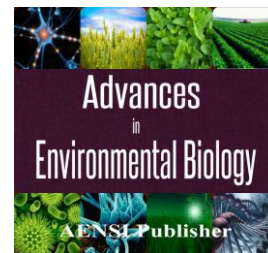




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### The Impact of Global Financial Crisis on CO<sub>2</sub> Emission Among Asean Members

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#### ABSTRACT

The Association of Southeast Asian Nations (ASEAN) includes 10 nations in Southeast Asia. Its population is approximately 600 million people with combined nominal GDP had grown to more than US\$ 2.3 trillion, almost equal with eighth largest economy in the world. Many strong economies worldwide suffered from the global financial crisis (GFC) in 2008 which resulted dipping in global CO<sub>2</sub>emission. This study surveyed the consumption trend of petrol, coal, and natural gas as main carbon emissions in all 10 countries from 2002 to 2012. Economic growth and its effect on CO<sub>2</sub>emission were illustrated. Although the effect of global financial economy varies in the different selected economies, the trend of CO<sub>2</sub>emission was not dependent on gross domestic production (GDP) changes. In contrast to global emission, the 2008 GFC and the decrease in GDP did not result in the reduction of CO<sub>2</sub>emission among ASEAN members.

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### INTRODUCTION

The global financial crisis (GFC) of 2008 was the worst economic crisis world wide [15] that affected many economies since the Great Depression of the 1930s. The decline rate in GDP was 9.8% in the Europe, 14.4% in Germany, and 7.4% in UK [18]. The close relationship between GDP and CO<sub>2</sub> emission is attributed to the changes in CO<sub>2</sub> by fluctuation in the economic growth. Declining world economy resulted in the dip in CO<sub>2</sub> level [17], although the decrease was much smaller than the experts' expectation. In 2012, the Nature Climate Change announced the rapid growth in CO<sub>2</sub> emissions after the 2008–2009 global financial crises [16]. However, all research and data reported a decrease in the global CO<sub>2</sub> emission through GFC.

This paper included 10 ASEAN members located in Southeast Asia. These countries are included almost 600 million populations and \$2.3 trillion GDP.

The ASEAN is a combination of different economies with a variety of sources, industries, and governmental policies. Singapore and Brunei are the two highest income countries (per capita) worldwide, but Myanmar people have less than US \$5 daily income.

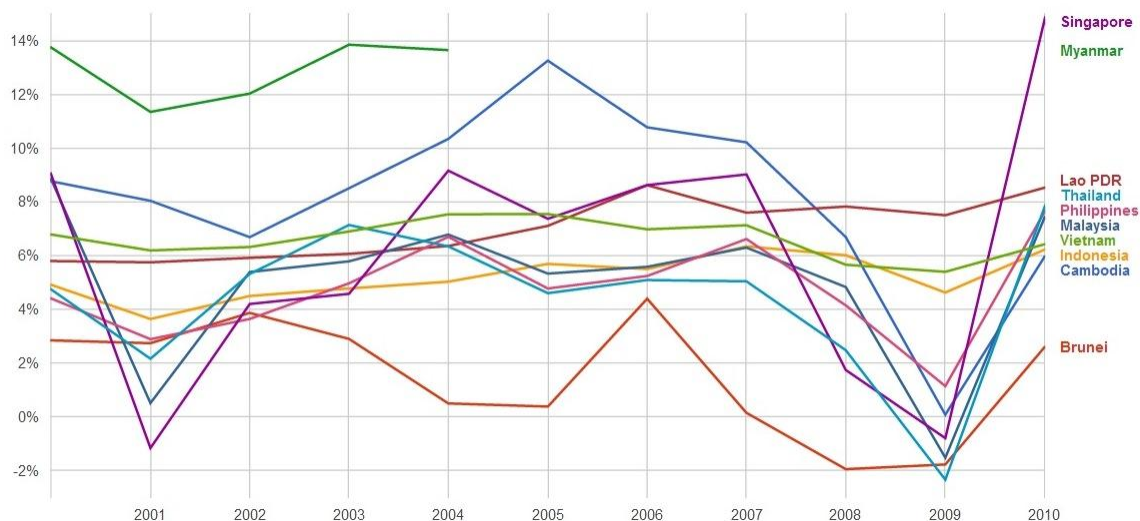
The 2008 GFC was the second financial crisis after 1997 in Asia and presented different effects. Accordingly, the development trend in some Asian countries stopped because of the crisis, but in some other countries, the effect was very small or short term. As shown in Figure 1, the economic growth of the selected countries had been decreasing since 2007 or 2008, with the highest reduction in 2009.

