Chapter 13

Impact of International Oil Price Shocks on Consumption Expenditures in ASEAN and East Asia

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CHAPTER 13
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This paper examines the impact of international oil shocks on consumption expenditure in selected ASEAN and East Asia economies. By including oil shocks into a standard macroeconomic model of consumption theory, one sees the response of consumption to the changes in the international oil price. Empirical results show that oil shocks do affect consumption and there are asymmetrical effects. There are clear differences in the level and direction of the impacts on each of the ASEAN and East Asia economies. These implications shed light on how the idea of regional energy market integration can be a way to share risks and optimise resource allocation. Nonetheless, given the clear disparity and similarity in sub-groups, integration should be implemented while allowing for differentiation in terms of the role each country plays.

Keywords: Oil shocks; Consumption expenditure; Permanent Income Hypothesis; ASEAN/East Asia; Energy market integration.
JEL: Q4, G12, G14

Introduction

The fast economic growth within the Association of South East Asian Nations (ASEAN) and surrounding East Asian countries such as China, during the last decade has created an enormous demand for energy, generating unprecedented pressures on regional energy supply chains. Among the primary energy sources, oil has the largest share in the regional energy consumption mix, and this is likely to remain so for several decades to come (Lu, *et al*., 2012).

In the East Asia region, four countries are currently in the list of the world's top 10 oil importers: These are China, Japan, South Korea, and Singapore (The CIA World Fact Book, 2012). Growing supply gaps increase these countries' dependence upon international energy markets and further expose them to international risk, in addition to those in the domestic market. Likewise, many countries in this area have started to deregulate their energy market and to make domestic prices more flexible to international shocks. This deregulation also increases their exposure to the risks in the international energy market. The price of international oil, therefore, is very likely to have significant impact upon economic activities within this region.

Scholars have long been paying attention to how oil shocks influence changes in economic activities. In one of the earliest works, Hamilton (1983) established a basic framework for studying the broad relationship between oil shocks and economic recession (sustained periods of negative GDP growth) in the United States.

Ever since Hamilton's early work, the real impact of international oil shocks has been studied intensively. However, the vast majority of these studies focus on the impact from the perspective of either economic growth (output) or the financial sector. Mehra and Peterson (2005) were among the first to explicitly investigate the impact of international oil shocks on the residential sector's consumption expenditure (i.e., to check how oil shocks may impact the consumer side of the economy).

Consumption expenditure (specifically, the consumption of domestically produced goods and services) has been an important contributor to economic development in the ASEAN and East Asian countries, especially since the 2008 global financial crisis that caused global demand for exported goods to decline. According to the Asia-Pacific Trade and Investment Report (2011), most ASEAN and East Asian economies' year-on-year growth in exports experienced a dramatic drop in the fourth quarter of 2008 and remained negative in the year 2009. Although it rebounded in 2010, the growth rate for almost all of the countries in this region slowed down steadily.

When the purchasing power of the advanced Western economies shrinks due to a crisis, it is necessary for the ASEAN and East Asian economies to resort to alternative drivers for their own economy. Among other things, this scenario has historically also resulted in lower levels of government expenditure as a precautionary measure, which again has an impact on the domestic growth's potential. As a result, there has been more emphasis on fostering domestic growth, as can be seen from the case of China:

"*China is now at such a crucial stage that without structural transformation and upgrading, we will not be able to achieve a sustained economic growth. In readjusting the structure, the most important aspect is to expand domestic demand…*"– The Chinese Prime Minister, Keqiang Li (2013)[1]

The statement above sends a clear message that boosting domestic consumption is crucial to Chinese economic development. While this is perhaps most pertinent to China given its dominant role in the global export market, other economies adopt a similar aspiration. Given (1) a stated desire to restructure (at least some) regional growth models so as to place a greater emphasis on domestic consumption expenditure; (2) the heavy oil-importing structure of the regional economies; and (3) other regions' experience with how oil shocks had potentially significant and multiple effects on their economic performance, it is therefore of great interest to empirically assess whether domestic consumption expenditures react to international oil shocks.

The policy relevance of this multi-country/market study also lies in the fact that there is an increasing desire/appetite for wider economic integration in this region. Closer linkages between the ASEAN and East Asian economies

[1]The address to the Summer Davos opening ceremony, September 11, 2013.

make deeper cooperation possible in all areas. The idea of an energy market integration (EMI) in this region has been intensely discussed in recent years owing to the comprehensive and compelling views put forward by Shi and Kimura (2010). That is, these dialogues tackled how EMI can potentially be helpful in terms of broader risk sharing (i.e., resilience against international energy market movements) and optimizing resource allocation.

The local/regional cooperation in the electricity market and other areas such as renewables development has already proven that multi-lateral cooperation on energy matters is feasible. Better risk sharing and optimizing resource allocation may further complement plans to smooth out the consumption trajectory in this region, which is also crucial for reducing regional economic volatility.

