How Oil Prices Impact the Taiwanese Economy: Evidence from the Stock Market

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Abstract: Oil prices are volatile. How do oil prices affect Taiwanese industries? This paper investigates how oil price increases driven by shocks to global aggregate demand and to oil supply affect Taiwanese sectoral stock returns. It uses Hamilton's (2014) approach to divide oil price changes into portions driven by demand and supply factors. The results indicate that the semiconductor sector and Taiwan Semiconductor Manufacturing Company (TSMC) are harmed by oil price increases. Since oil prices are often high and quick to change, these findings imply that TSMC should expedite its goal of switching from depending on fossil fuels to utilizing renewable energy.

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1. Introduction

Oil provides 54% of the energy used in final consumption in Taiwan. Industry is the largest user of energy in Taiwan, consuming 34% of total energy. This is followed by transport that uses 16% of Taiwan's energy and residences that use 8%.[1] How do oil price changes impact Taiwan's industries?

To investigate this question this paper examines how oil prices affect sectoral stock prices in Taiwan. Black (1987, pp. 113) said that "The sector-by-sector behavior of stocks is useful in predicting sector-by-sector changes in output, profits, or investment. When stocks in a given sector go up, more often than not that sector will show a rise in sales, earnings, and outlays for plant and equipment."

Fernald and Trehan (2005) observed that oil price increases function like a tax on oil importers. Golub (1983) noted that oil price increases transfer wealth from oil importers such as Taiwan to oil exporters. Since stocks as ownership claims on corporations represent a primary store of net wealth, oil price increases should decrease stock prices for oil importers (see IMF, 2014).

One caveat concerns whether oil price increases are driven by increases in global aggregate demand or by restrictions in oil supply. An increase in global aggregate demand would be good for exporting economies such as Taiwan. The beneficial effects of higher aggregate demand may outweigh the harmful impact of higher costs due to higher oil prices. An increase in oil prices due to decreases in supply is more likely to harm companies in oil importing economies.

[1] These data are from the International Energy Agency. The website for this source is: https://www.iea.org/countries/chinese-taipei .

In previous work Abhyankar et al. (2013) investigated how Japanese Crude Cocktail oil price shocks impact Japanese aggregate stock returns. They used Kilian and Park's (2009) method to divide oil price changes into portions driven by world oil production, world aggregate demand, and shocks specific to the oil market. Kilian and Park decomposed supply and demand effects on oil prices using a structural vector autoregression (VAR) including dry cargo bulk freight rates (to measure aggregate demand), global crude oil production, and crude oil prices. Abhyankar et al., using impulse-response functions from a VAR over the January 1988 to December 2009 period, found that increases in global aggregate demand raised aggregate Japanese stock returns and that increases in global oil production had little impact. They also reported that oil price changes not explained by demand or supply factors lowered Japanese stock returns.

Kotsompolis et al. (2024) used a threshold autoregressive distributed lag model and daily data to investigate how shocks to West Texas Intermediate oil prices affect stock returns in six East Asian economies. They investigated the January to June 2020 and June 2020 to May 2023 periods. They reported impulse-response evidence indicating that oil price increases were associated with stock price increases in all countries over the first period and with stock price increases in all countries except China over the second period. They also found that the responses tended to be larger during the first period.

Huang and Chao (2012) used non-linear time series techniques and monthly data over the January 1999 to December 2011 period to investigate how oil prices impact Taiwanese price indices. They reported that domestic oil price changes fail to Granger cause price indices. They also found that international oil price changes impact the wholesale price index. When left-wing parties who are more active in setting oil prices are in power, they reported that international oil price changes become even more important relative to domestic oil prices in influencing Taiwanese price indices.

Thorbecke (2019) employed Kilian and Park's (2009) method to investigate how oil prices impact stock returns in Taiwan and other Asian economies. Using structural VARs and monthly data over the January 1990-November 2017 sample period, he reported that Dubai oil price increases driven by global aggregate demand shocks did not impact stock returns in any Taiwanese sector. Oil price changes driven by global supply raised returns in five sectors and residual oil price increases lowered returns in four sectors and raised returns in one sector.

