency price of oil is taken into account. Thus, we conduct our analysis by using the oil price data expressed in both U.S. dollars and Swiss francs.

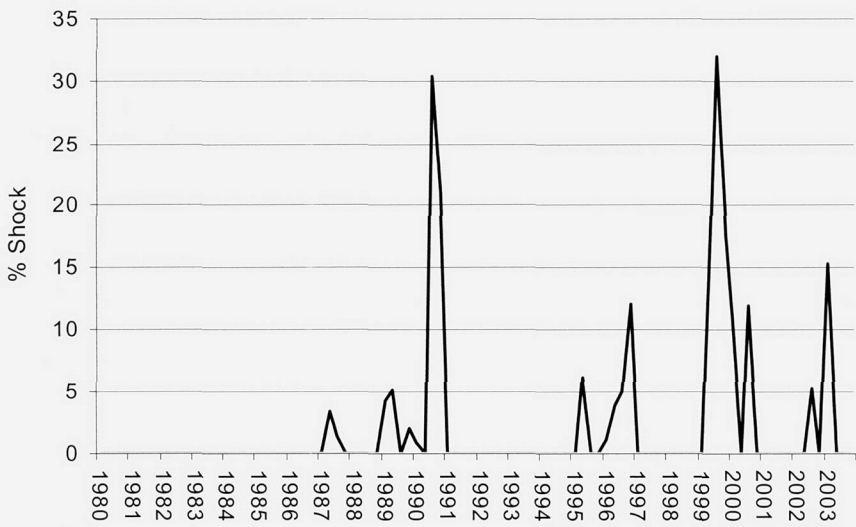


Based on the real oil price data shown in *Figure 1*, we use HAMILTON’s (1996, 2003) ‘net oil price (HNOP)’ concept to identify and quantify the oil price shocks. Since we have quarterly data, we define a positive oil price shock as occurring only if the price of oil at a given quarter is higher than the highest oil price in the preceding four quarters. We calculate the magnitude of such a shock in percentage change terms as follows:

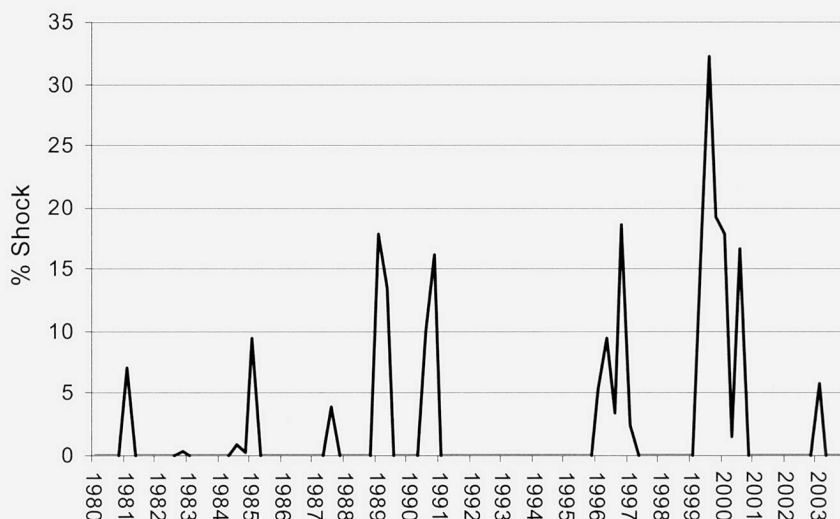
(1) 
$$\text{HNOP}_t = \begin{cases} (\text{POIL}_t - \max(\text{POIL}_{t-1}, \text{POIL}_{t-2}, \text{POIL}_{t-3}, \text{POIL}_{t-4})) / \text{POIL}_t * 100, & \text{if } \text{HNOP}_t > 0 \\ 0, & \text{otherwise} \end{cases}$$

*Figures 2A and 2B* show the HNOP calculated for the real oil price series in U.S. dollars (HNOP\_USD) and Swiss francs (HNOP\_SFR), respectively.

**Figure 2A** Shocks to the U.S. Dollar Price of Oil (HNOP\_USD)



Source: Figure by the author.