In tackling EMI, policymakers have to recognise the heterogeneity within the region both in terms of the level of economic development and economic structure. While integration may bring overall benefits to this region, it is necessary to consider how to balance the unequal energy resource endowments across the region, which are particularly obvious with respect to oil. The region consists of many countries dependent on imported oil (and thus subject to the shocks from the international oil market) on one hand, as well as oil-exporting nations with large regional reserves on the other hand. Thus, whether existing understandings of EMI carry over to the oil markets for the consumption side of the economy (as opposed to the production side) remains a valid question.

In this sense, measuring how economies in this region respond to the international oil shock through a time series framework can help one understand how EMI impacts regional economic development.

This paper looks into how international oil shocks impact consumption expenditure in nine ASEAN and East Asia economies. Thus, a widely used macroeconomic specification for modelling consumption expenditure (based on a permanent income hypothesis---PIH in short) is adopted, and differences between actual and planned consumption are quantified by using an error correction model (ECM) augmented to account for oil shocks. In its empirical model---which follows closely that of Mehra and Peterson (2005)--oil shocks are a transitory phenomenon and do not affect the long-run level of consumption expenditure.

Following, for example, the Broadstock *et al*. (2014) study, this paper argues that oil price shocks can transmit to consumption expenditure through both a direct and an indirect channel. Traveling in either a car[2] or riding a bus as a passenger creates a demand for oil, and is therefore an example of a direct effect. A hike in the price of oil and, in turn, oil-related products, will increase transportation costs and alter the consumption for goods that directly involve transport.

The indirect channel, on the other hand, may manifest in one of two ways. The first indirect effect may come through inflationary concerns and general income effects. The general idea is that rising oil prices lead to overall price inflation (Bernanke *et al*., 1997), which can trigger the monetary authority to respond with contractionary measures. This can sometimes cause further depression in the economy. In such circumstances, consumption would be negatively affected, too. The second source of indirect effect manifests as a substitution effect resulting from a rise in the price of oil.

In this study, the PIH-based empirical model of consumption expenditure is applied separately to a sample of nine economies from the region: China, Hong Kong, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, and Thailand. Within this group, four are from the ASEAN and five are from East Asian. While the countries were ultimately chosen on the basis of data availability, they nonetheless reflect the varied geographical, economic and social development levels across the region (i.e., different levels of economic development, physical scales and political systems, and also a mixture of oil producing, importing and exporting nations). The analysis in this paper, therefore, is in principle able to provide insights relevant to all regional members, even those not directly represented in its data.

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[2] The number of cars in the private sector has risen significantly over the last couple of decades. For example, the rates of private car ownership in China increased more than 30-fold, from 0.6 cars per 100 urban households in 2000 to 18.28 in 2011. At the same time, the consumption of oil used for transportation doubled between 2000 and 2010 due to the high speed of urbanisation. Similar patterns can also be seen in other economies in this study, making oil shocks more relevant to private consumption.

The order of the paper is as follows: The next section briefly reviews relevant literature. Section 3 then describes the empirical methodology and research design. Section 4 discusses the data used for analysis. Results, along with some policy implications, are then presented and discussed in Section 5, after which the paper concludes in Section 6.

Literature Review

The review in this section begins with a brief overview of the wider literature, many of which are on how oil shocks affect either total economic growth or financial market performance. However, existing literature on consumption expenditure is much sparser. This section, therefore, also provides summaries of studies on consumption expenditure.

The influence of international oil shocks upon overall macroeconomic performance has been well expounded in literature. After Hamilton's study (1983), which found a significant negative relationship between oil shock and economic growth, there have been many others adopting various time series methodologies, confirming their linkages in most, if not all, geographical contexts (see for example: Mork, 1989; Lee, Ni and Ratti, 1995; Hamilton, 2003; Zhang, 2008). The underlying premise is that rising oil prices pass through the economy as an increase in production costs, resulting in price inflation, which eventually creates wage inflation, coupled with reduced demand due to rising costs. The general consensus is that oil shocks are largely negative to an economy. Benanke, *et al*. (1997), for example, argue that inflationary pressure generated from oil price hikes triggers the Fed to respond with contractionary a monetary policy, which eventually causes further depression in the economy.

Studies on the impact of oil shocks on household consumption expenditure have just recently been a focus of study, and only by a handful of directly related papers such as those of Mehra and Petersen (2005), Odusami (2010), and Wang (2013).[3] Consumption expenditure is modelled in these papers using the permanent income hypothesis (PIH) framework that originated from Friedman (1956) and has become the "workhorse" for macroeconomists wishing to describe consumption expenditure either theoretically or empirically.

