

Advanced Financial Instruments for Sustainable Business and Decentralized Markets

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In this lesson, we discuss the connectedness of carbon markets with various other financial markets such as stock markets, cryptocurrency markets, green bonds and energy markets. From this video, we will start the discussion about carbon market connectedness with other financial markets. In particular, we will provide the theoretical underpinnings behind the financial market connectedness. First, the economic fundamentals hypothesis says that economic activities across regions may be interconnected, which will make the macroeconomic variables of one region affect the stock markets of other regions. That is the correlation of cross prices and returns among markets is predominantly due to correlation of economic fundamentals. With the financialization of commodities and the rapid development of globalized trade, cross country cooperation has become increasingly close and the circulation of goods and services and assets has become more convenient, which results in an increase in the interaction of global financial markets.



Financial Market connectedness

- The “economic fundamentals hypothesis” says that the macroeconomic variables of one region affect the stock markets of other regions
- With the financialization of commodities and the rapid development of globalized trade, cross-country cooperation has become increasingly close
- Also, from the view of the “market contagion hypothesis”, when a country’s financial market suffers an extreme risk impact, it substantially affects the psychological expectations of investors
- For example, after the outbreak of the European debt crisis, the fall in euro exchange rates caused serious negative impacts on the stock and commodity markets of core countries of the Eurozone through financial contagion. Another example is the covid-19 pandemic.

Also from the view of market contagion hypothesis, when a country's financial market suffers an extreme recent impact, it substantially affects not only the financial market of the country with close trade and financial price, but also the psychological expectations of investors. Driven by their psychological expectations and irrational behaviors such as the herd effect, investors frequently adjust their investments resulting in strong risks below us,

more specifically during crisis periods. For example, after the outbreak of European debt crisis, the fall in Euro exchange rates caused serious negative impact on the stock and commodity markets of core countries of the Euro zone through financial contagion. Another example is the Covid-19 pandemic.

To summarize, in this video, we discussed three main reasons or channels of financial market connectedness. These included economic fundamentals hypothesis, financialization of commodities and market contagion hypothesis.



Carbon market with Stock market

- The stock market acts as barometer of the level of economy activity, which reflects economic conditions and enterprise capitals.
- On the one hand, a positive economic situation is expected to promote firms' profits, which would make enterprise shares more attractive since the expected dividends to shareholders would be larger.
- At the same time, higher economic activities (reflecting higher level of production of goods and services) would lead to higher energy demands and consumption, would result in higher carbon emissions, which will lead to higher carbon allowance demand and carbon prices.

In this video, we will discuss the carbon market connectedness with stock markets, conventional stock markets and novel cryptocurrency markets. For an economy, often stock markets act as the barometer of the level of economic activity which reflects economic conditions and enterprise capitals. On the one hand, positive economic situation is expected to promote firms' profits which would make the enterprise shares more attractive since the expected dividends to shareholders would be larger.

At the same time, higher economic activities, reflecting higher level of production of goods and services, would also lead to higher energy demands and consumption of energy and is expected to result in higher carbon emissions which may result in demand for higher carbon allowance and thus higher carbon prices. While on one hand, carbon price changes may influence enterprise economic incentives and these incentives would be reflected in stock prices because carbon allowances act just like another factor of production and therefore adds to the input cost of enterprises. Carbon price changes can influence a firm's input mix preferences, output levels, cash flows and investment decisions. However, the financial impact depends on the ability of the firm depending upon their ability to pass on

extra costs on the next step of supply chain. Thus, carbon price changes pose some kind of spillover effect by altering input costs and affecting margins and in turn stock prices.



Carbon market with Stock market

- On the other hand, carbon price changes may influence the enterprises' economic incentives and these changes would be reflected in the stock prices.
- As carbon allowances act just like any other factor of production.
- Carbon price changes can influence a firm's input-mix preferences, output levels, cash flows, and investment decisions
- Thus, carbon price changes pose a spillover effect by altering input costs, affecting margins and, in turn, the stock prices.
- From a theoretical perspective, there is a bi-directional spillovers between carbon and stock markets.

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From a theoretical perspective, it appears to be a bidirectional spillover between carbon and stock markets.



Carbon market with cryptocurrency

- The annual carbon footprint of Bitcoin, the highest market cap cryptocurrency, is 36,937 kt, which is equivalent to the annual carbon footprint of New Zealand.
- Participation in the Bitcoin block chain validation process consumes a substantial amount of power, resulting in significant carbon emissions.
- It is concluded that Bitcoin/Cryptocurrency is undoubtedly a carbon-intensive market. From this, we can preliminarily infer that there is a correlation between carbon assets and Cryptocurrency.

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Next, in terms of its connectedness with cryptocurrency markets, the annual carbon footprint of Bitcoin, the highest market cap cryptocurrency is around 36,937 kt which is equivalent to the annual carbon footprint of entire New Zealand. Now, Bitcoin's annual electricity consumption is approximately 0.4 petawatt hours and estimated that it will have

a cumulative carbon emission of 2.0 giga tons by 2100.