As shown in Figure 1, some economies, such as Myanmar, showed a decreasing trend in growth that started in 2007 and continued until the end of 2008. The intensive decreasing trend in Myanmar began in the first months of 2008. The GDP trend for Lao was almost stable through these years. This trend indicates that the GFC did not affect the economies of these countries because of different reasons, and the crisis effect reached Indonesia with a year delay [3].

Accordingly, this study calculated and compared the trend of CO<sub>2</sub> emission from 2006 to 2012 and analyzed this trend in junction with the economic growth trend in the same period for all the selected countries. This study focused on the three main fossil energy consumptions, namely, natural gas, petroleum, and coal. The trend started in 2006, which was the stable year of countries before the GFC. The year 2008 was the crisis peak, 2010

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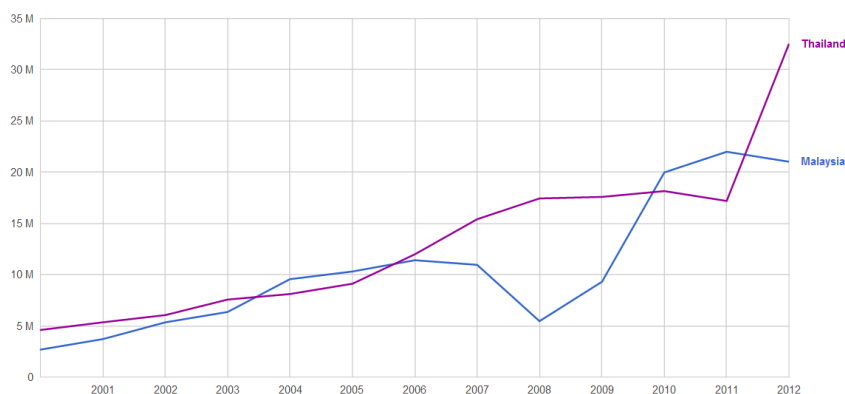
was simultaneous with unfolding signs of crisis recovery, and 2012 showed an almost table global economy. The results indicate that the changes in total CO<sub>2</sub> emission in the study periods were not related to the economic growth Southeast Asia.



**Fig. 1:** GDP amount from 2002 to 2012 for Southeast Asian countries (Grass Domestic Production, 2014) (GDP trend for Myanmar is not available).

#### *Fossil energy consumption in selected countries:*

Majority of Southeast Asian countries need to import fossil energies to fulfil their country needs. Among these 10 countries Malaysia and Thailand are importer of coal with an increasing trend (figure 2).



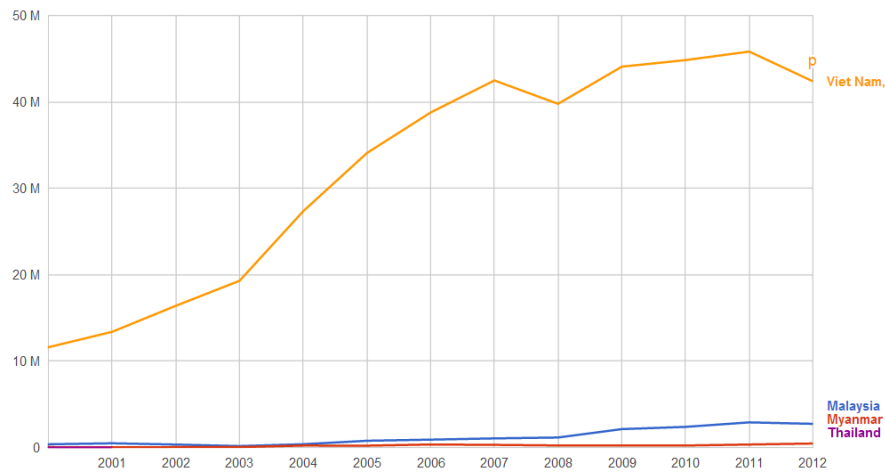
**Fig. 2:** Coal import by Southeast Asian countries (metric ton).