The simplest description of the PIH is that consumption is affected by the current level of income and wealth plus the expected value (discounted) of all future streams of income. That is, consumption choices are influenced by a permanent or lifetime expectation of income that is less likely to change from one year to the next. In a "perfect world", consumption expenditure will be determined by an optimal or equilibrium relationship with permanent income. In reality, however, any month/quarter/year is influenced by unexpected events that cause consumption expenditure to deviate from its optimal or, in the terminology of Campbell and Mankiw (1989) or Mehra and Peterson (2005), its "planned" level. Error correction models are therefore used to jointly model the long-run equilibrium level of consumption based on income and wealth, while at the same time measuring deviation from the equilibrium (planned) level of consumption. Mehra and Peterson (2005) specify the role of oil shocks in household consumption as a source of short-run deviation that does not fundamentally alter the planned consumption level, but rather acts as a determinant of short-run consumption behaviour.

Odusami (2010) makes some interesting departures in methodology from Mehra and Peterson (2005). Odusami (2010) agrees that consumption is somehow affected by oil shocks. However, instead of incorporating oil price movements into a consumption function directly, it is argued that they generate certain "rebalancing" effects that transpire as a change in the consumption-to-wealth ratio. Another paper taking yet another methodological approach is Edelstein and Kilian's (2009), which uses vector-auto regressions (VAR) and their associated historical decompositions to identify how different consumption categories respond to changes in purchasing power induced specifically by oil shocks. Among other things, Edelstein and Kilian (2009) demonstrate the existence of the "reallocation"

[3] While there have been, over the years, a number of studies developing structural models of the economy, their general equilibrium setups often require questionable or even unrealistic assumptions to make the system fully identified. This may in part explain why more recent work is comfortable adopting the partial equilibrium analysis.

effect, which states that households re-evaluate their consumption choices when faced by a new bundle of prices (due to the oil price change). Additionally, they argue that a 1-percent increase in the price of oil would lead to a net reduction of consumption expenditure of 0.15-percent a year later.

This paper's research follows most closely the methodology of Mehra and Petersen (2005), which will be presented in detail in the next section. While the frameworks of Edelstein and Kilian (2009) and Odusami (2010) both have merit, they are not applied here. Data limitations ultimately exclude Edelstain and Kilian (2009)'s VAR-based approach as a possibility. Meanwhile, Odusami's (2010) study allows oil shocks to determine the consumption-to-wealth ratio, therefore implicitly assuming that oil shocks can disrupt optimal consumption expenditure levels.

This paper prefers the assumptions in Mehra and Peterson (2005), which are more consistent with the idea that households, when faced by a rise in oil prices, may reallocate their consumption patterns (creating short run dis-equilibrium while the new preferred consumption bundle is "found"), but will continue to spend the same amount of money in the long run.

Methodology and Research Design

The methodological approach used here closely follows that of Mehra and Peterson (2005).[4] The empirical framework begins with a general/standard macroeconomic specification of (per-capita) household consumption, where the level of consumption in an economy, C_t, is affected by the existing level of wealth, W_t, as well as current and discounted expected future income, Y_t and $E(Y_{t+1})$, respectively, where $i = 1,...,\infty$. In this regard, the approach embeds the commonly used PIH, which has been used recently (for example, by Palumbo *et al.*, 2006) to describe consumption by the household sector. Defining consumption, income, wealth, and the interest rate in real terms as C_t, Y_t, W_t, and r_t, respectively, the household budget constraint can be written

[4] The general framework is an extension of an earlier study by Mehra (2001) but is extended here to include oil shocks.

as:

$$W_{t+1} = (1+r_t)(W_t + Y_t - C_t), \quad (1)$$

such that next-period wealth equals the discounted value of current-period wealth plus earned income minus any consumption expenditure. Assuming a constant real interest rate $(r_t = r_{t+1} = r)$ and imposing the condition that $\lim_{i\to\infty}\left(W_{t+i} / (1+r)^i\right) = 0$, then, by repeated substitution of the budget constraint, current-period wealth is obtained as:

$$W_t = \sum_{i=0}^{\infty} \frac{C_{t+i}}{(1+r)^i} - \sum_{i=0}^{\infty} \frac{Y_{t+i}}{(1+r)^i}. \quad (2)$$

Result from Hall (1978), where consumption follows a martingale process, gives $E(C_{t+1}) = C_t$. Then, taking the expectations of equation (2) results in the common form of the PIH:

$$C_t = \frac{r}{1+r} \sum_{i=0}^{\infty} \frac{E(Y_{t+i})}{(1+r)^i} + \frac{r}{1+r} W_t. \quad (3)$$

Assuming a constant growth rate of real income, g, then $E(Y_{t+1}) = (1+g)Y_t + \eta_{t+1}$, where η_{t+1} is a white noise process. Thus:

$$C_t = \frac{r}{r\text{-}g} Y_t + \frac{r}{1+r} W_t + \sum_{i=1}^{\infty} \frac{\eta_{t+1}}{(1+r)^i}. \quad (4)$$