Several researchers have faulted Kilian and Park's (2009) method of separating oil price changes into demand and supply components. Demirer et al. (2020) observed that Kilian and Park's approach underweighs the impact of oil production and global economic activity on oil prices. Hamilton (2021) demonstrated that using dry cargo bulk freight rates to measure global economic activity produces strange results. For instance, it implies that global activity fell more in 2015 then during the 2008-2009 Global Financial Crisis or the 1974-1975 recession. Global industrial production actually fell far more in 2008-2009 and 1974-1975 than it did in 2015. Hamilton also observed that Kilian and Park took the logarithm of a logarithm when calculating bulk dry cargo freight rates. Using this approach, the initial value used impacts subsequent values of the time series. Hamilton showed that choosing different initial dates generates substantively different values for the series.

Hamilton's (2014) developed another approach to divide crude oil price changes into the portion driven by global aggregate demand and the portion driven by oil supply and other influences. To measure how aggregate demand affects oil prices, he regressed the change in the log of oil prices on the change in the ten-year Treasury constant maturity interest rate, the change in the log of the trade-weighted dollar exchange rate, and the change in the log of copper prices. To measure the change in oil prices driven by oil supply and other factors, he took the residuals from this regression. Bernanke (2016) employed this approach to investigate how shocks to aggregate demand and oil supply impact stock returns.

If Hamilton's measure of changes in oil prices driven by aggregate demand factors is a good measure of global demand, it should be related to returns on the world stock market. The correlation coefficient between oil price changes driven by aggregate demand factors calculated using Hamilton's method and world stock returns equals 0.70.[2] The associated covariance t-statistic equals 14.49. There is thus a close relationship between Hamilton's demand-driven oil price changes and world stock returns. This increases confidence that Hamilton's measure is related to global economic activity.

Using Hamilton's (2014) decomposition, the results indicate that oil price increases driven by increases in global aggregate demand benefit both aggregate equity prices and also the prices of iron and steel, textile, and industrial material stocks. They also lower the prices of technology hardware, telecommunications equipment, and semiconductor stocks. Oil price increases driven by oil supply shocks harm semiconductor stocks. Given the importance of semiconductors to the Taiwanese and world economies, efforts should be made to reduce the reliance of semiconductor manufacturers on fossil fuels.

Section 2 discusses the data and methodology. Section 3 contains the results. Section 4 concludes.

[2] The sample period for this estimation extends from February 2001 to November 2019. Data on world stock returns come from the Refinitiv Datastream database.

2. Data and Methodology

Many papers have examined how exchange rate changes impact stock returns. These include Dominguez and Tesar (2006) and Ito et al. (2016). In these models, a sector's stock return is regressed on the return on the overall stock market and on the exchange rate. This paper follows the exchange rate exposure literature by including the return on the market and the change in the log of the exchange rate as right-hand side variables. It then adds the change in the log of crude oil spot prices.

Oil price changes are measured in two different ways. In the first specification, the change in the log of the Dubai crude oil spot price is included. Dubai crude oil is the main type of oil imported by Taiwan. In the second specification, the log of the Dubai crude oil spot price is divided using Hamilton's (2014) approach into the portion due to world aggregate demand and the portion due to oil supply.

Hamilton's (2014) method captures the portion of oil price changes driven by world demand by regressing the change in the log of Dubai oil prices on the change in the log of copper futures prices, the change in the ten-year constant maturity U.S. Treasury interest rate, and the change in the log of the U.S. nominal effective exchange rate. The fitted values from this regression captures oil price changes driven by changes in global demand. The residuals from this regression capture oil price changes driven by changes in oil supply and other shocks. The R-squared from this regression equals 0.30. Demand-side factors thus explain 30% of the variance of oil price changes and supply-side factors explain 70%.

Data on Dubai crude oil spot prices come from the Refinitiv Datastream database. Data on copper futures come from investing.com. The other data for Hamilton's regression come from the Federal Reserve Bank of St. Louis FRED database.[3]

This paper uses data on sectoral returns on 28 sectors as the left-hand side variables. It uses the return on the market portfolio, the NT dollar/US dollar exchange rate, and Dubai crude oil prices (or the portions driven by demand- and supply-side factors) as the right-hand side variables. The data come from the Refinitiv Datastream database. The sample period extends from February 2001 to November 2019. It ends just before the COVID-19 pandemic to avoid any distortions that might be caused by this very unusual period.