Both Thailand and Malaysia importing more than 20million metric ton coal, right now. In 2011 the trend of importing coal for Thailand was increasing aggressively but for Malaysia it was reducing. The other ASEAN members don't have coal import. Four countries in Southeast Asia are able to product coal. As figure 3 shows, Vietnam has most production of coal in the region.

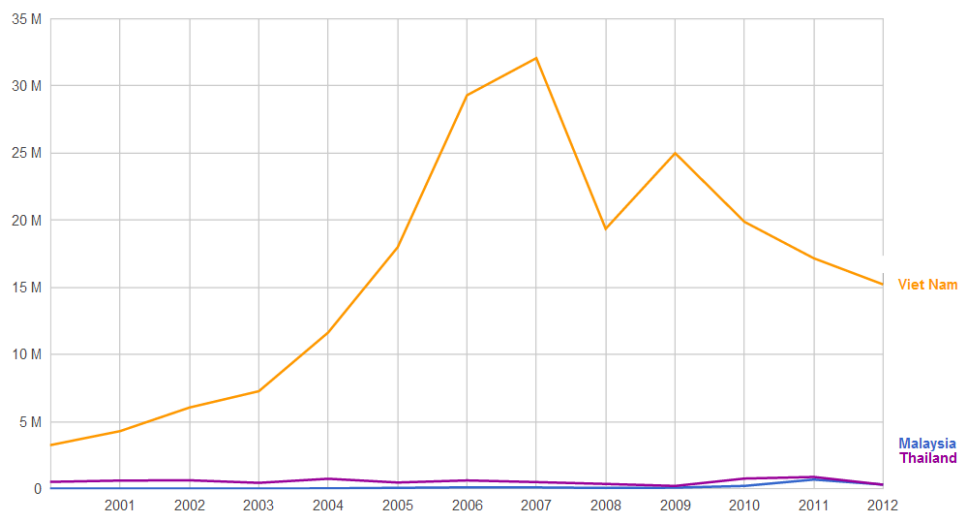
Vietnam in 2012 produced more than 40million metric ton carbon when Malaysia produced less than 5million metric ton [4]. Myanmar (Burma) and Thailand coal production was around 1million ton. Accordingly, most export in area has done by Vietnam. This country had more than 15million metric ton coal export to its neighbours (Figure 4).

Malaysia and Thailand burned most of their coal production in the country and their export is only around 1million ton.

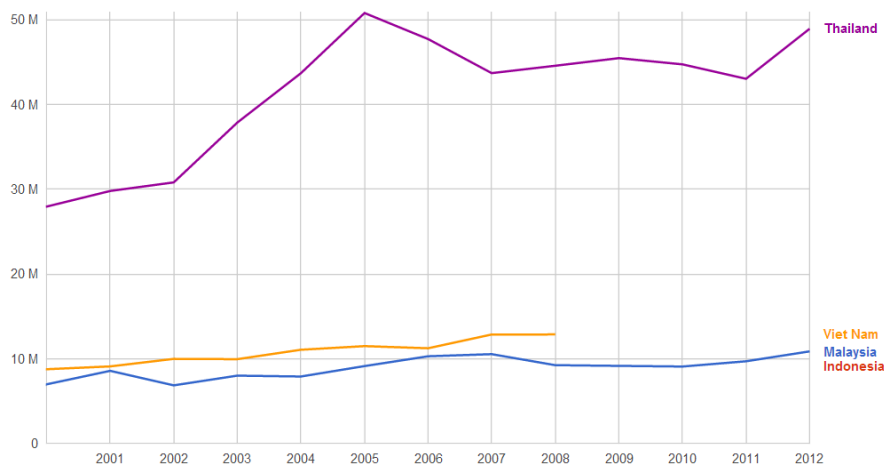
In petroleum group, Thailand is largest importer in the region. Only in 2012 Thailand imported 48million metric ton crude petroleum. This amount for Vietnam is not clear but for Malaysia is 11million metric ton (Figure 5).



