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Steel scrap and equity market in Japan

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ABSTRACT

Steel scrap is an important raw material in the steel making industry. As steel is a vital metal in modern life, the price of steel scrap is viewed as an important indicator of the macroeconomic activity. Steel scrap is consumed mainly in the electric arc furnace steel making, which represents approximately 30 per cent of the world annual steel production. Unlike other minerals including iron ore, both the supply and consumption amounts of steel scrap can be relatively easily adjusted based on the contemporary industrial activity level. For this reason, the steel scrap price reflects the condition of the macro economy and thereby it can be used as an indicator of future stock market performance in the country by market participants. Nevertheless, there is not much research on the market of steel scrap. This study aims to close this gap by testing the lead–lag relationship between the changes of steel scrap price and the aggregate Japanese stock market movement. Our empirical analyses suggest that the steel scrap price changes are informative in explaining the future stock market performance in Japan.

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1. Introduction

Predicting equity market returns has been of great interest to academics and speculators. To increase the accuracy of prediction, past studies have incorporated various internal and external factors into economic models. Those factors can be related to the macro economy (e.g., interest rate and industrial production), the micro economy (e.g., earnings of and dividend paid by companies), information regarding stock markets in other regions, information regarding other asset categories (e.g., commodity markets), and the past information of its own stock market (e.g., 12 months moving average market performance). However, in some instances, there are gaps between the perception of academic researchers and financial market participants (such as traders) on what drives the market. To close these gaps, our paper examines the effect of local steel scrap market condition on the equity market return in Japan. The behaviour of this recycled metal market is considered as a leading indicator of the equity market by a number of market participants including Dr Alan Greenspan, a former chairman of the Federal Reserve of the U.S.

The steel scrap price is a "favourite" economic indicator by Dr Greenspan (Desai, 2013). The price of this metal might be a good indicator because (1) steel scrap is one of the main raw materials for steel making and steel is an essential material for modern industrial activities, (2) both the supply and demand of steel scrap adjust relatively quickly to macroeconomic conditions, and (3) there is no exchange in which steel scrap is actively traded. In relation to the first two points, steel scrap is mainly remelted in electric arc furnaces (EAF) and the production pace of this type of furnace can be easily adjusted. This is not the case for blast furnaces, which represents a larger portion of the world's steel production and mainly consumes iron ore. For this reason, the demand of steel scrap should reflect the contemporary consumption level of steel products and thereby macroeconomic conditions.

Furthermore, the demand of steel scrap is assumed to be minimally affected by speculation activities (Desai, 2013). Since an increase in the economic activity gives rise to the growth in the demand of steel products, the consumption level of steel scrap is likely to be a positive function of the macroeconomic condition. If the above rationales are valid, there may exist a positive lead–lag relationship between steel scrap price and equity market, as the condition of macroeconomic activities and the stock market in a country tend to move together. In particular, the result of Kaneko and Lee (1995) indicates that the lagged industrial production index in Japan contains valuable information in determining the

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current equity market return in the country. Nevertheless, to the best of our knowledge, there is no previous scholarly paper focusing on the influence of steel scrap price on equity market. Our study aims to close this gap and adds a new dimension to equity market related studies.

There are a number of other locally traded commodities such as cement, papers and glass whose supply/demand environment can be also affected by internal factors of a country. However, given many reasons, they are believed not to be suitable proxies for the contemporary macroeconomic condition of the country. For instance, the production of flat glass, an important material directly used in industries such as the construction industry, cannot be easily altered as the furnace used in the production process cannot be stopped on a regular basis (Caner Taşkın and Tamer Ünal, 2009). By contrast, this is not the case for the steel scrap market.

In this paper, we focus on Japan to test the presence of the relationship between steel scrap price[1] and equity market returns. This is because (1) the country is believed to have a sufficient amount of steel scrap reserves in the economy, (2) there is a well-established off-exchange steel scrap market in the country, and (3) the impact of external factors such as an influence of supply/demand in other regions or countries is considered to be small. As steel stock accumulates in the economy (stored as durable final products like buildings) over the years of industrial activities, it requires some time before steel scraps are recycled. An empirical study that examines the notion elaborated above has to be done in the case of a well industrialised country such as Japan. For instance, the life cycle of automotive is usually more than 10 years; e.g., the average age of cars in the U.S. is over 11 years (IHS, 2014). The life cycle of steel products used in buildings can be even longer.