The derivation to this point establishes that a long-run relationship exists between consumption, income, and wealth. Mehra and Peterson (2005) refer to this as the planned level of consumption, C_t^p, expressing it in a simpler form by first taking expectations of the error term and adding a constant term, leading to the estimable long-run relationship

$$C_t^p = a_0 + a_1 Y_t + a_2 W_t, \quad (5)$$

where $a_1 = \frac{r}{r-g}$ and $a_2 = \frac{r}{1+r}$. Actual consumption, however, differs from planned consumption for a multitude of reasons. Campbell and Mankiw (1989) show that the short-run dynamics of consumption can be conveniently written in the form of an error correction model:

$$\Delta C_t = b_0 + b_1\left(C_{t-1}^p - C_{t-1}\right) + b_2 \Delta C_{t-1}^p + \sum_{s=1}^{k} b_{3s} \Delta C_{t-s} + \mu_t. \quad (6)$$

Substituting equation (5) into (6),

$$\Delta C_t = b_0 + b_1\left(a_0 + a_1 Y_{t-1} + a_2 W_{t-1} - C_{t-1}\right) + b_2 \Delta\left(a_0 + a_1 Y_{t-1} + a_2 W_{t-1}\right) + \sum_{s=1}^{k} b_{3s} \Delta C_{t-s} + \mu_t. \quad (7)$$

Assuming that future income grows constantly relative to the current level, and that consumers have rational expectations, the expected value of accumulated and discounted future income streams is proportional to the current income. The model can be simplified to:

$$\Delta C_t = \beta_0 + \beta_1 \left(C_{t-1}^p - C_{t-1} \right) + \beta_2 \Delta Y_{t-1} + \beta_3 \Delta W_{t-1} + \sum_{s=1}^{k} \beta_{4s} \Delta C_{t-s} + \mu_t . \qquad (8)$$

Equation (8) is the baseline model used in the analysis to capture the dynamics of consumption changes. Following Mehra and Peterson (2005), oil prices are augmented into the short-run equation

$$\Delta C_t = \beta_0 + \beta_1 \left(C_{t-1}^p - C_{t-1} \right) + \beta_2 \Delta Y_{t-1} + \beta_3 \Delta W_{t-1} + \sum_{s=1}^{k} \beta_{4s} \Delta C_{t-s} + \sum_{s=1}^{k} \beta_{5s} \Delta oil_{t-s} + \mu_t . \qquad (9)$$

Equations (5) and (9) establish the main equation for the empirical analysis.

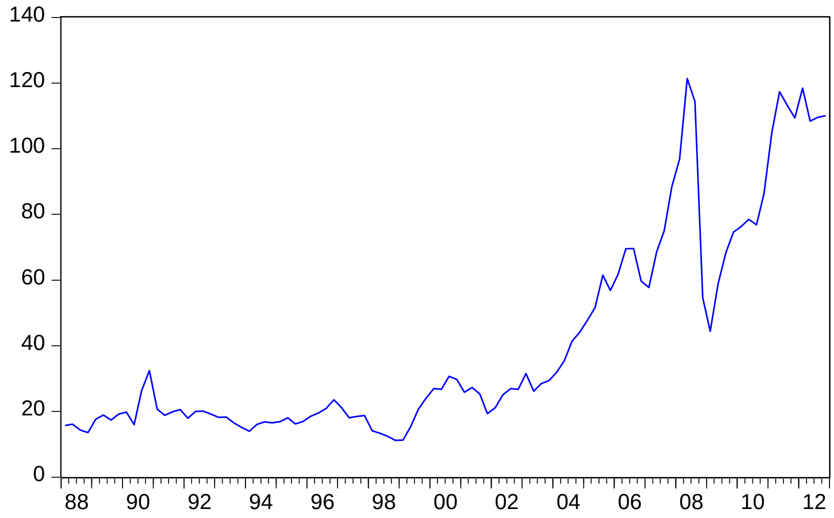
Data

As mentioned earlier, this paper's empirical study covers nine countries: China, Indonesia, Japan, Malaysia, Singapore, South Korea, Taiwan, Thailand, and Hong Kong. Quarterly frequency data on consumption, income, and wealth[5] ranging from 1988Q1 to 2012Q4 are obtained from DATASTREAM. Oil price data are taken from the US Energy Information Administration (EIA), and based on European Brent prices since Brent accounts for around 60 percent of international oil trade[6] (see, for example, Odusami [2010, p. 860] for further discussions on this). The oil price data are shown in Figure 13.1, which highlights among other things, the significant variation in international prices over the sample period. In particular, note the tremendous surge in prices after 2000, and the subsequent collapse in 2008.

[5] Wealth is the end-of-quarter per-capita net worth in the household sector (see DATASTREAM's definition).

[6] Other relevant oil prices (i.e., Daqing, Dubai, Cinta, and Minas) were also compared with Brent. They are highly correlated and follow almost identical trends.

Figure 13.1: Brent oil price (in US dollars)



All consumption, wealth, and income data are denominated in local currency, and X12 is used to perform seasonal adjustment. The series are all deflated into real terms using the domestic GDP deflator. For the estimation, natural logarithms are taken for each of the series. Oil prices are converted to the local currency to mitigate any exchange rate-related effects, and are also scaled by the GDP deflator into real terms relevant to the domestic economy.[7]

Empirical Results

This section presents and provides some initial explanation on the empirical results. Before going into the details, it is useful to first prove that the error correction model (ECM) output is a (statistically) valid approach to the data, based on the time series properties of the data.