**Fig. 3:** Trend of coal production among ASEAN members (metric ton).

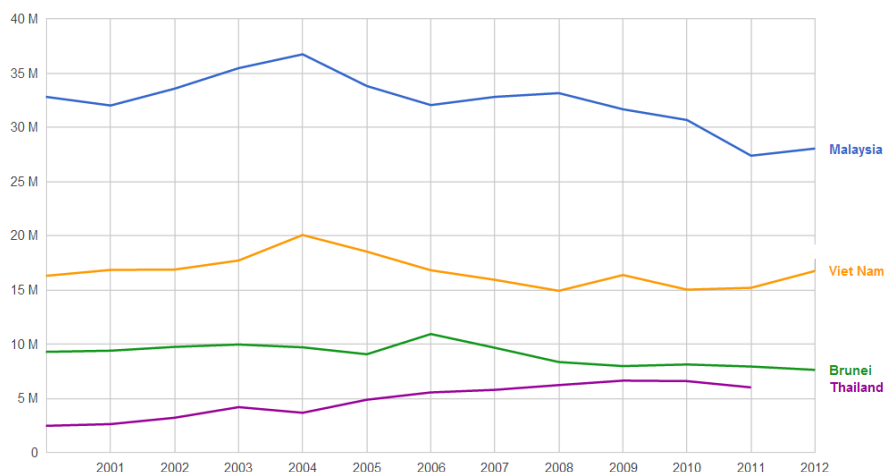


**Fig. 4:** Trend of coal export among Southeast Asian countries (metric ton).



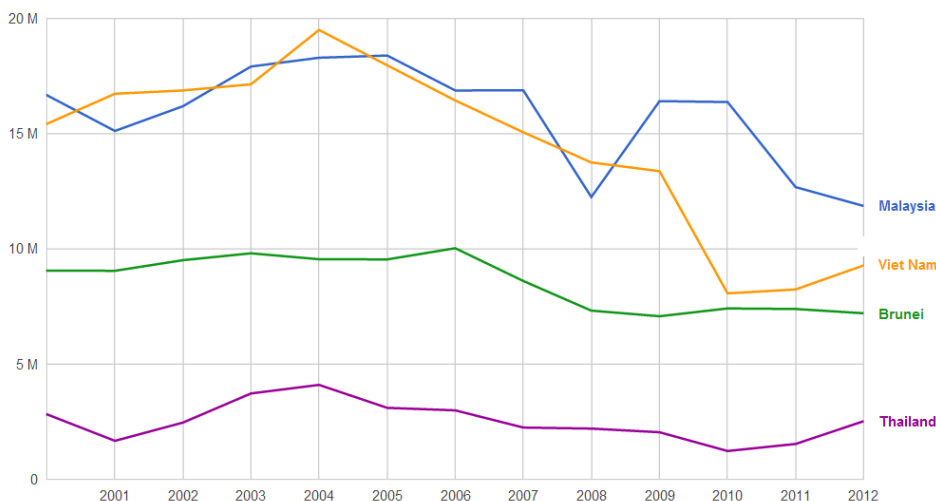
**Fig. 5:** Trend of crude petroleum import among Southeast Asian countries (metric ton).

Although Indonesia is one of the crude petroleum importers in the area, the amount of imports is less than 1million metric ton. Meanwhile the production of crude petroleum among Southeast Asian countries shows that Malaysia is biggest producer of petroleum. As it is shown in figure 6, after Malaysia Vietnam and Brunei and Thailand are producing crude petroleum.



**Fig. 6:** Trend of crude petroleum production in Southeast Asia (metric ton).

Figure 6 confirms that in a 10 years period, trend of production petroleum in Malaysia, Brunei and Vietnam had been reduced but for Thailand this trend shows a slow increase. Figure 7 shows that 4 from 10 ASEAN countries are exporting crude petroleum. Malaysia has exported more than 12 million metric ton crude petroleum in 2012. This amount for Vietnam was 9, Brunei 7 and Thailand 3 million metric ton (Figure 7).



**Fig. 7:** Trend of crude petroleum export among Southeast Asian countries (metric ton).

As figure 7 indicates Brunei and Thailand had a smooth trend in their export but Malaysia and Vietnam's petroleum export had been fluctuated.