**Figure 2B** Shocks to the Swiss Franc Price of Oil (HNOP\_SFR)

Source: Figure by the author.

A comparison of *Figure 2A* and *2B* illustrates that there are some differences in the existence and the magnitude of oil price shocks calculated by using the U.S. dollar and Swiss franc oil price series. In the 1980s, for example, the real oil price series calculated in Swiss francs show more 'shocks' than the U.S. dollar-based series. As shown in *Figure 3*, the depreciation of the Swiss franc led to an increase also in oil prices for domestic consumers and producers in Switzerland. While this is not an international oil price shock as such, it is a factor to be reckoned with since it still represents a shock increase in the domestic currency price of an imported factor of production. Domestic relative prices may also change depending on differences in oil intensity and energy efficiency across sectors, among other factors. Looking at *Figure 1* again, it can be seen that the U.S. dollar price of oil was generally on the decline between 1981 and mid-1987 (i.e., no shocks in HAMILTON's sense in *Figure 2A*) while the Swiss franc price of oil showed more volatility – with four shock increases in oil prices as seen in *Figure 2B*. On the other hand, a stronger Swiss franc (see *Figure 3*) appears to have smoothed the magnitude of some of the shocks to the U.S. dollar price of oil, especially in 1991 and 2003.

**Figure 3** Swiss Franc / U.S. Dollar Exchange Rate

Source: Figure by the author.

### 3.3 Empirical Results

In order to test for Granger-causality from the net oil price shock variables to the macroeconomic variables listed in the *Appendix*, we first tested whether the HNOP\_USD and HNOP\_SFR variables are stationary or not. This was done by using the augmented Dickey-Fuller and Phillips-Perron tests. Both variables were found to be stationary. Thus, we also induced stationarity on the macroeconomic variables listed in the *Appendix* by using their quarter-over-quarter growth rates in testing for Granger-causality.<sup>6</sup> The methodology explained in *Section 2* was used in carrying out the Granger-causality tests. *Table 1* shows the best subset autoregressions of the Swiss macroeconomic variables and their subset transfer functions in the face of oil price shocks. The latter is then interpreted to draw inferences on Granger-causality.

6 Short-term and long-term interest rates and the unemployment rate are in quarter-over-quarter first differences. The level series is used in the analysis for the net exports of goods (exports – imports). The Phillips-Perron (1988) test statistic for the null hypothesis of a unit root in the levels of the net exports variable is  $-4.10$  (model with constant and trend term), where the 1% and 5% critical values are  $-4.07$  and  $-3.46$ , respectively. That is, the unit root hypothesis is rejected.

**Table 1** Tests of Granger-Causality from Oil Price Shocks to Macroeconomic Performance in Switzerland

	Univariate		HNOP_USD			HNOP_SFR		
	SBIC	(lags)	SBIC	(lags)	Sign	SBIC	(lags)	Sign
GDP	-7.0639	(1,8)	-7.0673	(8)	(-)*	-7.0673	(8)	(-)*
DOMDEM	-6.4654	(3)	-6.4797	(8)	(-)*	-6.5051	(8)	(-)*
IFIX	-4.1695	(3)	-4.2061	(6)	(-)*	-4.1617	(6)	(-)
ICBUS	-3.8544	(4)	-3.8354	(1)	(-)	-3.8327	(8)	(-)
IME	-3.1013	(1,3)	-3.1192	(6)	(-)*	-3.1123	(7)	(-)*
EXCI	-4.4599	(5)	-4.5037	(8)	(-)*	-4.5223	(8)	(-)*
EXCNI	-4.4526	(5)	-4.5255	(8)	(-)*	-4.5078	(4,8)	(-)*
IMC	-4.3644	(3,8)	-4.3852	(7)	(-)*	-4.4183	(7)	(-)*
NETEXC	15.7774	(1,2,3,4)	15.7189	(6)	(+)*	15.7745	(7)	(+)*
PGDP	-7.3053	(3,6)	-7.2900	(2)	(+)	-7.2647	(8)	(+)
PCORE	-7.9715	(4,8)	-7.9638	(8)	(-)	-7.9576	(3)	(+)
SRATE	2.1179	(1,4)	2.1202	(8)	(-)	2.1148	(1)	(+)*
LRATE	0.3853	(1,5)	0.3882	(8)	(-)	0.4000	(3)	(+)
STOCKM	-2.1529	(1)	-2.1546	(8)	(-)*	-2.1500	(6)	(-)
LTOT	-7.6891	(2,5,8)	-7.7302	(8)	(-)*	-7.7580	(7)	(-)*
LTOTFT	-7.7823	(1,2,4,8)	-7.8226	(8)	(-)*	-7.7580	(7)	(-)
URATE	-2.2909	(1,5)	-2.3005	(7)	(+)*	-2.3037	(7)	(+)
WAGE	-9.9203	(1,3,5,6)	-9.9115	(1)	(+)*	-9.9137	(1)	(+)
LPROD	-7.0082	(8)	-6.9743	(8)	(-)	-7.0583	(8)	(-)*
YBBU	-4.7937	(4)	-4.7996	(7)	(-)*	-4.8150	(7)	(-)*