To help validate the ECM application, it is thus useful to conform to the stationarity properties of consumption, income, and wealth. A first condition for the ECM to be "valid" is that the individual series must first be integrated

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[7] This study acknowledges the possibility that exchange rate movements can impact consumption since there are many exports in this region. However, consistent with the body of literature reviewed in this paper, such is not considered further here, although this is an area where further research is justified.

of the first order, denoted as I(1) or non-stationary, which implies that the data are trending. After taking the first differences, the trend component is eliminated and can be denoted as I(0) or stationary. An augmented Dickey-Fuller test (ADF) is used to determine whether each series is stationary or not, with the results reported in Table 13.1. It is clear that these series are each I(1) process (except all variables for Japan, which are marginally stationary around a constant and time trend, and the income variable for Malaysia). In general, these test results indicate that an ECM-type process---and hence the planned consumption framework---may be reasonable.

Table 13.1: Unit Root Tests for Variables Entering into the Long-Run Consumption Function

Series:	**Consumption**		**Income**		**Wealth**	
Country	**ADF level**	**ADF difference**	**ADF level**	**ADF difference**	**ADF level**	**ADF difference**
CHN	-2.2772	-11.8583**	-2.1367	-7.2622**	-2.2427	-6.1429**
HK	-2.0011	-7.2446**	-1.7805	-6.2573**	-2.5952	-7.1837**
JPN	-3.3841*	-11.3645**	-3.7411*	-14.5814**	-3.3050*	-5.5643**
SIN	-2.8136	-7.3607**	-2.8667	-8.5545**	-2.3826	-7.3174**
MAL	-3.1281	-10.4676**	-3.8936*	-6.3655**		
IND	-2.3077	-11.9654**	-1.5151	-8.4556**		
THAI	-3.0902	-8.0644**	-2.7742	-9.5302**		
TW	-2.2113	-9.7606**	-2.8381	-9.2934**		
SK	-2.2315	-6.6824**	-2.5851	-6.1092**		

Note: lag orders are for the test are selected using SIC, as is the inclusion of a deterministic trend. Stars are used to denote significance as follows: ** for 1-percent level of significance and * for 5 percent.

Wealth data for the whole sample period are only available for China, Japan, Hong Kong and Singapore; other regions either do not have wealth data or have only very short series available---too short for robust or consistent comparison. For regions with wealth data available, all three variables (wealth, income, and consumption) are used to establish the equilibrium.

The Estimated Consumption Function and Evidence of a "Statistical" Equilibrium

Testing the validity of the planned consumption framework and the PIH is not the primary interest of this study. Nonetheless, it is important to confirm as far as practicable that this framework applies readily to the data in the selected sample. A second condition that must be satisfied for an ECM to be valued is that the residuals from estimating Equation (5) are themselves I(0) or stationary. Table 13.2 gives the results of both ADF and KPSS (Kwiatkowski *et al*. 1992) tests. The KPSS is generally preferred on theoretical grounds. It is also considered since Thailand and South Korea seem to fail on the simpler ADF test. For these latter two countries, the KPSS test still supports stationarity and justifies proceeding to estimate the short run ECMs in Equation (4).

Cumulatively, the results in Tables 13.1 and 13.2 support the existence of error correction. Strictly speaking, the results do not prove the planned consumption approach to be valid, but there is certainly strong evidence that the planned consumption framework has significant merit for the countries/sample period under investigation.

Table 13.2: Residual Based Co-Integration Tests for Sample-Countries

Residuals for	ADF test	KPSS test
CHN	-3.9112*	0.0560
HK	-4.4742**	0.0359
JPN	-7.2549**	0.0586
SIN	-4.2143*	0.0455
MAL	-5.3767**	0.0345
IND	-4.7471**	0.0781
THAI	-3.2905	0.0760
TW	-3.4807*	0.0610
SK	-3.3522	0.0543

Note: Critical values for ADF test on co-integration is taken from MacKinnon (1991). The KPSS test on co-integration is taken from Shin (1994). Stars are used to denote significance as follows: ** for 1-percent level of significance and * for 5 percent.

The ECM results reported below in Table 13.3 and their interpretation have several important aspects. Before discussing the role of international energy prices, it is useful to understand the general behaviour/performance of the income and wealth components of the models to ensure that they are (at least reasonably) consistent with expectations. In this regard, the first areas to look at are the standard components of the consumption function; namely, the wealth, income, lagged consumption, and error correction effects. This is discussed briefly in the next section before moving on to the role of international oil shocks in each of the studied countries.

