Asian and Global Financial Crises' Effect on Malaysia Co$_2$ Emission

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ABSTRACT

Malaysian economy has experienced two financial crises in <12 years. The Asian financial crisis started in Thailand on July 1997, which intensively affected the Malaysian Ringgit within days. The rate of the Malaysian gross domestic product (GDP) dropped to −7.36 at its nadir in 1998. In 2008, the global financial crisis hit Western countries and rapidly affected the economic growth of Malaysia. The GDP growth decreased by 0.1% in the last quarter of 2008, and reached −1.51 in a particular situation in 2009. Through a qualitative analysis, this paper investigates the CO$_2$ emission during these financial crises by focusing on three main fuel CO$_2$ emission, namely, coal, natural gas, and petroleum. This study shows that the rate of CO$_2$ emission growth in Malaysia decreased despite the negative GDP during both crises, but the carbon emission trend did not decline.

Keywords: CO$_2$ Emission, Gross Domestic Product, Global Financial Crisis, Asian Financial Crisis
JEL Classifications: G01, Q43

1. INTRODUCTION

With its 28 million people Asian Financial Crisis (AFC) (1997), the increasing population and high economic growth of Malaysia resulted in a rising trend in energy consumption in the country. According to the 9th Malaysian Plan (2006-2010), the primary sources of energy are natural gas (56%), coal (36%), and oil (<1%) Abidin and Rasiah (2011). With 4 billion barrels of proven oil reserves, Malaysia is one of the main oil countries in ASEAN. Malaysia produces almost 620,000 barrels of crude oil per day. This country owns almost 83 trillion cubic feet of proven natural gas reserves (Baily and Elliott, 2009). Malaysia has a positive trade balance as net export for both oil and gas (Bakhtyar et al., 2012a). The profile of the primary energy sources of Malaysia indicates that almost 18% of the total Malaysian energies are derived from coal, 37% from natural gas, and 39% from petroleum (Baily and Elliott, 2009). About 63% of Malaysian energy is used for electricity and heat, 13% for manufacturing and construction, 14% for transportation, and 10% for other activities (Bakhtyar et al., 2012).

These sources of fossil fuel help Malaysia to enhance the economy and its related indexes. On the other side increase in gross domestic production (GDP) needs more energy sources and consequently will increase CO$_2$ emission in the country. This research has a look to two financial crises through last 20 years which affected Malaysia economy. The effect of financial crises on country GDP shows two halt in 1997-1998 and 2008-2009 and fluctuated GDP growth. The research shows the relationship between GDP and CO$_2$ emission through Malaysia financial crises and presents effective factors.

2. CO$_2$ EMISSION IN MALAYSIA

About 80% of Malaysian energy is obtained from Peninsular Malaysia, and most of this energy is used for generating electricity. The proportion of natural gas, coal, and petroleum in generating electricity in Peninsular Malaysia are 65%, 9%, and 0%, respectively (Abidin and Rasiah, 2011). Based on the computation of the carbon life cycle, almost 25,545,450 tons of CO$_2$ are emitted annually by coal alone. The amount of CO$_2$ emitted in generating electricity for Peninsular Malaysia using natural gas is about 24,157,223 tons. In total, electricity generation in Malaysia produces 60 million tons of CO$_2$ annually, which means that each Malaysian produces 2.12 tons of CO$_2$ for their electricity needs alone.

Gangnon et al. was the first to provide an estimate of the carbon life cycle for natural gas, diesel, and oil. Other researcher subsequently employed various means to estimate the carbon emission of different sources. For every kWh, coal produces 1050 g of CO_2e through various generator types without scrubbing. This rate for petroleum is as large as that for oil or diesel (778 g of CO_2e/kWh) and for natural gas (443 g of CO_2e/kWh) (CCS in Malaysia, 2013). Thus, any increase in coal thermal plant capacity will substantially increase carbon emission.

3. THE MALAYSIAN ECONOMY DURING THE TWO FINANCIAL CRISES

The first financial crisis started in Thiland and immediately reached Malaysia, which caused the Ringgit to fall significantly (AFC, 2012). The Malaysian GDP trends show that the country entered recession in the third quarter of 2008, but its first negative growth was recorded in the first quarter of 2009 (Feridun, 2014). In January 1998, the government introduced a peg Ringgit 3.8 to the US dollar and implemented a tight market control policy. The market price of Ringgit at that time lost 50% of its value, which fell from RM 2.5 to RM 4.57 per US $1. The stock market lost 50% of its capital, and the Kuala Lumpur Stock Exchange Composite Index dropped below 600, from 1200 before the recession (Ibrahim, 2010).