*Note:* The univariate SBIC stands for the SCHWARZ's (1978) Bayesian Information criterion value obtained under the lag specification given in the parentheses. The SBIC values reported for the specifications with oil price variables (HNOP\_USD and HNOP\_SFR) are those obtained from the transfer function specification given in the parentheses. The values in *Table 1* can be read as follows: in the case of GDP, for example, the inclusion of HNOP\_USD into the above specification with lag 8 produces a lower SBIC value (-7.0673) than the univariate specification of GDP (SBIC = -7.0639). This leads us to the conclusion that HNOP\_USD Granger-causes GDP. The signs of the estimated coefficients on HNOP variables are indicated in the columns next to the SBIC values. A star sign (\*) indicates that HNOP Granger-causes the variable in question.

*Source:* Table by the author.

The results presented in *Table 1* suggest that oil price shocks, defined in HAMILTON's (1996, 2003) sense, have negative real macroeconomic effects in Switzerland. This result is robust to whether the oil price is expressed

in U.S. dollars or in Swiss francs. Looking at the components of GDP, both HNOP\_USD and HNOP\_SFR were found to negatively Granger-cause domestic demand and investment in machinery and equipment. The negative effects of oil price shocks on investment in machinery and equipment may have the longer-term consequence of adversely affecting the economy's potential output. Lower economic growth and purchasing power in Switzerland's export markets are also found to be depressing the exports of goods. So far, these effects combine to create a decline in GDP. However, the economy responds to this environment with lower import demand. Oil price shocks were indeed found to negatively Granger-cause imports of goods. Given that there is a shrinkage in both exports and imports of goods, we also tested for Granger-causality from HNOP\_USD and HNOP\_SFR to net exports of goods. The result is a positive Granger-causality, which is in line with the open economy considerations discussed in *Section 1*. Thus, there is some evidence that imports might be shrinking more than the decline in exports and producing an increase in net exports in response to an oil price shock. Similar to an automatic stabiliser, this should be smoothing a possibly larger decline in GDP.

At this point, given the importance of the effects of oil price shocks on the net exports variable, a statistical digression to examine the details of the tests for Granger-causality from the oil price shock variables (HNOP\_USD and HNOP\_SFR) to the net exports of commodities (NETEXC) variable is in order.<sup>7</sup> As seen in *Table 1*, the best subset autoregression of the NETEXC contains the first four lags and produces a Schwarz BIC value of 15.7774. The introduction of HNOP\_USD<sub>t-6</sub> (i.e., the sixth lag of HNOP\_USD) improves over this specification, yielding a SBIC value of 15.7189. That is, HNOP\_USD Granger-causes NETEXC. The estimated coefficient on the HNOP\_USD variable is +31.36 with a t-statistic of 3.08, which is significant at 1%. Similarly, for HNOP\_SFR, the SBIC is lower (15.7745) when the seventh lag is included and the estimated coefficient is +22.07 with a t-statistic of 2.13 (significant at 3.6% level).<sup>8</sup> Nevertheless, one may question the subset transfer function methodology since the chosen optimal specifications have often picked only one lag. The following example illustrates that this is not necessarily the case. For example, an alternative (second best) model with the first, sixth and the seventh lags of the HNOP\_USD produced a SBIC value of 15.7742, which is lower