Augmented Dickey-Fuller tests permit rejection of the null hypothesis that the series have unit roots. The equations are thus estimated using least squares. When using the change in the spot price of Dubai oil as the right-hand side variable, the following equation is estimated:

$$\Delta R_{i,t} = \alpha_0 + \alpha_1 \Delta R_{m,t} + \alpha_2 \Delta\left(\frac{\text{NT dollar}}{\text{US dollar}}\right)_t + \alpha_3 \Delta \text{Dubai}_t, \qquad (1)$$

where $\Delta R_{i,t}$ is the monthly stock return for sector *i*, $\Delta R_{m,t}$ is the monthly stock return for Taiwan's aggregate market, Δ(NT dollar/US dollar)$_t$ is the change in the log of the nominal NT dollar exchange rate relative to the U.S. dollar, and ΔDubai_t is the change in the log of the Dubai crude oil crude oil.

[3] The websites for Datastream, investing.com, and FRED are, respectively, https://www.lseg.com/en/data-analytics/products/datastream-macroeconomic-analysis , https://www.investing.com/commodities/copper-historical-data , and https://fred.stlouisfed.org/ .

When Dubai crude oil price changes are decomposed into the portions arising from global aggregate demand (Oildd) and from oil supply factors (Oilss), the following equation is estimated:

$$\Delta R_{i,t} = \alpha_0 + \alpha_1 \Delta R_{m,t} + \alpha_2 \Delta\left(\frac{\text{NT dollar}}{\text{US dollar}}\right)_t + \alpha_4 \text{Oildd}_t + \alpha_4 \text{Oilss}_t \; . \qquad (2)$$

Chen et al. (1986) argued that causality in regressions such as equations (1) and (2) should flow from the macroeconomic variables on the right-hand side to the individual portfolios on the left-hand side and that any causality flowing in the other direction should be second-order. The same assumption is made here.

3. Results

The results of regressing the return on the aggregate Taiwanese stock market on crude oil prices and the NT dollar/US dollar exchange rate, with heteroskedasticity and autocorrelation consistent (HAC) standard errors in parentheses, are:

$$\Delta R_{m,\text{Taiwan}} = \underset{(0.05)}{0.11^{**}} \Delta \text{Dubai} - \underset{(0.22)}{1.53^{***}} \Delta(\text{NT dollar/US dollar})$$

Adjusted R-squared = 0.194, Standard error of regression = 0.050, Sample period = February 2001 – November 2019. *** (**) indicates significance at 1% (5%) level.

An increase in oil prices is thus associated with an increase in Taiwanese stock returns. To investigate these findings further, aggregate returns can be regressed on oil price changes divided into the parts due to global aggregate demand shocks and due to oil supply shocks. The results, with HAC standard errors in parentheses, are:

$$\Delta R_{m,\text{Taiwan}} = + 0.40^{***}\text{Oildd} + 0.03\text{Oilss} - 0.97^{***}\Delta(\text{NT dollar/US dollar})$$

(0.08)	(0.04)	(0.24)

Adjusted R-squared = 0.253, Standard error of regression = 0.439, Sample period = February 2001 – November 2019. *** indicates significance at 1% level.

These findings indicate that an increase in oil prices due to higher global demand raises Taiwanese stock returns. The coefficient on oil price changes driven by oil supply factors is also positive, although not statistically significant. There is thus no evidence that supply-driven oil price increases harm Taiwanese aggregate returns. This is not what one might expect for an oil importing economy such as Taiwan (see, e.g., IMF, 2014).

Tables 1 and 2 present results for individual sectors. The model performs well, with an average R-squared across sectors of 0.370. Column (2) presents exposures to the aggregate Taiwanese stock market. All are positive, and all but one are significant at the 1% level. Necessities such as food producers, consumer staples, retailers, drug and grocery stores, and telecommunications services (cellphone service) have low betas. Industrial and technology sectors have higher betas, indicating that they are more cyclical. Consumer discretionary, autos and parts, banks, and tires have beta values between those for necessities and those for cyclical stocks.

Column (3) presents betas to the NT dollar/US dollar exchange rate. Only four sectors have statistically significant exposures to the exchange rate. One of these is computer hardware. A depreciation of the NT dollar makes this sector more competitive and increases its share prices. It is important to note that many sectors are exposed to the exchange rate because the exchange rate impacts the return on the overall market and through this channel impacts individual stocks.

Column (5) presents exposures to overall Dubai crude oil prices. Only three sectors exhibit statistically significant exposures to overall oil prices plus one more at the 10% level.

Those harmed by oil price increases include semiconductors, technology hardware, and, at the 10% level, telecommunications equipment. One reason semiconductor stocks are impacted is because producing and shipping semiconductors requires huge amounts of energy.

