The Length of Swings for Net-Zero Emissions in a Country Based on Economic Periods

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ABSTRACT

Carbon emission is closely related to human economic activities; therefore, this paper suggests that the environmental business cycle structure is similar to the business cycle structure. The first empirical evidence regarding the pure net-zero carbon emissions in the United Kingdom observed a two-century inverted U-shaped pattern, such as the environmental Kuznets curve (EKC) pattern, on the amount of CO_2 emissions. In this study, the EKC model is based on the concept of income-driven willingness to pay for the environment. Carbon emissions from coal have been observed to have an EKC pattern in the U.K. for a period of 120-180 years. Noteworthily, there is no economic definition of this phenomenon in the past literature. This study proposes that the swings over 128 years are based on the sixty Juglar swings from marketing activity sources, the eight short-Kuznets swings from marketing activity sources and processing activity sources, the four long-Kuznets swings from refinery activity sources, or the two Codrulieff swings from mining activity sources. Our prior study applied the EKC model to prove that reducing CO_2 emissions differs from reducing CO_2 concentrations in the atmosphere. The reduction of CO_2 emissions limits emissions from personal activities, while the reduction of the CO_2 concentration is a recovery process adopted by societal activities. This means that reducing CO_2 concentrations should be considered a societal concern.

1. INTRODUCTION

When the growth curve is with an inverted U shape, it is called the "Environmental Kuznets Curve (EKC)", which is proposed from the income-driven willingness-to-pay for the environment theory (Kuznets, 1955; Grossman and Krueger, 1991; Stern, 2004; Egli and Steger, 2007; Yu and Chen, 2012; Kong and Khan, 2019). Carbon emission frequency is closely related to human economic activities; therefore, we suggest that the environmental business cycle structure is akin to the Schumpeter business cycle structure. The first empirical evidence on the pure net-zero carbon emission in the UK observed a 250-years inverted U at 2021 (Amar, 2021), such as the environmental Kuznets curve (EKC) pattern, on the amount of CO_2 emissions. In this study, the EKC model is based on the concept of income-driven willingness to pay for the environment. Carbon emissions from coal have been observed to have an EKC pattern in the UK for a period of 120-180 years. Figure 1 demonstrates the replotted trending curve of the work of Prof. Amar in the literature (Amar, 2021). And in this study we have transferred the GDP scale to time

scale in the coming investigations. Noteworthily, there is no economic definition of this phenomenon in the past.

Figure 1: The demonstrated CO_2 environmental Kuznets curve (EKC) in the UK.

Log UKGDP (*Literature*) ----► Log Time scale (*This study*)
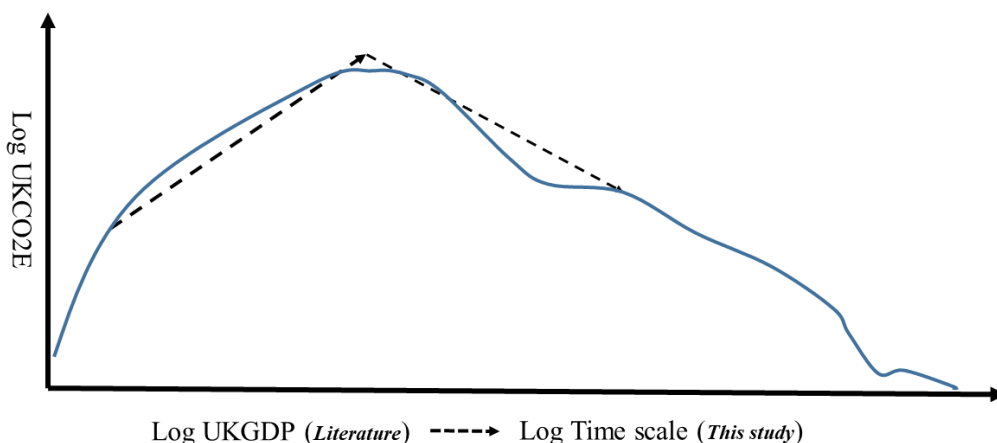
## 2. METHODS AND MAIN RESULTS