7 I would like to thank a referee for this suggestion.

8 The presence of the causal relationship from the HNOP variables to the NETEXC variable remains robust under alternative model selection criteria, such as the Akaike information criterion (AIC). Detailed results are available upon request.

than the best univariate specification for NETEXC. That is, Granger-causality from HNOP\_USD to NETEXC is again confirmed. The estimated coefficients and their significance levels are as follows: +12.86 (20.5%), +22.64 (5.8%), +19.10 (12.8%). Clearly, the first and the seventh lags are not significant at conventional levels, but they still contribute to the explanation of NETEXC (the associated t-statistics are greater than 1). In a general case, when more than one lag is included in the specification, the question is whether they are jointly significant. One possibility, as discussed in STURM and DE HAAN (1998), is that the estimated coefficients might be significant on their own but the overall effect may not be significant if they carry opposite signs and cancel out. In the case of HNOP\_USD, all estimated coefficients are positive, therefore there is no ambiguity for the sign of the overall effect. In addition, the Wald test for their joint significance yields a value of 11.46, which is significant at 1%. For HNOP\_SFR, the specification from which Granger-causality is inferred was found to be unique. Hence, there is again no ambiguity on the sign and the significance of the estimated coefficient. In sum, we have seen that the transfer function approach chooses the best specification, but there may also be a second best alternative that leads to similar qualitative inferences. The advantage of using a subset transfer function approach in the context of Granger-causality tests is that the specification chosen by the best transfer function specification is the most parsimonious and the strongest representation of the case for (non-)causality between the two variables.

After this digression that clarifies some methodological issues and confirms the result that shock increases in oil prices have led to an increase in Swiss net exports of goods (with some time lag), we return to the discussion of the causal findings presented in *Table 1*. Despite a smoothing effect from an increase in net exports, the overall net effect on GDP still turns out to be negative: both HNOP\_USD and HNOP\_SFR negatively Granger-cause GDP growth. This macroeconomic environment also reflects itself into the labour market with an increase in unemployment and a decrease in employment. Our results also indicate business profits to be negatively Granger-caused by an oil price shock. The same result applies for the stock market, as well. Lower profits, a bleak domestic and international outlook, and unresolved uncertainties lead to a decline in the stock market index.

On the monetary side, we have a rather mixed picture. Neither HNOP\_USD nor HNOP\_SFR were found to Granger-cause the GDP deflator.

Furthermore, they do not Granger-cause the core consumer price index. That is, the inflationary effects of oil price shocks can be said to take place contemporaneously, and they do not create long-term inflationary pressures. As such, HNOP\_USD and HNOP\_SFR do not Granger-cause the long-term interest rates. However, we detect positive Granger-causality from HNOP\_SFR to short-term interest rates. In this case, since we may also be looking at the depreciation of the Swiss franc, the increase in the short-term interest rates might be reflecting some monetary policy response.

One may expect wages to decline in view of lower real economic activity. This appears, however, not to be the case. HNOP\_SFR, for example, is found not to Granger-cause (nominal) wages. HNOP\_USD, on the other hand, was found to positively Granger-cause (nominal) wages. Given that neither HNOP\_USD nor HNOP\_SFR were found to cause an increase in prices, our findings do not indicate a negative impact of oil price shocks on real wages in Switzerland.

Finally, a comparison of the differences between the macroeconomic consequences (in terms of Granger-causality) of the real oil price shocks defined in U.S. dollars and Swiss francs illustrate the role of uncertainty associated with shocks to the U.S. dollar price of a barrel of crude oil. For instance, only the HNOP\_USD negatively Granger-causes fixed capital investments and stock market performance, both of which are sensitive to risks and uncertainties in the investment environment. As a result, HNOP\_USD also (Granger-)causes a decline in full-time equivalent employment.