Column (7) presents exposures to increases in oil prices driven by global aggregate demand. Three sectors exhibit positive and statistically significant exposures to demand-driven oil price changes. These are iron and steel, industrial materials, and textile products. These sectors gain from increases in global aggregate demand that also raise oil prices. Other sectors gain because aggregate demand-driven oil price increases raise returns on the overall Taiwanese stock market and through this channel raise returns on individual sectors.

Three sectors lose from demand-driven oil price increases. These are technology hardware, semiconductors, and telecommunications equipment. Though increases in global demand benefits these sectors, this effect is outweighed by the negative impact of higher oil prices.

Column (2) of Table 2 presents exposures for oil price increases driven by oil supply. Only one sector, semiconductors, is harmed by supply-driven oil price increases. To investigate these results further, Table 3 presents betas for supply-driven oil price increases for Taiwan's major semiconductor firms. It shows that the only company exposed to supply-driven oil price changes is Taiwan Semiconductor Manufacturing Company (TSMC). TSMC is by far the largest and most important company in Taiwan. Since it produces the world's most advanced chips, its energy requirement is high relative not only to semiconductor companies but also relative to all companies. In 2023 for instance TSMC used 25,000 gigawatt hours of energy. This is more than twice as much as General Motors used in 2023.[4]

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[4] Data for TSMC are available here: https://www.statista.com/statistics/1312965/tsmc-energy-consumption-by-source/ and for General Motors here:

TSMC should seek to reduce its use of fossil fuels within its supply chain. This would not only reduce its exposure to oil price shocks but also make it more attractive to customers and reduce the carbon footprint of electronic devices. Gupta et al. (2021) and Mora (2024) reported that most of the carbon output of electronic goods comes from manufacturing the chips inside of the devices. This makes sense as semiconductor manufacturing is exceptionally energy-intensive.

TSMC should prioritize reducing its carbon footprint. It can do this by reducing Scopes 1, 2, and 3 emissions. Scope 1 emissions could be reduced by decreasing the share of process gases with high global-warming potential (McKinsey, 2020). Scope 2 emissions could be reduced by using innovation to improve the energy efficiency of clean rooms, furnaces, and other capital equipment. Scope 3 emissions could be reduced by employing ecologically-friendly ways to transport chips to final customers.

Taiwan should also develop more renewable energy options. It could promote wind farms off of the west coast. It could carefully study whether nuclear power might now be safe and feasible. If so, it could try to convince its citizens of this. It could facilitate the import of ammonia and the use of hydrogen power. It could also explore cooperation with Northeast Asian neighbors. Europe, Southeast Asia and other regions engage in extensive cross border trade in energy. Because of geopolitical constraints, Northeast Asian economies do not. If political constraints could be overcome, the possibilities for economic gains from obtaining more extensive and reliable access to renewable energy is great.

4. Conclusion

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https://www.gm.com/content/dam/company/docs/us/en/gmcom/company/GM_ESG_Data_2023.pdf .

Taiwan is a major oil importer. For this reason, an increase in oil prices should decrease net wealth in Taiwan. Since stock prices are one of the primary stores of net wealth, oil price increases should decrease Taiwanese stock prices.

This paper uses Hamilton's (2014) decomposition to divide oil price increases into those driven by increases in global aggregate demand and those driven by oil supply and other factors. Oil price increases driven by increases in global aggregate demand raise Taiwanese aggregate stock returns. They also raise returns for iron and steel, industrial materials, and textile products. These three sectors gain from increases in world demand.

There are also three sectors that lose from demand-driven oil price increases. These are semiconductors, technology hardware, and, at the 10% level, telecommunications equipment. Although these sectors benefit from increases in world demand, their huge energy requirements cause them to be harmed by oil price increases. Semiconductors is also the only sector harmed by supply-driven oil price increases. Within the semiconductor sector only one firm, TSMC, is harmed by supply-driven oil price increases. TSMC uses massive amounts of energy to produce and transport semiconductors.

The results reported here thus indicate that, for many Taiwanese sectors, oil price do not matter. This is surprising since Taiwan imports almost all of its crude oil and oil prices should thus act as a tax on Taiwanese companies. Future research should investigate why oil price increases are a non-event for so many Taiwanese companies.

TSMC, Taiwan's largest and most famous company, is harmed by oil price increases. It also consumes the most energy of any company in the world.[5] To reduce its exposure to oil

[5] These data come from: https://www.statista.com/statistics/1250731/electricity-consumption-top-tech-companies-worldwide/ .

price increases, remain attractive to customers, and prevent global warming, TSMC should expeditiously transition from relying on fossil fuels to employing renewable energy.