It is estimated that there is over 1.3 billion metric tons (MT) of steel accumulated in Japan, equivalent to more than 10 years of domestic steel production (World Steel Association, 2014a; HANWA, 2015). Supported by this plentifully recyclable metal in the economy, there is a well-developed supply chain of steel scrap and there are over 30 companies identified in the country which produce steel using an EAF, a steel making process which mainly consumes steel scrap as a raw material. In comparison, there are only 19 member companies in the American Iron and Steel Institute (2015) in the U.S. and this includes basic oxygen steelmaking (BOS) companies which use blast furnaces and mainly consume iron ore as a raw material. In addition, the market of steel scrap in Japan is expected to be driven mostly by the domestic supply/demand condition. This is evident from the fact that as much as over 80 per cent of the steel scrap collected is consumed domestically and, at the same time, the country imports only a fraction (<1 per cent) of the overall consumption (Ministry of Economy Trade and Industry, 2013; World Steel Association, 2014a).

In addition, by focusing on Japan in this study, we examine whether the price of an important resource for a mineral-poor nation appropriately reflects the economic condition of that country (assuming, as indicated in past studies including Kaneko and Lee (1995) and Jones and Kaul (1996), that the equity market reflects the condition of macro economy). Prices of major natural resources such as crude oil, coal and metallic minerals are determined by various factors including the financial market conditions, the global economic activities, monetary/fiscal policy decisions of major developed nations and political decisions of major mineral exporters. For this reason, mineral poor nations in most cases are price takers of internationally traded commodities and their economies are, therefore, expected to be vulnerable to those external forces. For instance, a rapid drop in the crude oil price in 2015 was assumed to have a 7 trillion yen (approximately 60 billion USD as of April 2015) positive impact on the Japanese economy (The Mainichi Newspapers, 2015).

Our study examines the lead–lag relationship between the prices of steel scrap and the equity market in Japan for the period from January 2003 to March 2015. We conduct bi- and multivariate VAR and associated Granger-causality tests to study this relationship. In the multivariate settings, we consider various control variables. Our work contributes to the literature in the following ways. First, the secondary metals (recycled metals) including steel scrap are important resources for industrialised yet mineral poor nations and our study helps understand whether the prices of those crucial natural resources appropriately reflect the economic activities in those countries. Second, it introduces a new country-specific indicator for the equity market. Unlike other macroeconomic variables such as unemployment rate, industrial production and GDP, there is no considerable announcement time lag for steel scrap prices. This is a strong advantage of such a variable being used as an indicator for the stock market behaviour. Third, our work adds further evidence to existing inconclusive discussions of which internal and external factors contribute to the understanding of the dynamic nature of the Japanese stock market. In summary, our results generally support our hypothesis. In particular, we find that the monthly change in the steel scrap price in Japan contains valuable information in explaining the variation of the future stock market returns.

The remainder of the paper is structured as follows. Section 2 provides a review of related past studies and the motivation of our study. Section 3 introduces our hypotheses in the study. Section 4 presents the methodology and the data. Section 5 reports our results, while Section 6 concludes.

2. Background

2.1. Steel scrap as an indicator

In the past, Dr Greenspan made various comments and statements about the steel scrap market:

> *"The aggregate scrappage rate has a pronounced cyclical pattern, falling sharply during recessions and rebounding during recoveries" (McKee and Cohn, 1996).*
>
> *"Scrappage [of motor vehicles] varies with the business cycle" (Greenspan and Cohen, 1999).*
>
> *"It is shown that scrappage [of motor vehicles] varies in a procyclical manner" (Greenspan and Cohen, 1999).*
>
> *"Every day, I still look for the price of No.1 heavy melt steel scrap [one of the most major categories of steel scrap]" (Boselovic, 1997).*
>
> *"[Scrap price is] a not insignificant indicator [of the economy]" (Boselovic, 1997).*

As steel is an affordable crucial material for various industries such as construction, automotive and electronics industries, its demand is assumed to be closely related to the overall state of the macro economy. For this reason and as this is one of the important raw materials for steel making, steel scrap is directly fed into consumer and capital spending (Lahart, 2003). Therefore, the industrial activities are presumably driving the consumption of steel scrap. To help understand the markets of essential raw materials for iron and steel making, namely, iron ore and steel scrap, we next elaborate how the two materials are consumed and how the supply/demand of steel scrap is determined.

Steel is 100 per cent amenable to recycling by means of a remelting process (World Coal Association, 2014), and recycled steel

[1] We do not incorporate steel scrap trading volumes as such data are not available.

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