Carbon market with cryptocurrency

Analysing the linkage between cryptocurrency and carbon prices is important for several reasons:

- First, the large carbon footprint, together with the rapid expansion of the cryptocurrency market, implies that cryptocurrency prices could drive carbon prices in the future,
- Second, cryptocurrency's large energy consumption and carbon emission imply that investments in these currencies are subject to increasing climate
- Third, the rise of sustainable cryptocurrency will attract more environmentally conscious investors in the future

However, with much faster decarbonization that achieves carbon neutrality around mid-century, Bitcoin's cumulative carbon emissions will not be decisive for limiting global warming below 2.0°C. Now, participation in the Bitcoin blockchain validation process consumes a substantial amount of power resulting in significant carbon emissions. It is concluded that Bitcoin and cryptocurrency in general is undoubtedly a carbon intensive market and from this we can firmly infer that there is a correlation between carbon assets and cryptocurrency. Hence, the huge energy consumption in carbon emissions generated by Bitcoin industry and other cryptocurrencies mining may become an obstacle on the road to worldwide emission reduction and sustainable development goals with the intended carbon neutrality goal since it needs lot of energy resources such as electricity and water.

Moreover, analyzing the linkages between cryptocurrency and carbon prices is very important for several reasons. First, the large carbon footprint together with rapid expansion of the cryptocurrency market implies that cryptocurrency prices could drive carbon prices in the future thereby influencing the effectiveness of carbon allowance policies in curbing climate change. Second, cryptocurrency's large energy consumption and carbon emission imply that investments in these currencies are subject to increasing climate risk in future and thus cryptocurrency investors can rely on alternative, environment-friendly financial instruments such as the carbon emission allowance market to hedge their portfolios against climate risk. Lastly, the rise of sustainable cryptocurrency will attract more environmentally conscious investors in the future thereby increasing the connectedness between cryptocurrency and other green financial assets including carbon prices. To summarize, in this video we discussed the connectedness of carbon market with conventional stock markets and cryptocurrency markets.



Carbon market with green bonds

- Green bonds are defined as any type of bonds where “the proceeds will be exclusively used to finance or re-finance, in part or in full, new and/or existing eligible green projects”.
- With green bonds, the issuer obtains the capital to finance green projects, while the investors receive fixed income in the form of interest. At maturity, the principal is repaid.
- Green bonds in this way are the same as any corporate bond,
- This makes green bonds a double-edged sword; on one side, green bonds help tackle climate change by financing green projects, and on the other hand, green bonds present an opportunity for investors to diversify their portfolios and manage their risks.

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We saw why it is important to analyze these linkages and what is the implication for future sustainable goals related to climate change mitigation. In this video, we will discuss the connectedness of carbon markets with green bonds. The emergence of green bonds signals a new trend in recovering the world economy through developing low carbon technologies to reduce emissions. Green bonds are defined as any type of bonds where the proceeds will be exclusively used to finance or refinance in part or full new or existing eligible green projects. With green bonds, the issuer obtains the capital to finance green projects while the investors receive fixed income in the form of interest and at the maturity the principal is repaid.

Green bonds in this way are same as any corporate bond but they are labeled green because the issuer pledges to use the proceeds for environment-friendly or climate-focused projects in accordance with the sustainability standards. This makes green bonds a double-edged sword. On one side, green bonds help tackle climate change by financing green projects and on the other hand, green bonds present an opportunity for investors to diversify their portfolios and manage their risks. According to the purpose and content of the transactions in the carbon and green bond markets, both the markets share the same intention of reducing greenhouse gas emissions and realizing environment-friendly economic development. In some countries and regions such as Europe and China, various carbon trading and green bond markets have started to develop rapidly at similar times.

In the relevant policy arrangements for low carbon development, these two markets, green bonds and carbon market, are also frequently connected and concerned with each other. Green financing represented by green bonds can also provide financial supports for various carbon trading markets in many cases and a comprehensive grasp of their features is of

great significance to the correlative arrangement for economic activities and low carbon transformation. Lastly, the development of green bonds depends on building investor confidence in the green bond market and enhancing the understanding of green bond characteristics, which are closely associated with the regulatory changes in green policies. Because the environment surrounding carbon trading is subject to significant uncertainty due to regulatory changes and green policies, green bonds should play an important role in the successful management of carbon market risk. Green bond markets can be considered as a complement to the conventional carbon markets with lower prices used for short-term hedging.



Carbon market with green bonds

- Both the markets share the same intention of reducing greenhouse gas emissions and realizing environmentally friendly economic development.
- In some countries and regions, such as Europe and China, various carbon trading and green bond markets have started to develop rapidly at similar times
- Green financing represented by green bonds can also provide financial support for various carbon trading markets in many cases

However, green bond markets can be considered also as a substitute to carbon markets with higher prices used for long-term hedging. Furthermore, increase in green bond issuance also impacts carbon prices. Funds from green bond issuance are directed towards low carbon projects, which further decrease the carbon emissions and hence decrease the carbon prices because then demand for emission allowances would be less. To summarize, in this video, we discussed the connectedness between carbon market and green bonds. We noted that both of these instruments are novel instruments available to investors for portfolio risk diversification and hedging and both of them facilitate achievement of the climate change mitigation goals.