The crisis slowed down many developing economies in the world, including Malaysia and its neighboring countries. This trend reduced the prices of petroleum around the fourth quarter of 1998. The price of oil dropped to less than US $11 per barrel (Bakhtyar et al., 2012a). This reduction in oil price extended the financial crisis to oil producers, and more the Russian economy suffered more than any other. The Russian financial crisis treated the long-term capital management of the US in 1998 (World Economic and Financial Surveys, 2013).

The AFC had a very heavy impact on Malaysia and some of its neighboring countries, but the Malaysian economy controlled the consequences of the economic crisis. Overall, the first financial crisis affected Malaysia's economic sectors. The construction sector shrunk by 23.5%, whereas the manufacturing and agricultural sectors were reduced by 9% and 5.9%, respectively (Ibrahim, 2010).

The second financial crisis, the global financial crisis (GFC) of 2008, is widely regarded as the worst financial crisis since the 1930s. The exact cause of the 2008 recession remains unknown, but economists point to the liquidity crisis in England and the bursting of the US housing bubble in 2006 as the probable causes (Malaysia Energy Analaysis, 2013). The crisis affected investor confidence, which subsequently affected stock markets all over the world. The crisis expanded to other countries, which slowed down the economies around the world.

The crisis quickly spread to Asian countries, and Japan experienced the most pressure under the recession. The GDP of Japan started to dip at around 2007. The economic growth of Japan reached zero in the third quarter of 2007, which countinued until 2009. The GDP growth of Japan reached −5.53 in 2009, which was the worst case of recession in Asia during the GFC (Sovacool, 2008). China and India were not affected hardly by the crisis. During the lowest point in the recession in 2009, the GDP growth of China plumetted to <9%. The minimum recorded economic growth for India is >5% (Sovacool, 2008).

Malaysia was heavily affected by the 2008 GFC because of its large scale trading with the US and Japan. According to the Department of Statistics of Malaysia (2011), the agricultural sector dropped to −4.3 in 2009. The recorded maximum drop for mining and quering was −5.7 in the fourth quarter of 2008 (Feridun, 2004). However, the worst case occurred in the manufacturing sector, for the drop in this sector began in the second quarter of 2008, reaching −17.6 in the first quarter of 2009. Electricity, gas, and water dropped from the second quarter of 2008, which reached −8.2 in the first quarter of 2009. The Malaysian exports to Japan started in the first quarter of 2009, and countinued for 6 months. The rate and amount of Malaysian export to most ASEAN countries dropped. The contraction in the Malaysian export to the US was one of the highest, with decline rates of −15.8% for the fourth quarter of 2007, −23.1% for the fourth quarter of 2008, and −35.1% for the second quarter of 2009 (Feridun, 2004).
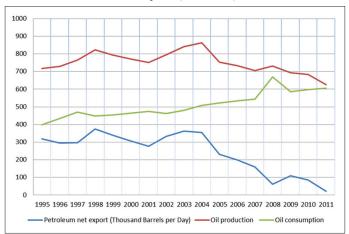
4. ANALYSIS AND DISCUSSION

The price of energy, particularly oil, declined during the two financial crises because of the decline in the economic growth and production in countries all over the world. Figure 1 provides the trends in the Malaysian petroleum production, consumption, and net export from 1995 to 2011.

Table 1 shows the percentage of the GDP growth at constant price during the Asian and global financial crises (Sovacool, 2008), as well as the CO_2 emission rate in these years.

Figure 2, which illustrates the data listed in Table 1, shows that the rate of carbon emission and GDP growth varies, although the financial crises are visible for both. The green spaces (darker)

Figure 1: Petroleum net export, production, and consumption (1995-2011)

occurred when the growth rate for the GDP is greater than that for CO_2 emission. The yellow spaces occurred when the growth rate is less than the CO_2 emission rate.

Figure 2 shows that the Malaysian economy experienced a profound negative growth due to the first economic crisis from 1997 until 1998. In 2008 and the first months of 2009, Malaysia encountered a similar negative economic growth, although at a smaller scale. Although CO_2 emission has dropped significantly during both crises, the emission levels never reached zero. The lowest increase in CO_2 emission growth (0.4) from 1995 to 2011 was observed in 2004, and the trend of total carbon emission by coal, petroleum, and natural gas in the country has consistently increased from 1995 to 2011 with varying rates of acceleration.

The production and consumption of Malaysian petroleum increased during the first financial crisis, but the recession caused oil consumption to drop in mid-1997. However, the growth of oil production continued for the subsequent 12 months. Oil consumption and production increased during the second crisis from mid-2007 for more than 1 year (All Malaysian fuels data using in Figures 1 and 3-5 has extracted from US energy information administration database). This rate declined from the middle of 2008.