#### **4 Conclusions**

In this paper, we investigated the causal relationships between oil price shocks and Swiss macroeconomic performance by means of bivariate Granger-causality tests in conjunction with subset autoregressions/transfer function methodology and Schwarz's BIC. According to our findings, significant increases in oil prices lead to a decline in Swiss real GDP and depress the general macroeconomic environment. More importantly, investment in machinery is found to be negatively Granger-caused by oil price shocks – which may restrict long-term growth potential as well. This point needs further investigation.

The overall effect on GDP, however, appears to be reduced by the reaction of the foreign trade sector to oil price shocks. Net imports were found to be positively Granger-caused by oil price shocks. That is, imports decrease more than the decrease in exports – thus smoothing a potentially larger decline in GDP. These points illustrate the importance of evaluating the effects of oil price shocks in an open economy context over a large set of macro variables rather than measuring just what the total effect on GDP is.

By conducting our analyses both in terms of the U.S. dollar and the Swiss franc price of oil, we have also found that their overall macroeconomic effects are largely similar. However, shocks to the U.S. dollar price of oil possibly have more information content (such as reflecting increased uncertainty or a negative world economic environment), and they have additional negative effects especially on risk and uncertainty sensitive variables, such as fixed capital investments and the stock market.

How should the findings of this paper be interpreted in view of the large oil price increases experienced in 2003, 2004, and 2005? Since our results are causal inferences, one must conclude that oil price increases must have played some role in depressing the economic activity – especially in 2003 when real GDP contracted by 0.4 percent. However, it should be kept in mind that the Swiss economy was already losing steam before the large increases in oil prices took place. For example, after registering a peak of 3.6 percent increase in 2000, the real GDP growth rates were 1.0 percent in 2001 and 0.3 percent in 2002. In general, an economy has more flexibility and shock absorbing capacity during an expansion than in a contraction. Thus, oil price shocks are likely to be more detrimental to economic activity in a slow down phase of the business cycle than in an expansionary phase. In this context, further increases in oil prices that have taken place in 2004 and 2005 coincided with a period of picking up in economic activity in Switzerland (with a real GDP growth rate of 1.6 percent in 2004 and a similar expectation for 2005). In addition, the Swiss franc appreciated against the U.S. dollar. Hence, the real economic cost of the shocks in 2004 and 2005 might be lessened by the business cycle's positive phase and a stronger exchange rate. However, the course of the monetary policy, further exchange rate developments, and especially the effects of oil price shocks on the economies of Switzerland's main export markets will co-determine the final outcome.



## References

- ATKESON, ANDREW and PATRICK J. KEHOE (1999), Models of Energy Use: Putty-Putty vs. Putty-Clay, *American Economic Review* 89 (4), pp. 1028–1043.
- BACON, ROBERT W. (1991), Rockets and Feathers: the Asymmetric Speed of Adjustment of U.K. Retail Gasoline Prices to Cost Changes, *Energy Economics* 13, pp. 211–218.
- BROWN, STEPHEN P. A. and MINE K. YÜCEL (2002), Energy Prices and Aggregate Economic Activity: An Interpretative Survey, *Quarterly Review of Economics and Finance* 42, pp. 193–208.
- CUNADO, JUNCAL and FERNANDO PEREZ DE GARCIA (2003), Do oil price shocks matter? Evidence for some European countries, *Energy Economics* 25, pp. 137–154.
- FERDERER, PETER J. (1996), Oil Price Volatility and the Macroeconomy: A solution to the Asymmetry Puzzle, *Journal of Macroeconomics* 18, pp. 1–16.
- GRANGER, CLIVE W. J. (1969), Investigating Causal Relationships by Econometric Models and Cross-Spectral Methods, *Econometrica* 37 (3), pp. 424–438.
- HAMILTON, JAMES D. (1983), Oil and the Macroeconomy since World War II, *Journal of Political Economy* 91 (2), pp. 228–248.
- HAMILTON, JAMES D. (1988), A Neoclassical Model of Unemployment and the Business Cycle, *Journal of Political Economy* 96 (3), pp. 593–617.
- HAMILTON, JAMES D. (1996), This is What Happened to the Oil Price-Macroeconomy Relationship, *Journal of Monetary Economics* 38 (2), pp. 215–220.
- HAMILTON, JAMES D. (2003), What is an Oil Shock?, *Journal of Econometrics* 113 (2), pp. 363–398.
- HSIAO, CHENG (1979), Autoregressive Modelling of Canadian Money and Income Data, *Journal of the American Statistical Association* 74, pp. 553–560.
- HSIAO, CHENG (1982), Autoregressive Modelling and Causal Ordering of Economic Variables, *Journal of Economic Dynamics and Control* 4, pp. 243–259.
- HUNT, BENJAMIN, PETER ISARD and DOUGLAS LAXTON (2001), *Macroeconomic Effects of Higher Oil Prices*, IMF Working Paper No. WP/01/14, Washington D.C.: International Monetary Fund.
- HUNTINGTON, HILLARD G. (1998), Crude Oil Prices and the U.S. Economic Performance: Where Does the Asymmetry Reside, *Energy Journal* 19 (4), pp. 107–132.