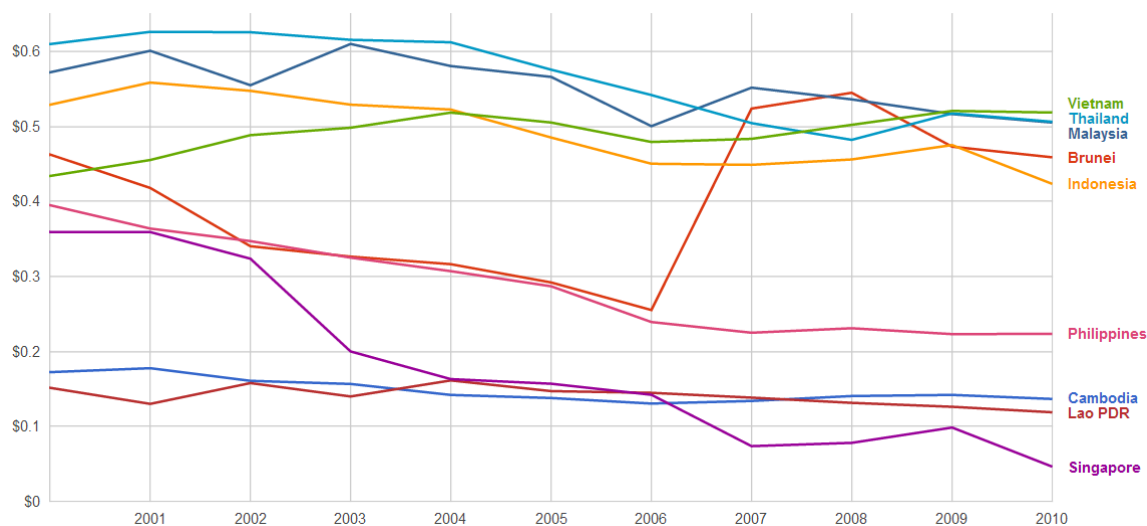
Brunei is the only exporter of Natural gas in Southeast Asia. As well as Brunei, Malaysia is producing natural gas but all Malaysian natural gas burns inside the country. It seems Singapore is the major gas importer in this area.

Figure 8. Shows trend of CO<sub>2</sub> emission in the area based on purchasing power parity (PPP). Singapore is producing minimum CO<sub>2</sub> among these countries and Vietnam maximum CO<sub>2</sub>. Also Brunei CO<sub>2</sub> emission from 2006- 2008 has increased intensively.

Since 2000 the trend of emitting CO<sub>2</sub> in most of the Southeast Asian countries has a decreasing trend except Vietnam trend. Also, CO<sub>2</sub> emission of Brunei despite of decreasing trend until 2006 has a jump in 2007 and 2008.

#### *CO<sub>2</sub> emission and GDP trend in selected countries:*

The effect of GFC on countries' GDP is clear. Based on this finding, the countries' GDP shows the effect of financial crisis on the countries' growth [12]. The effect of GDP on the countries' CO<sub>2</sub> emission resulted from coal, petroleum, and natural gas (Table 1). Table 1 shows the calculated CO<sub>2</sub> emission for any GDP between 2006 and 2012 for the selected countries [5].

