

# ***ENERGY PRICE VOLATILITY: THE LINK BETWEEN FOSSIL ENERGY AND WOODY BIOENERGY***

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## **Overview**

One of the arguments for promoting woody bioenergy is that they are expected to lower energy price volatilities, which promotes stable economic conditions in the energy system. However, woody bioenergy prices have turned out to be volatile as well and not fully independent from the fossil fuel prices. Significant price fluctuations can be observed in several regions and countries. In general, the lower cost share relevant fuel have of the total generation cost in an energy system, the less sensitive it is to fuel price volatilities.

There are two main links between the prices of fossil fuels and woody bioenergy. Firstly, fossil fuel prices affect input prices in the forestry sector. An increasing price on fossil fuels would thus result in a decline in the production level of woody bioenergy. Secondly, fossil fuel prices also affect the output prices in the forestry sector. For instance, if the price of fossil fuels is higher than the energy equivalent of woody bioenergy, the demand and thus price for woody bioenergy would increase. An analysis of woody bioenergy price volatility is thus important for various decision-makers since high price volatility can increase the production costs and create uncertainty detaining investments and sectorial development.

The aim of this study is to estimate and analyze price volatility for woody bioenergy. In particular, the price volatilities of wood fuels, which are of growing interest for energy utilities and private households, are in the focus of this study and are compared to the price volatility of fossil fuels. Specifically, the following questions will be addressed: Does woody bioenergy price constitute a stabilizing factor for the energy system? What are directions and magnitudes of the linkage between the fossil and woody bioenergy prices?

## **Methods**

Price levels and price volatility and their changes are the result of a complex set of factors. In general, the interaction of inelastic demand and supply elasticities and changes of supply and demand quantities determine the extent of price fluctuations. Changes of supply and demand quantities are driven by factors such as yields and stock levels.

Some level of price volatility can typically be observed on woody bioenergy markets. The general factors affecting the price volatility of woody bioenergy and its linkage to fossil fuel prices studied include market fundamentals, policy response and linkage between energy and commodity markets. The market fundamentals can in turn be subdivided into three effects. First, forestry output varies from period to period because of natural shocks such as weather events. Second, many woody bioenergy products are by-products making them inelastic to own-price changes. Third, the rotation period for forest stands are long suggesting that supply might not be able to respond to price changes, especially if harvesting levels are close to the maximum sustainable yield. In addition, policy responses also contributed to the price volatility, and could continue to do so unless the policies are designed to avoid such actions. Finally, the increasing linkages between energy markets and those of woody bioenergy commodities have also contributed to increased price volatility.

The term volatility is not consistently defined in the literature and different methodologies with respect to concepts, data and estimation procedures can be applied. The approaches include autoregressive moving average (ARMA) and autoregressive conditional heteroskedasticity (ARCH) models. GARCH models respectively the moving average of the standard deviation of the monthly log price differences is used to compute price volatility. Furthermore, we focused on testing and quantifying the price volatility of several woody bioenergy commodities rather than to identify statistically significant impact factors.

## **Results and conclusions**

In all analyzed time series, structural breaks could be detected which indicates that volatility has changed over time. The length of the time periods between structural changes varies between the commodities, suggesting that different factors influence the price volatility of the different commodities. The price volatility of sawmills' by-

products and wood-pellets is statistically significantly higher than that of roundwood, although they are still less volatile than the price of fossil fuel. The higher volatility is caused partly by supply shortage.

The price volatility of woody bioenergy products varies significantly depending on the product. It can be observed that the more standardized a product is, the higher its energy density and the more (international) trade of this product exists, the higher is the price volatility. In general, the products with higher price volatility are also those for which an integrated market exists.