The four famous periods of Kondratieff, Kuznets, Juglar, and Kitchin business swings are applied as the "*Quantized Time Levels*" in our newly proposed physical structure of the "*Environmental Economics Time Theory*". The major goal of our new model is to extend the time level to more than 100 years, in order to explain the first empirical evidence of the pure net-zero carbon emission "*Inverted U shape*" EKC pattern in the UK, which has been observed over a two-century period. In the atomic physical quantum structure, there are four orbitals called as s, p, d, f orbitals. As shown in Fig. 1, these four orbitals are built up in a 2D diagram, from low energy to higher energy as increasing in atomic size. If we can build up the time theory for economic activates by following the principle of atomic quantum theory.

The typical Kondratieff swing covers a period of 45-60 years. The Schumpeter business cycle structure of one Kondratieff swing includes three Juglar swings, while one Juglar swing includes three Kitchin swings, meaning a period of 3-5years. This study proposes 128-year swings based on sixty Juglar swings from marketing activity sources, eight Short-Kuznets swings from marketing activity sources and processing activity sources, four long-Kuznets swings from refinery activity sources, or two Codrulieff swings from mining activity sources.

In the past three years, we have built up the time theory for economic activates. Table 1 shows the results of the above-mentioned swing lengths are the quantized time levels of 8, 32, and 128 years, respectively. The data in Table 1 is from the assembled results of basing on the four famous business swings, here are called as "Swing length". And the name of "Swing shape" is created from our previous publication. To think about the swing length and swing shape is as like as the two important properties of a wave,

Frequency and Amplitude. The data in the Table 1, is the 2, 4, 8, 16 times of the four famous business swings.

Figure: 2 Argon element's Atomic Orbital Structure
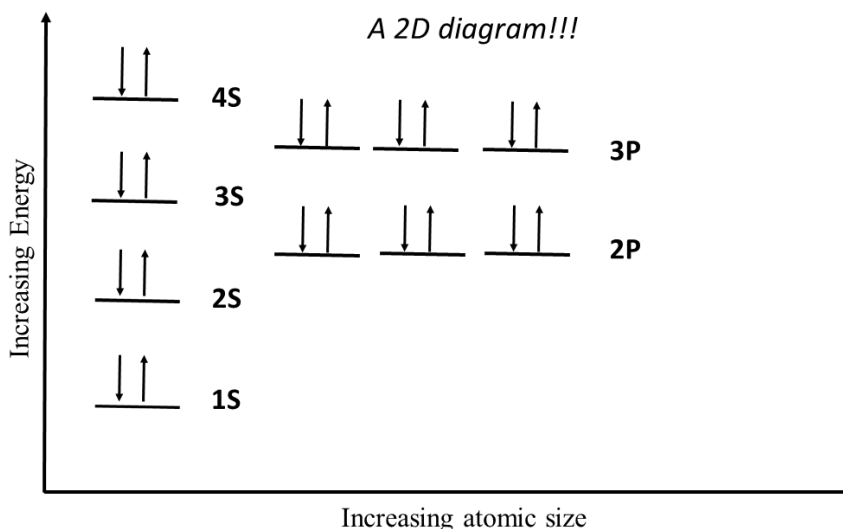
These swing lengths are presented as four types swing shapes, named as "Wave Type", "Zigzag Type", "Circular Type", "Stretched Type" to demonstrate the dynamic characters. We have learned the idea of those swing shapes from our previous publications [Huang, 2020, 2021a; 2021b], we applied the EKC model to prove that reducing CO_2 emissions differs from reducing CO_2 concentration in the atmosphere. The reduction of CO_2 emissions limits emissions from personal activity, while the reduction of the CO_2 concentration is a recovery process adopted by societal activity. This means that reducing CO_2 concentration should be considered a societal concern.

Regarding the whole processes from natural resources mining to good products, there are four major industrial chains from natural to marketing products: natural resources, refinery, processing, marketing. And the technical re-generation rate is mining > refinery > processing > marketing. Therefore, for the EKC pattern in the UK for a period of 120-180 years, the longest swing we developed in Table 1 is 128 years, just meet this value range. And the economic resource will be coal mining for energy used, this is composed by two Codrulieff period, this is also fitted with the topological observation in Fig. 1. Another impact of the Table 1 is that; we have observed a new economic period for very short term of 0.5 years, for example, the nature increasing and decreasing cycles of $PM_{2.5}$ in the atmosphere [Mulomba Mukendi and Hyebong., 2024].