Table 1. The Exposure of Taiwanese Sectors to Oil Price Changes and the Aggregate Stock Market Returns.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sector	Coefficient On Taiwanese Stock Market	Standard Error	Coefficient On NT dollar/ US dollar Exchange Rate	Standard Error	Coefficient on Total Dubai Oil Price Changes	Standard Error	Coefficient on Dubai Oil Price Changes Driven by Aggregate Demand	Standard Error
Auto & Parts	0.775***	0.153	-0.598	0.554	-0.064	0.050	0.052	0.109
Banks	0.805***	0.092	-0.666**	0.282	0.029	0.030	0.088	0.074
Consumer Discretionary	0.815***	0. 088	0.340	0. 250	0.002	0.037	0.116*	0.062
Consumer Staples	0.674***	0.078	0.674***	0.102	-0.057	0.340	0.082	0.090
Cement	0.892***	0.141	-0.746	0.481	0.011	0.064	0.228	0.154
Chemicals	0.816***	0. 077	-0.026	0. 214	0.061	0.042	0.149	0.091
Computer Hardware	1.220***	0.044	0.676***	0.213	0.016	0.034	0.029	0.073
Drug/Grocery Stores	0.427***	0.079	-0.520	0.420	0.060	0.055	-0.055	0.088
Electronic Components	1.436***	0.143	0.409	0.420	0.109	0.053	0.058	0.125
Food Producers	0.690***	0.080	0.028	0.037	-0.045	0.058	0.114	0.127
Footwear	0.881***	0.129	0.475	0.430	0.409	0.346	-0.002	0.141
General Industrials	0.726***	0.097	-0.165	0.271	0.015	0.049	-0.069	0.111
Industrial Engineering	1.490***	0.208	0.718	0.700	0.007	0.101	-0.008	0.218
Industrial Materials	1.041***	0.157	-0.054	0.451	0.008	0.042	0.286**	0.125
Industrial Transport	0.292	0.207	-0.533	0.589	0.002	0.083	0.116	0.184
Iron & Steel	0.461***	0.096	-0.367	0.300	0.067	0.055	0.278***	0.105
Leisure Goods	1.319***	0.205	0.614	0.686	0.024	0.079	-0.027	0.181
Life Insurance	0.976***	0.110	-0.320	0.430	0.077	0.048	0.180*	0.108
Machinery: Industrial	1.491***	0.207	0.718	0.700	0.007	0.101	-0.008	0.218
Marine Transport	0.932***	0.133	-0.605	0.371	0.117	0.074	-0.026	0.149
Oil Refining and Marketing	0.68***	0.168	0.135	0.386	0.051	0.059	0.164	0.113
Retailers	0.484***	0.079	0.484***	0.079	0.086	0.054	0.035	0.097
Semiconductors	1.195***	0.051	0.104	0.197	-0.084***	0.022	-0.187***	0.058
Technology Hardware	1.235***	0.032	0.241	0.175	-0.040**	0.020	-0.119**	0.054
Telecommunication Equipment	1.387***	0.219	-0.892*	0.494	-0.174*	0.095	-0.730***	0.202
Telecommunication Services	0.188***	0.058	-0.275	0.302	-0.003	0.024	0.034	0.070
Textile Products	1.041***	0.157	-0.054	0.451	0.008	0.043	0.286**	0.125
Tires	0.750***	0.156	-0.106	0.511	-0.097	0.068	0.095	0.192

Notes: The coefficients in columns (2), (4), and (8) represent the regression parameters from a regression of stock returns for the sectors listed in column (1) on 1) the return on the Taiwanese stock market (column (2)), 2) the NT dollar/US dollar nominal exchange rate (column (4)), 3) the change in the log of Dubai spot crude oil prices driven by global aggregate demand (column (8)), and 4) the change in the log of Dubai spot crude oil prices driven by supply (reported in Table 2). The coefficients in column (6) represent the regression parameters from a regression of stock returns for the sectors listed in column (1) on 1) the change in the log of Dubai spot crude oil prices (column (6)), 2) the return on the Taiwanese stock market (not reported) and 3) the yen/dollar nominal exchange rate (not reported). Following Hamilton (2014), the change in crude oil prices driven by aggregate demand factors is captured by regressing the change in the log of oil prices on the change in the log of copper futures prices, the change in the ten-year Treasury constant maturity interest rate, and the change in the log of the trade-weighted dollar exchange rate. The change in oil prices driven by oil supply and other factors is measured as the residuals from this regression. The regressions are all run over the February 2001 to November 2019 period. Columns (3), (5), (7), and (9) report heteroskedasticity and autocorrelation consistent standard errors.