The share of petroleum net export fluctuated from 2004, and significantly declined in 2011. Thus, the amount of oil production in Malaysia declined, whereas the consumption of oil experienced a long-term increase. To understand this better, we look at the Malaysian petroleum export and import for the same period, as shown in Figure 3.

Figure 3 shows the world oil prices in the upper left corner when both the financial crises occurred, and the entire figure indicates the value of the oil export and import per US$. The price of oil and the value of oil export and oil import declined in both crises, whereas the gap between export and import declined, particularly after the price increased in 2009. Therefore, the growth of the Malaysian oil export was caused by the increase in the price of oil, whereas the oil import was caused by the increase in the value and amount of oil.

Figure 4 indicates the trend in gas production and consumption in Malaysia during the two crises. The long-term gas production generally improved, aside from the single stop point in first crisis, which continued for at least a year, and occurred again during the second crisis. In 2008, the improving trend in gas production stopped, and even shifted down until 2009.
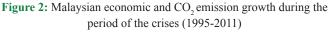
Gas consumption in Malaysia considerably fluctuated in the last 17 years. However, this type of consumption was only affected by the second crisis, when the growing trend in Malaysian gas consumption stopped and increasingly reduced for a year until 2009. Consequently, the Malaysian natural gas export is inversely related to gas consumption. Therefore, the lower rate of gas consumption resulted in greater net export, whereas any increase in gas consumption lowered the Malaysian gas net export. This

case occurred when the price of natural gas was considerably fluctuating.

Figure 5 shows the conditions of the Malaysian coal and world price. Malaysia introduced a new approach towards coal in 1999, which significantly increased the coal consumption in the country. Figure 5 shows that the increase in the national coal production

Table 1: Life-cycle estimates for electricity generators (CCS in Malaysia, 2013)

Technology	Capacity/configuration/ fuel	Estimate (g CO_2 e/kWh)*
Gas	Various combined cycle turbines	443
Coal	Various generator types with and without scrubbing	960-1050
Hydro	1.1 MW, reservoir 300 kW, run-of-river	11-13
Solar PV	Polycrystalline silicone	32

*Carbon emission growth calculated only for CO_2 emitted by coal, natural gas and petroleum for finding the calculation process refer to Appendix I
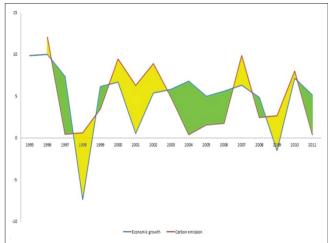
Figure 2: Malaysian economic and CO_2 emission growth during the period of the crises (1995-2011)

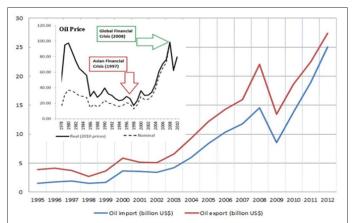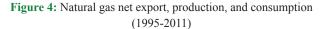**Figure 3:** The Malaysian oil import and export (billion US$) from 1995 to 2011

Table 2: Ratio of total CO$_2$ emission (million metric tons) to annual GDP (billion US$)

Fuel\Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total carbon emission*	89.5	101.7	102.2	102.8	106.5	117.6	125.4	137.6	144.65	145.25	147.6	150.2	166.6	170.8	175.44	190.7	191.44
Total GDP [12]	155.67	174.5	190.5	178.55	192.3	213.5	219.47	235	252.8	277.6	313.5	341.7	373.75	400.5	397.88	432	463.68
CO$_2$ emission/ GDP	0.574	0.582	0.536	0.5757	0.553	0.550	0.571	0.585	0.572	0.523	0.470	0.439	0.445	0.426	0.44	0.441	0.412

*The calculated amount of carbon emission is visible in Appendix I, GDP: Gross domestic product

Figure 4: Natural gas net export, production, and consumption (1995-2011)

Figure 5: Coal net import, production, and consumption (1995-2011)

cannot address the needs of Malaysia. Thus,' coal import has an almost direct relationship with Malaysian coal consumption. No significant changes can be observed in the coal prices during the first financial crisis. However, the increasing trend in coal price temporarily stopped during the second crisis.

Coal consumption increased rapidly after the first crisis, but its growth slowed down in 2005, 2007, and 2008. Figure 6 indicates a growing trend in CO$_2$ emission for the three energy sources being studied. The trend in the emission by petroleum slowly increased after 2002 because of the increase in oil consumption in the country. However, petroleum CO$_2$ emission almost stabilized during the Asian crisis.

Natural gas CO$_2$ emission demonstrated a gradual but consistent increase during the financial crises because of the increase in natural gas consumption at that time. Coal CO$_2$ emission decreased during the first crisis, but it started to grow at varying rates.