3.   CONCLUSION REMARKS AND POLICY IMPLICATIONS

The UN must include all countries within their governing; thus, the policy must collect all the data of the countries, to conduct classification of the countries. While the CO_2 concentration might be considered as the "catalyst" to enhance extreme climate, it does not play the key role on increasing room temperatures or to move the amount of precipitation from A region to B region. As proven in our previous paper [Huang, 2021a,b], the catalyst is to reduce the reaction energy, while remaining uninvolved in the

reaction. However, as it must be over a minimum concentration to initiate the catalyzing work, the concentration of the catalyst is very complicated as the catalyst is continuously increasing, while the reaction rate cannot be increased any more. That is why CO_2 concentrations have increased since 2010, while the extreme climate issues have not improved. Moreover, extreme climate has been observed in more and more regions. Is it a diffusion of CO_2? We think this issue is due to the economic development from developed countries to undeveloped countries. The same story always occurs when local CO_2 concentrations are over the criteria concentration. In chemistry, for water to perform the hydration reaction to separate cation and anion, the salt must be in a neutralized state. This is a physical process and is reversible, which means that extreme climate might be also reversible, meaning that people can reduce the local CO_2 concentration across several countries in a region that is defined by the diffusion radius of CO_2 gas in the atmosphere. According to this viewpoint, a regional economic alliance, such as "Trade and Investment Framework Agreement (TIFA)", can undertake this duty to practice this concept in real-life.

4. APPLICATION ON THE CO_2 REDUCTION POLICY

Therefore, reducing the amount of CO_2 emissions and reducing the CO_2 concentration in the atmosphere are totally different. The former is to limit the emissions resulting from personal activity, while the latter is a recovery process adopted by societal activity. This is why changing from fossil driven vehicles to electricity driven vehicles is not equal to reducing the CO_2 concentration in the atmosphere and can only reduce the CO_2 concentration for a micro-environment. However, as CO_2 is a gaseous state, it diffuses very quickly; therefore, the concentration will archive a constant through transporting the surrounding CO_2 gas. This means that reducing CO_2 concentrations must be a global society activity and a universal activity for all countries, which can be conducted through taxes, meaning a company or a person shall be taxed wherever they own property or a business, whether within or out of their-own country.

The specific policy suggestions of this finding is that, any country can double check their owned "Net-Zero Emission Year", especially for those using the coal as dominated electric power sources, as like as in Taiwan. The coal power has been used since 1987, until now we have sued coal power for 37 years. And, Taiwan Government has announced that "2050 is the Net-Zero Emission Year", we remain 26 years to archive the goal, the whole de-coal power process in UK was 128 years, but in Taiwan we have to accelerate as soon as 63 years (37+26=63). Therefore, this announcement is NOT so reasonable, due to swing length for Net-Zero Emission is found as 128 years for the first case in the world.

Table 1. The Contributions of Economic Swings from Main Four Economic-Activities

Quantized Time Levels / (Economic Natural Re-sources from Environment section)		*Swing Shape*			
		Quantized Time Types/ (Economic Activity Sources from Human Production Section)			
		Wave Type (Marketing)	Zigzag Type (Processing)	Circular Type (Refinery)	Stretched Type (Mining)
Swing Length	128 years (Centennial system)	16 x 8 years (Juglar period)	8 x 16 years (Short-Kuznets period)	4 x 32 years (Long-Kuznets period)	2 x 64 years (Codrulieff period)

	32 years (Three Decade system)	16 x 2 years (Kitchen period)	8 x 4 years (Juglar period)	4 x 8 years (Juglar period)	2x16 years (Kuznets period)
	8 years (Decade system)	16 x 0.5 years (A new period?)	8 x 1 years (Kitchen period)	4 x 2 years (Kitchen period)	2 x 4 years (Juglar period)

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