Table 13.3: ECM Regression Results for Asymmetric Oil Shocks

	China	Hong Kong	Japan	Singapore	Indonesia	Malaysia	South Korea	Taiwan	Thailand
Intercept	2.614**	0.841**	0.468*	1.305**	1.747**	1.147	0.531	1.406**	0.865
p-value	0	0.001	0.04	0.001	0.008	0.115	0.354	0	0.174
ect_1	-31.287**	-22.027**	-54.637**	-6.279	-16.158	-15.664*	-10.229*	1.021	-4.224
p-value	0.001	0.001	0	0.356	0.142	0.034	0.023	0.953	0.356
inc_1	-0.091	0.072	-0.144	-0.293*	0.043	0.36*	0.423	0.63	0.034
p-value	0.497	0.13	0.197	0.048	0.8	0.037	0.535	0.13	0.811
wea_1	-0.064	0.028	-0.142	0.021					
p-value	0.656	0.584	0.121	0.749					
con_1	-0.122	0.227	0.039	0.491*	-0.125	-0.098	0.233	-0.731	0.175
p-value	0.381	0.054	0.684	0.012	0.322	0.322	0.399	0.087	0.478
oil_neg_1	-0.004	-0.009	0.016	0.052*	-0.011	0.036	-0.011	0.013	0.036*
p-value	0.834	0.633	0.262	0.041	0.487	0.136	0.446	0.455	0.03
oil_neg_2	-0.011	-0.045*	-0.022**	-0.007	-0.023	-0.006	-0.039**	-0.048**	-0.007
p-value	0.427	0.022	0.001	0.691	0.394	0.72	0.01	0	0.684
oil_neg_3	0.018	0.021	0.003	-0.006	-0.011	0.061*	0.01	-0.008	-0.011
p-value	0.375	0.145	0.655	0.606	0.677	0.024	0.511	0.431	0.545
oil_neg_4	-0.041	0	-0.005	0.015	0.082*	0.054	0.002	-0.025	-0.023
p-value	0.292	0.987	0.334	0.218	0.035	0.241	0.823	0.074	0.186
oil_pos_1	-0.007	-0.051	0.01	-0.01	-0.05	0.001	0.016	0.001	0.01
p-value	0.698	0.008	0.289	0.649	0.316	0.954	0.359	0.916	0.698
oil_pos_2	-0.001	0.032	-0.002	0.013	0.042	0.09**	0.012	-0.004	-0.026
p-value	0.961	0.114	0.839	0.446	0.271	0.009	0.65	0.816	0.144
oil_pos_3	-0.037*	-0.015	0.026	0.025	0.03	0.015	-0.011	0.009	0.018
p-value	0.022	0.395	0.086	0.376	0.371	0.658	0.483	0.67	0.394
oil_pos_4	0.009	-0.015	-0.026	-0.029	-0.049	0.015	-0.042*	-0.046	-0.007
p-value	0.564	0.384	0.069	0.14	0.089	0.693	0.033	0.062	0.677
Log.lik.	-211.204	-187.46	-123.12	-195.221	-270.79	-238.73	-198.02	-179.77	-204.63

Note: Inference is based on heteroscedasticity and auto-correlation corrected standard errors. Stars are used to denote significance as follows: ** for 1-percent level of significance and * for 5 percent. Structural breaks were tested for using a Quant-Andrews test procedure, but not found to be significant and hence not reported.

Wealth, Income, Lagged Consumption and Error Correction

The "standard" components of the consumption function are wealth and income, mediated in the short- and long-run via lagged consumption effects and error correction terms.

As earlier mentioned, the wealth component can only be modelled for four out of the five regions owing to data limitations. Results are available for China, Hong Kong, Japan, and Singapore. For each of these, the result is the same. That is, that the wealth component is statistically insignificant (Table 13.3).

Since the estimated equations explain the short-run effects, it can then be concluded that changes in wealth do not generate an immediate short-run change in the level of consumption by the residential sector. Although no clear conclusion can be drawn for the remaining five regions, it seems likely that similar results might exist---i.e., that wealth is not a short-run determinant of residential consumption. This does not rule out the possibility of a long-run relationship.

This finding differs from the study of Mehra and Peterson (2005), which show a positive wealth effect for the US data. The difference may, in part, be explained by the generally different stages of economic development, where the Asia region is still generally catching up with the US. Also, different social and political structures may underpin different attitudes towards the treatment of wealth in consumption choices.

As to the effect of income, results are quite mixed across the nine regions. Some of the more major/developed economies such as China, Hong Kong, and Japan as well as some of the smaller economies that include Taiwan and Thailand, have no short-run reaction to changes in income. On the other hand, Indonesia, Malaysia, and South Korea all see a short-run increase in consumption as a result of a change in the level of income. Perhaps most interesting is Singapore's case, where the relationship between income and residential consumption in the short-run is negative. What mechanism justifies rising incomes to result in lower consumption expenditure? One likely answer lies in the partial scope of this study's analysis, where only the consumption of non-durable items was considered and therefore, the effect on durable items or even savings/investments cannot be ascertained. It is possible that rising incomes lead to a substitution across consumption categories beyond those classified in this study's data.