- JONES, DONALD W., PAUL N. LEIBY and INJA K. PAIK (2004), Oil Price Shocks and the Macroeconomy: What Has Been Learned Since 1996, *Energy Journal* 25 (2), pp. 1–32.
- KANG, HEEJOON (1989), The Optimal Lag Selection and Transfer Function Analysis in Granger-Causality Tests, *Journal of Economic Dynamics and Control* 13, pp. 151–169.
- MILLS, JEFFREY A. and KISLAYA PRASAD (1992), A Comparison of Model Selection Criteria, *Econometric Reviews* 11, pp. 201–233.
- MORK, KNUT ANTON (1989), Oil and the Macroeconomy when the Prices Go up and down: An Extension of Hamilton's Results, *Journal of Political Economy* 97 (3), pp. 740–744.
- MORK, KNUT ANTON (1994), Business Cycles and the Oil Market, *Energy Journal* 15 (4), pp. 15–38.
- PENM, JACK H. W. and R. DEANE TERRELL (1984), Multivariate Subset Autoregressive Modelling with Zero Constraints for Detecting 'Overall Causality', *Journal of Econometrics* 24 (3), pp. 311–330.
- PHILLIPS, PETER C. B. and PIERRE PERRON (1988), Testing for a Unit Root in Time Series Regression, *Biometrika* 75 (2), pp. 335–346.
- PIERCE, JAMES L. and JARED J. ENZLER (1974), The Effects of External Inflationary Shocks, *Brookings Papers on Economic Activity* 1, pp. 13–61.
- SCHWARZ, GIDEON (1978), Estimating the Dimension of a Model, *Annals of Statistics* 6 (2), pp. 461–464.
- STURM, JAN-EGBERT and JAKOB DE HAAN (1998), Public Capital Spending in the Netherlands: Developments and Explanations, *Applied Economics Letters* 5 (1), pp. 5–10.
- TATOM, JOHN A. (1988), Are the Macroeconomic Effects of Oil Price Changes Symmetric?, *Carnegie-Rochester Conference Series on Public Policy* 28, pp. 325–368.

## **Appendix: List of variables included in the empirical analysis**

### **Real Macroeconomic Variables**

Real GDP (GDP),  
Domestic demand (DOMDEM),  
Construction investment in industry and business facilities (ICBUS),  
Fixed investments (IFIX),  
Investments in machinery and equipment (IME),  
Total goods exports to industrialised countries (EXCI),  
Goods exports to non-industrial countries (EXCNI),  
Total goods imports (IMC),  
Net exports of goods ( $\text{NETEXC} = \text{EXCI} + \text{EXCNI} - \text{IMC}$ ).

### **Price Variables**

GDP Deflator (PGDP),  
Consumer price index (CPI),  
Core consumer price index (CPICORE).

### **Labour Market Variables**

Total full-time equivalent employment (LTOTV),  
Unemployment (URATE),  
Total wage income (WAGE),  
Labour productivity (LPROD).

### **Monetary and Financial Variables**

Short-term interest rates (SRATE),  
Long-term interest rate (LRATE),  
Stock market index (STOCKM),  
Business profits (YBBU).