*** (**) [*] denote significance at the 1% (5%) [10%] levels.

Table 2. The Exposure of Taiwanese Sectors to Oil Price Changes Driven by Oil Supply.

(1)	(2)	(3)
Sector	Coefficient on Dubai Oil Price Changes Driven by Oil Supply Changes	Standard Error
Auto & Parts	-0.095*	0.056
Banks	0.013	0.074
Consumer Discretionary	-0.028	0.041
Consumer Staples	-0.058	0.051
Cement	-0.046	0.067
Chemicals	0.039	0.043
Computer Hardware	0.013	0.033
Drug/Grocery Stores	0.091	0.066
Electronic Components	0.123	0.076
Food Producers	-0.086	0.047
Footwear	-0.056	0.061
General Industrials	0.001	0.048
Industrial Engineering	0.011	0.111
Industrial Materials	-0.065	0.055
Industrial Transport	-0.038	0.082
Iron & Steel	0.011	0.052
Leisure Goods	0.038	0.082
Life Insurance	0.050	0.053
Machinery: Industrial	0.010	0.111
Marine Transport	-0.141	0.068
Oil Refining and Marketing	0.017	0.063
Retailers	0.099	0.065
Semiconductors	-0.057**	0.027
Technology Hardware	-0.019	0.023
Telecommunication Equipment	-0.028	0.110
Telecommunication Services	-0.012	0.039
Textile Products	-0.065	0.055
Tires	-0.097	0.068

Notes: The coefficients in column (2) represent the regression parameters from a regression of stock returns for the sectors listed in column (1) on 1) the return on the Taiwanese stock market (reported in Table 1), 2) the yen/dollar nominal exchange rate (reported in Table 1), 3) the change in the log of Dubai spot crude oil prices driven by global aggregate demand (reported in Table 1), and 4) the change in the log of Dubai spot crude oil prices driven by supply (reported in column (2)). Following Hamilton (2014), the change in crude oil prices driven by aggregate demand factors is captured by regressing the change in the log of oil prices on the change in the log of copper futures prices,

the change in the ten-year Treasury constant maturity interest rate, and the change in the log of the trade-weighted dollar exchange rate. The change in oil prices driven by oil supply and other factors is measured as the residuals from this regression. The regressions are all run over the February 2001 to November 2019 period. Column (3) report heteroskedasticity and autocorrelation consistent standard errors.
*** (**) [*] denote significance at the 1% (5%) [10%] levels.

Table 3. The Exposure of Taiwanese Semiconductor Firms to Oil Price Changes Driven by Oil Supply.

(1)	(2)	(3)
Sector	Coefficient on Dubai Oil Price Changes Driven by Oil Supply Changes	Standard Error
Ase Technology	-0.011	0.71
Asmedia Technology	-0.195	0.135
Global Wafers	-0.009	0.259
Mediatek	-0.019	0.063
Nanya Technology	-0.068	0.106
Novatek Microelectronics	-0.012	0.075
Realtek Semiconductor	-0.021	0.682
Silergy	-0.153	0.144
Taiwan Semiconductor Manufacturing Company	-0.108**	0.045
United Semiconductor Manufacturing	-0.041	0.050
Vanguard International Semiconductor	0.118	0.102
Win Semiconductors	0.058	0.154
Winbond Electronics	-0.035	0.088

Notes: The coefficients in column (2) represent the regression parameters from a regression of stock returns for the firms listed in column (1) on 1) the return on the Taiwanese stock market (not reported), 2) the yen/dollar nominal exchange rate (not reported), 3) the change in the log of Dubai spot crude oil prices driven by global aggregate demand (not reported), and 4) the change in the log of Dubai spot crude oil prices driven by supply (reported in column (2)). Following Hamilton (2014), the change in crude oil prices driven by aggregate demand factors is captured by regressing the change in the log of oil prices on the change in the log of copper futures prices, the change in the ten-year Treasury constant maturity interest rate, and the change in the log of the trade-weighted dollar exchange rate. The change in oil prices driven by oil supply and other factors is measured as the residuals from this regression. The regressions are all run over the February 2001 to November 2019 period. Column (3) reports heteroskedasticity and autocorrelation consistent standard errors.

** denote significance at the 5% level.

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