Carbon market with energy market

- Energy prices are one of the most crucial factor impacting the carbon prices
- The fossil energy price changes can affect the energy consumption structure of enterprises
- A decrease / increase in energy prices can increase / decrease companies' energy use
- For example, a rise in coal prices will negatively impact the carbon allowance demand and its prices
- However, a significant decline in coal prices will increase the carbon allowance demand and its price as low coal prices make oil and natural gas a costlier input for power firms

In this video, we will discuss the connectedness of carbon markets with energy markets and conclude the discussion on carbon market connectedness. Energy prices are one of the most crucial factors impacting the carbon prices as consumption of fossil energy is the main source of carbon emissions. On the one hand, the fossil energy price changes can affect energy consumption structure of enterprises, thereby affecting the demands of carbon emissions and further leading to volatility in carbon market. A decrease/increase in energy prices can increase/decrease companies energy use which may increase/decrease the demand for carbon allowances and accordingly the diversification potential of energy futures for carbon assets is worthy of attention. For example, a rise in carbon prices will negatively impact the carbon allowance demand and its prices because a decline in coal price will increase the switching effects from dirty energy to cleaner fuels as burning high priced coal will be a costly affair for the firms as they need to pay more at both the ends for coal as well as carbon allowance.



Carbon market with energy market

- The price of carbon can adjust and guide the structure of fossil energy consumption
- The ETS are designed mainly to motivate enterprises to reduce fossil-fuel-based energy consumption
- For example, lower prices for fossil fuels may increase its consumption by firms, which could lead to excess demand for allowances and consequently increase carbon prices.
- However, higher carbon prices in the ETS will give firms more incentive to develop clean energy technologies, which can reduce renewable energy prices and affect prices in other energy forms.

However, a significant decline in coal prices will increase the carbon allowance demand and its price as low coal prices make oil and natural gas a costlier input for power generating firms. On the other hand, the price of carbon adjust and guide the structure of fossil energy consumption arise in the price of carbon will shift fuel consumption from coal to natural gas when it causes a shift in marginal fuel cost for energy generation. Thus, the carbon emission of power enterprises can be reduced to a larger extent even if the scale of fuel conversion is small. The ETS emission trading systems are designed mainly to motivate enterprises to reduce fossil fuel based energy consumption and increase investment in clean low carbon technologies or adopt renewable energy. It therefore introduced a complex mechanism linking carbon price in the emission trading system and energy markets.

For example, lower prices for fossil fuels may increase its consumption by firms which could lead to excess demand for allowances and consequently increase carbon prices. However, higher carbon prices in emission trading systems will give firms more incentive to develop clean energy techniques which can reduce renewable energy prices and affect prices in other forms. Given the fact that EU is one of the biggest markets and energy consumers in the world changes in the energy demand due to optimization by individual firms in EU can also trigger price changes in the international energy markets which makes the pricing system more complicated and not so easy to understand.



Carbon market with energy market

- EU is one of the biggest markets and energy consumers in the world
- The links between carbon prices and energy markets are expected to be dynamic, reflecting the changes in the fundamental structure of the ETS and the dynamics in global energy markets..

The links between carbon prices and energy markets are expected to be dynamic reflecting the changes in fundamental structure of the ETS and the dynamics in global energy markets. Revealing this dynamic linkage is important for understanding how the system works and therefore it is valuable for firms to react optimally to market changes.

In this video, we tried to explore the connectedness between carbon market and energy markets across the world in particular EU. We noted that these linkages are complex and their understanding is required for firms to optimally react to policy changes. Carbon markets are connected to various other financial markets through three key hypothesis that provide the theoretical end-up in. First, the economic fundamentals hypothesis that suggests that financial markets are connected due to their linkages between economic activities. Next, there is the financialization of commodities which has been ever increasing and cross-border trades resulting in incremental interaction and linkages across global financial markets.

Lastly, market contagion hypothesis suggests that financial markets are linked due to common impact of global events such as Covid-19 on investor psychology. Now, the stock market is a reflection of economic activity. A higher economic activity results in more emissions and thus a higher demand for carbon allowances, thus resulting in the linkage across carbon market and conventional stock markets. Cryptocurrency mining is an energy intensive process and hence higher volumes of cryptocurrency may result in higher energy consumption and therefore higher level of emissions. This would create additional demand for carbon allowances thus affecting the carbon prices.

Also, green bonds are complementary to carbon markets and facilitate investment in climate-friendly projects resulting in lower level of emissions and thus the lower demand for carbon allowances and in turn creating linkages between carbon markets and green bonds. Lastly, energy markets are also strongly connected to carbon markets. Higher energy prices reflect higher demand for energy consumption and in turn higher emissions. This is expected to increase the demand for carbon allowances and therefore carbon prices.

Thank you.