Coal has a higher carbon life cycle and produces more pollution compared with the other two fuel sources, which is 2.37 times for natural gas and 1.34 times for petroleum [6]. Hence, increase in coal consumption after 2002 resulted in the exponential increase in CO$_2$ pollution. The study shows that the decrease in coal consumption along with the decrease in GDP and in national production during the first crisis slowed down the general trend in CO$_2$ emission in Malaysia, but it continued to increase slowly. The rate of coal consumption declined again during the second financial crisis in 2007, which resulted in the decline in the rate of total CO$_2$ emission in the country.
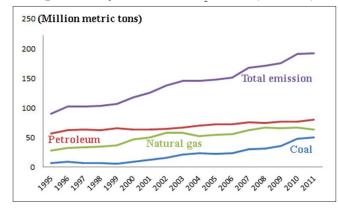
Another index that can explain the change in CO$_2$ emission in response to the growth of economic activity is the Fossil Fuel Carbon Intensity (FFCI). Table 2 shows the total amount of CO$_2$ produced from three fossil fuel types, namely, coal, natural gas, and coal from 1995 to 2011.

FFCI refers to the level of CO$_2$ emitted from economic activities per unit of GDP (based on purchasing power parity valuation of country GDP). Figure 7 shows the CO$_2$ intensity resulting from the use of the three main fuels in Malaysia.
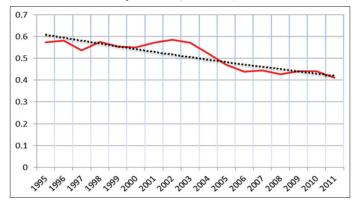
Figure 7 shows that according trend line, the total ratio trend of the emitted from fossil fuel is decreasing. Both financial crises encountered a minor break in 1997 and 2008, but these breaks were small and short.

The Malaysian economy is rapidly growing. Thus, the country requires more energy. As an available fuel with an acceptable

Figure 6: Malaysian fossil fuel CO_2 emission (1995-2011)

Figure 7: Malaysia CO_2 intensity (kg) for natural gas, coal, and petroleum (1995-2011)

price, coal sufficiently addresses this need. However, the rate of the GDP growth in Malaysia is higher than the rate of CO_2 emission. Consequently, after 2002 the intensity of CO_2 emission in Malaysia is slowly declining year after year.

5. CONCLUSION

Malaysia is one of the countries affected by the AFC in 1997 and the GFC in 2008. The first crisis caused the crash of the Malaysian economy, which caused the GDP to plummet to −7.36 in 1998. The effect of the second crisis was not as bad as the first, but country's GDP dropped to −1.51 in 2009. The decrease in the production of the countries resulted in less demand for energy, and prices shifted down across the world. The decline of GDP in Malaysia during both financial crises decreased the growth rate of CO_2 emission, but the emission growth never stopped. CO_2 emission shifted from

12.04% to 0.43% during the first financial crisis in 1997. The rate dropped from 9.84% to 2.45% during the second crisis in 2008.

This study shows that the CO_2 emission in Malaysia is based on coal consumption and almost a direct relationship is visible. The increasing proportion of coal usage as an energy source in Malaysia resulted in the decrease in the rate of CO_2 emission for petroleum and natural gas, although the trend of carbon emission steadily increased over the years. However, the ratio of carbon intensity from the three primary fuel sources is decreasing. Therefore, the amount of CO_2 emission for every US $1 GDP is abating despite the effects of the two financial crises and the increase in the usage of coal as fuel in national production.

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APPENDIX I

Calculating CO_2 emission for three sources namely; petroleum, natural gas and coal

Table 1: Total CO$_2$ emission ratio

Growth\Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Growth rate (%)	-	12.04	0.43	0.58	3.46	9.44	6.25	8.87	4.85	0.4	1.59

Table 2: The amount of CO_2 emission by fuel sources in Malaysia 1995-2011

Fuel\Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Coal	6.17518	8.34083	6.3251	6.36825	5.27236	8.96009	12.44635	15.65S66	20.54696	23.54452	21.68491	23.02765	29.94329	31.02102	34.88709	47.63324	49.40399
Petroleum	56.23123	61.97016	62.93537	62.06797	64.70611	62.82086	62.93315	64.39614	66.73293	69.47295	71.92946	71.94724	74.93112	73.70226	75.81937	76.48572	79.24662
Natural gas	27.08904	31.42992	32.9294	34.34997	36.50054	45.79338	50.03533	57.58322	57.37565	52.24032	53.99077	55.2677	61.76756	66.12474	64.73495	66.55644	62.79353
Total									144.6555						175.4414		191.4441