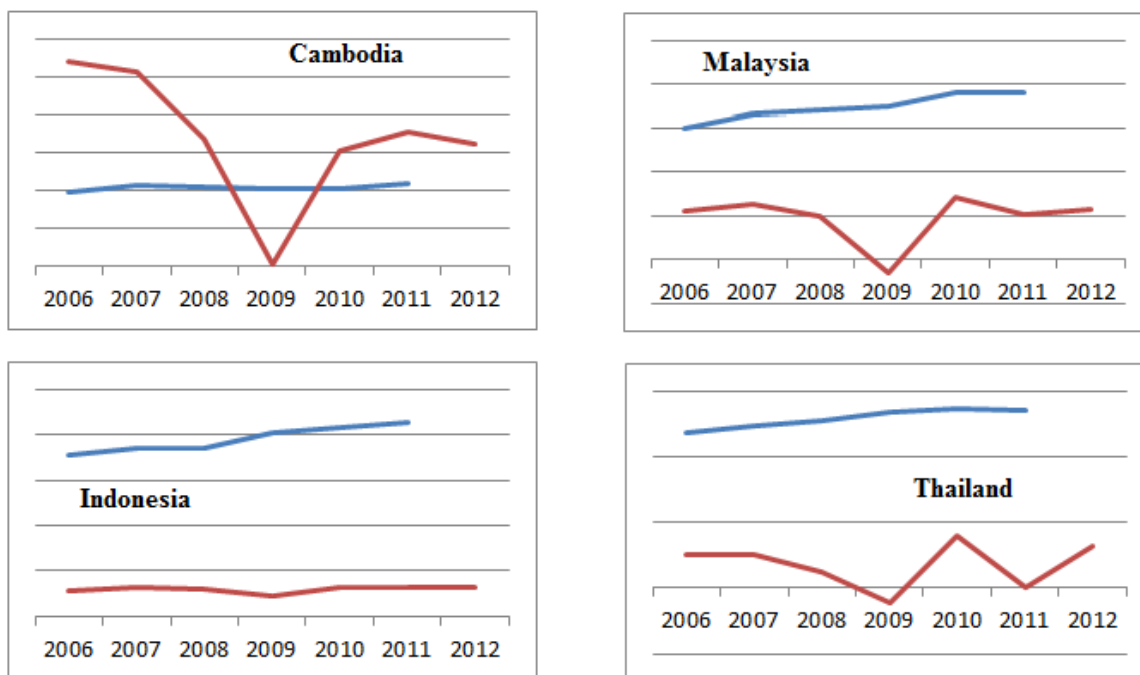


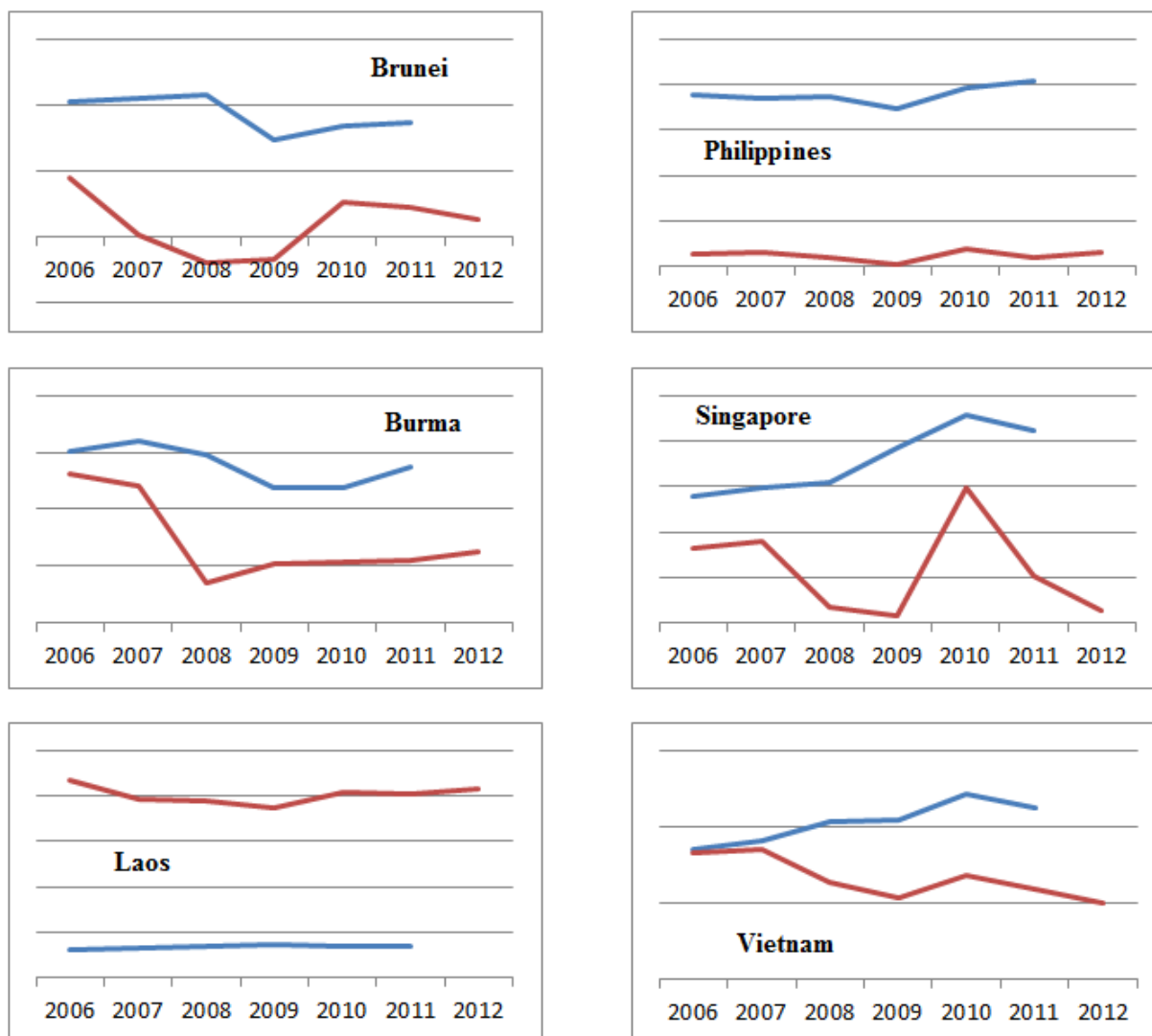
**Fig. 8:** Trend of CO<sub>2</sub> emission in Southeast Asia (kg per PPP \$ of GDP).