Lagged consumption is an important variable since it embeds within it additional routes for income and wealth effects to emerge. This is easily seen by noting from Equation (5) that:

$$C_{t-1}^{p} = a_0 + a_1 Y_{t-1} + a_2 W_{t-1} \tag{10}$$

Therefore, when the coefficient on the lagged term is significant, the lagged income and wealth effects may possibility be transmitted to short-run consumption. The lagged terms are significant for Hong Kong, Singapore, and Taiwan. For Hong Kong and Taiwan in particular, the existence of some long-run income effect is implied by the auto-regressive lagged consumption term (while noting again that wealth information is not available for Taiwan). Indonesia and Thailand show no sign of a stable long-run relationship of any type, since neither the error correction term nor the auto-regressive term (the lagged consumption) is significant. These two countries are smaller and, in relative terms, have lower levels of political and economic development/stability than the other regions studied. Given the relatively short study window, it is perhaps not entirely surprising that a stable result cannot be found.

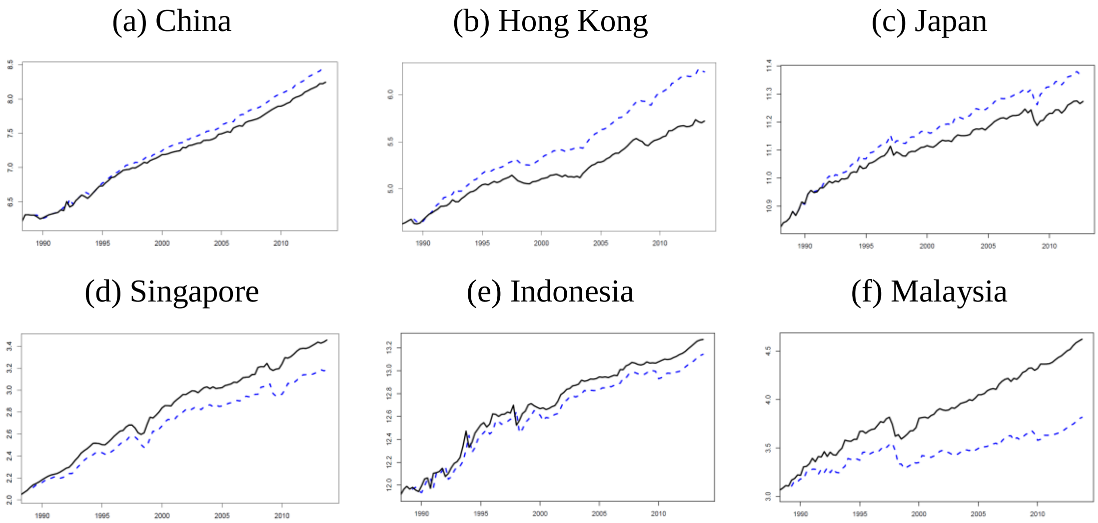
Error correction---i.e., a significant adjustment from actual consumption to some equilibrium level of planned consumption---is seen in China, Hong Kong, Japan, Malaysia, and South Korea. If one was willing to accept a loose 15-percent significance level, then Indonesia is also error correcting. For Singapore, Taiwan, and Thailand, error correction---and hence significant dis-equilibrium adjustment---is not a feature of the sample data. As mentioned above, these cases are not considered evidence that the theory itself is invalid. The theory simply does not hold strongly enough within the narrow sample period.

Oil shocks, which are entered into the model with up to four lags, are seen to be significant in all countries. However, there are some notable differences in how they affect each of the counties. China is only affected by positive price shocks, while Thailand, Taiwan, and Singapore are only impacted by negative shocks. Hong Kong, Japan, Indonesia, Malaysia, and South Korea feel the impact from both price rises and falls. Reactions to both negative and positive price shocks can be either positive or negative.

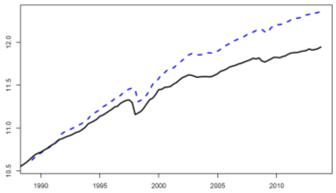
A Simple Counter-Factual Assessment of the Impact of International Oil Shocks

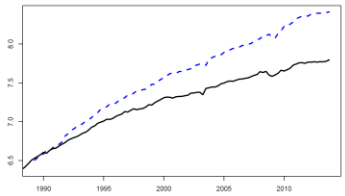
While important, the results in Table 13.3 require a certain amount of effort to discern and interpret. To this end, Figure 13.2 summarises the empirical implications of the results much more directly by providing a simple counter-factual simulation of what household consumption may have been if international oil shocks had not occurred (i.e., if international prices remained fixed at the real 1989Q2 price; hence, nominal prices would change directly in line with domestic inflation). Other scenarios are of course possible, but this one serves as an illuminating benchmark to the net consequence of oil shocks on each of the economies. This is done by taking the cumulative values of the short-run fitted equation (Equation 9), and calculating the resulting level of consumption expenditure when (1) the oil shocks are as observed in the real data; and (2) when the oil shocks are set to zero (i.e., international oil prices are held fixed in real terms at the 1988Q1 level).