**Table 1:** Total CO<sub>2</sub> emission and percentage of GDP in ASEAN from 2006 to 2012 (data were extracted from the World Bank database).

| Country         | 2006                     |       | 2007                     |       | 2008                     |       | 2009                     |       | 2010                     |       | 2011                     |      | 2012                     |      |
|-----------------|--------------------------|-------|--------------------------|-------|--------------------------|-------|--------------------------|-------|--------------------------|-------|--------------------------|------|--------------------------|------|
|                 | CO <sub>2</sub> emission | GDP   | CO <sub>2</sub> emission | GDP   | CO <sub>2</sub> emission | GDP   | CO <sub>2</sub> emission | GDP   | CO <sub>2</sub> emission | GDP   | CO <sub>2</sub> emission | GDP  | CO <sub>2</sub> emission | GD P |
| Brunei          | 10.18528                 | 4.4   | 10.4931                  | 0.15  | 10.74226                 | -1.94 | 7.34797                  | -1.77 | 8.44944                  | 2.6   | 8.6563                   | 2.21 | NA                       | 1.3  |
| Burma (Myanmar) | 15.02226                 | 13.08 | 16.02391                 | 11.99 | 14.84                    | 3.6   | 11.90408                 | 5.14  | 11.90702                 | 5.35  | 13.6666                  | 5.46 | NA                       | 6.3  |
| Cambodia        | 3.85899                  | 10.77 | 4.20535                  | 10.21 | 4.17976                  | 6.69  | 4.08155                  | 0.09  | 4.10147                  | 6.1   | 4.39003                  | 7.08 | NA                       | 6.45 |
| Indonesia       | 355.5198                 | 5.5   | 371.9598                 | 6.35  | 370.1906                 | 6.01  | 405.7012                 | 4.63  | 414.5489                 | 6.22  | 426.7895                 | 6.49 | NA                       | 6.23 |
| Laos            | 1.25688                  | 8.65  | 1.33051                  | 7.84  | 1.41818                  | 7.79  | 1.45312                  | 7.5   | 1.42522                  | 8.13  | 1.40443                  | 8.04 | NA                       | 8.31 |
| Malaysia        | 150.2426                 | 5.59  | 166.642                  | 6.3   | 170.848                  | 4.83  | 175.4414                 | -1.51 | 190.6754                 | 7.15  | 191.4441                 | 5.08 | NA                       | 5.61 |
| Philippines     | 75.20143                 | 5.24  | 73.8189                  | 6.62  | 74.41465                 | 4.15  | 69.35039                 | 1.15  | 78.27515                 | 7.63  | 81.15054                 | 3.91 | NA                       | 6.59 |
| Singapore       | 139.7681                 | 8.26  | 148.3495                 | 9.02  | 155.2404                 | 1.75  | 192.3783                 | 0.79  | 228.6166                 | 14.78 | 212.3924                 | 5.16 | NA                       | 1.32 |
| Thailand        | 237.2201                 | 5.09  | 246.8459                 | 5.04  | 255.0851                 | 2.48  | 267.8846                 | -2.33 | 273.0922                 | 7.81  | 269.6228                 | 0.08 | NA                       | 6.44 |
| Vietnam         | 84.45284                 | 8.23  | 90.24243                 | 8.46  | 103.4439                 | 6.31  | 104.6751                 | 5.32  | 121.35                   | 6.78  | 112.6613                 | 5.89 | NA                       | 5.02 |

Figure 9 shows the ASEAN countries' growth conditions with CO<sub>2</sub> emission. The carbon emission data were clear until 2011.