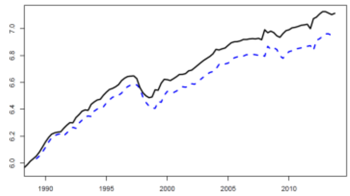
Figure 13.2: Counter-factual Assessment of Consumption Expenditure in the Absence of International Oil Shocks



(g) South Korea (h) Taiwan (i) Thailand







Note: Solid (black) lines denote actual consumption expenditure; Dashed (blue) lines denote counter-factual consumption expenditure in the absence of international oil price shocks.

Figure 13.2 shows that some economies have benefited from changes in the international price of energy while others have been hurt. Expectedly, major oil importers China and Japan are negatively affected by oil price changes, which have generally been increasing over the analysis period. Interestingly, but still not surprisingly, the oil exporters (Singapore who import crude oil and export refined oil products, and Indonesia and Malaysia who export crude oil) have benefited from rising international oil prices where the extra revenue to the economy from oil exports enables higher levels of consumption to be sustained. Meanwhile, the rest of the countries in this study (notwithstanding Thailand) would have had higher levels of household consumption had the international oil price not been fluctuating over time.

The results for Thailand are, on the surface, thought provoking. The country is perhaps the most unstable (economically and politically) of all of the nations in the sample, and this paper makes no real effort to justify these findings. The ECM for this country has very low explanatory power, suggesting that more work may still be needed in the estimation.

Preliminary results have shown some interesting findings. Oil shocks do impact household consumption decisions in the short run, and these effects show clear asymmetries. The ECM coefficient is of course important, but on itself conveys only a limited message. Counter-factual assessment of the domestic household consumption had international oil shocks not occurred proves enlightening.

One key message is that international oil shocks are actually good news for many countries; hence, regulations against international oil shocks may not be as advisable as it may first appear. While most of the economies in the

ASEAN and East Asia area are trying to make their domestic oil market more flexible towards free markets, it might be worth thinking carefully what the appropriate speed and timing of liberalisation must be.

Energy market integration opportunities are a focus within the region. The results here offer some indirect insights. That is, collaboration and integration may be helpful in terms of risk sharing/hedging against international price shocks or optimizing resource allocation; however, the stronger economies must be prepared to play their part.

Policy Implications and Conclusions

A core purpose of this study is to add new evidences on energy market interactions in the region and then to consider how the evidences contribute to EMI. Energy market integration is a desired objective for the region. After all, energy is naturally an industry with substantial scale economies (e.g., in power generation), and creates a need for cross-border trade since many of the energy resources (e.g., oil and coal reserves) are not located in the same place where they are consumed.

Broadly speaking, international oil shocks are a common concern facing all countries in the region, either directly or indirectly. As the ASEAN and East Asia combined is a heavily oil-importing region with very close geographical ties and in many cases very close historical relationships, establishing a platform for shared debate and shared resilience to international markets would have several advantages.

By definition, an important aspect of the EMI is the "market", which is broadly composed of three players: suppliers, consumers, and a governing body. Existing research works in relation to a possible EMI already reveal substantial information on the state of governance in the region---for example, overlapping political systems and general energy market regulation---although there is still room for increased transparency in governance, as will be discussed further below. Likewise, there is a growing body of evidence on EMI in the production (or supply) side of the picture. Now, what this paper here attempts to do is to provide an assessment on the demand side from one perspective so as to identify what additional considerations are needed for a comprehensive EMI.

When considering the EMI opportunities that the results imply, there are several points to keep in mind. For one, existing studies that had looked at the energy supply of the regional economies prove that market integration is feasible. However, by focusing on the pass-through effects of oil prices to the consumer side of the economy, it can be shown that a more complicated picture prevails. Reactions to international energy shocks differ widely, due in part to the differing levels of scale and economic development, as well as to the differing dependencies on imported oil/energy. This implies a need for a different type of strategy towards EMI on the demand side. Lessening the impact of oil shocks on those countries more severely affected would help smoothen consumption in the region and therefore support regional integration in energy.

Just a word of caution: A comprehensive EMI (i.e., integration across supply, demand, and governance) is not supported immediately by this study's results, nor should it be. By making the consumer side of the economy the point of focus here, this study makes it more apparent that there are important specificities across countries in the region. These are a result of differing lifestyles, social structures, attitudes to religion, political systems, resource endowments, levels of development, education, etc. Accordingly, households' energy consumption patterns are likely to differ widely from one country to the next. For example, Indonesia and Singapore each represents opposing ends of the economic development spectrum.

While consumers across countries might aspire to have similar energy supply technologies with common regulation over suppliers, they will still have differing energy consumption demands consistent with their differing lifestyles. Thus, a comprehensive EMI must have looser boundaries for acceptable integration on the consumer side.

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