**Fig. 9:** Relationship between GDP growth and CO<sub>2</sub>emission in Southeast Asia from 2006 to 2012.

Figure 9 illustrates an increasing trend of CO<sub>2</sub> emission in some countries such as Brunei is directly related to GDP fluctuations but in some other countries such as Thailand cannot see any relationship between GDP and CO<sub>2</sub>emission.(Table 2).

**Table 2:** Effect on selected countries by the GFC.

| Country         | GDP affected by GFC | CO <sub>2</sub> emission affected by GDP |
|-----------------|---------------------|--|
| Brunei          | Yes                 | Yes                                      |
| Burma (Myanmar) | Yes                 | Yes                                      |
| Cambodia        | Yes                 | NO                                       |
| Indonesia       | Yes                 | NO                                       |
| Laos            | Yes                 | NO                                       |
| Malaysia        | Yes                 | NO                                       |
| Philippines     | Yes                 | Yes                                      |
| Singapore       | Yes                 | NO                                       |
| Thailand        | Yes                 | NO                                       |
| Vietnam         | Yes                 | Yes                                      |

Table 2 indicates the CO<sub>2</sub>emission grew constantly in the aforementioned economies, in contrast to the fluctuating CO<sub>2</sub>emission in other countries. The GDP trend in the selected countries showed that GDP was affected by GFC. The CO<sub>2</sub>emission of the 10 selected countries showed two different situations. CO<sub>2</sub>emission indicated a dependency to GDP in the first condition but not in the second situation. The effect of GDP on GFC in some countries, such as Malaysia, showed a small decrease in emission speed, but this slower emission did not result in the decrease in total emission, such as GDP. Despite the change in acceleration of emission in

Malaysia, the CO<sub>2</sub> emission trend was still increasing. A glance on the economic condition mentioned in figure 9 showed that all ASEAN members are affected by the global recession. Also the CO<sub>2</sub> emission trend of the ASEAN countries, namely, Brunei, the Philippines, and Burma, showed a direct dependence on GDP trend and GFC.

#### Conclusion:

The global financial crisis (GFC) of 2008 was the worst economic crisis worldwide that affected many economies since the Great Depression of the 1930s. Except Laos, all Southeast Asian countries show a declining trend in GDP growth rate since 2006 or 2007 which is on lowest point in 2009. Nevertheless, GDP per capita, PPP (constant 2005 international \$) shows a stability for most of the countries' region except Singapore and Brunei. Malaysia increased the production and import of coal; Vietnam increased coal production and decreased exporting coal to the other countries. Thailand also increased the production of coal. Countries tried to have to fix their petroleum imports. Malaysia, Brunei and Vietnam decreased in their petroleum production but Thailand slightly increased in its production. But all four countries decreased in their petroleum exports. Brunei is the only exporter of Natural gas in Southeast Asia. As well as Brunei, Malaysia is producing natural gas but all Malaysian natural gas burns inside the country where Singapore is the major gas importer in this area. The close relationship between GDP and CO<sub>2</sub> emission is attributed to the changes in CO<sub>2</sub> by fluctuation in the economic growth. Accordingly, observation on GDP growth and CO<sub>2</sub> emission in these countries splits countries to two different groups. First group including Cambodia, Malaysia, Thailand and Singapore don't show any meaningful relationship but the second group including Indonesia, Brunei, The Philippines, Burma, Laos and Vietnam show a strong relationship between GDP and CO<sub>2</sub> emission. Most probably this attitude is related to the countries energy consumption. The survey on energy production and consumption confirms GFC was effective on growth rate of the countries in Southeast Asia in a short time but countries with replacing energy sources tried to continue their growth trend.

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