A summary of literatures on the role of macroeconomic factors in energy-food price transmission

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Introduction

Over the past decades, the nexus of food and energy systems has received periodic though persistent attention as unanticipated events have resulted in short-lived jumps or persistent shifts in levels, trends, or volatility. In examining the effect of oil prices on food prices, the role of macro-economic factors cannot be ignored (Harri et al. 2009, Nazilouglu 2011).

Methods

Many of past empirical studies on energy-food price and volatility transmission did not consider the effect of macro-economic indicators on their models. However, as Serra and Zilberman (2013) pointed out, macroeconomic conditions are very important because of their impact on agricultural price levels and volatility. Thus it is very necessary to integrate macroeconomic indicators into model when analyzing such price and volatility transmission problem. Such necessity has also been noted by Harri et al. (2009), Cooke (2009), Balcombe (2011), Nazilouglu (2011) and Wright (2011). It has also been shown that multiple macroeconomic indicators have effects on energy-food price modelling, such as real and nominal exchange rates (Chen and Chen, 2007; Baek and Koo, 2009; Harri et al. 2009; Hamilton, 2009; Beckman and Czudaj, 2012), real income (Gohin and Chantret, 2009; Hamilton, 2009) and GDP (Hamilton, 2009). This means we need to consider multiple macroeconomic indicators when investigating the energy-food price levels and volatility transmission. Motivated by such needs of integrating multiple macroeconomic indicators, a multivariate approach should be appropriate in empirical modelling. In our case, we should most appropriately use a multivariate (instead of bivariate) VAR model and/or VECM.

Given the results from Phillips curve studies (see Hamilton (2010) for a summary), it is not surprising that functional form might constitute an important specification for study of energy price transmission to other prices. Our past research also shows that functional form is a critical specification that conditions inference. Using weekly agriculture commodity prices and weekly UK Brent Blend spot price from January 2000 through December 2010, we found very different causality inferences using linear and nonlinear causality tests. Thus in considering the macroeconomic conditions in the nexus of food and energy prices, one has to investigate the problem of nonlinearity (this is also noted by Beckman and Czujaj (2012)). In our case, this includes testing structural breaks using a series of nonparametric tests (CUSUM, MOSUM, sup-F, and exp-F) as well as testing nonlinear causilty using TY test (Toda and Yamaoto, 1995) and DP test (Diks and Panchenko, 2006).

Most past studies in this area use low frequency data (daily, weekly, monthly). This is mainly because of the relative stability of macroeconomic conditions in short run as well as the availability of data. However, during the past decade, high frequency data for many financial instruments such as agricultural commodity and crude oil futures has become more available. This leaves us an opportunity for us to investigate the nexus of food and energy prices using high frequency data modelling.

Exchange Rate

Many studies have investigated the dynamics of oil prices and exchange rates. Chen and Chen (2007) investigate the long-run relationship between real oil prices and real exchange rates using panel data. They test the cointegration of real exchange rates and oil prices using monthly data on the G7 countries from 1972:1 to 2005:10. They show that the real oil prices may have been the dominant source of real exchange rate movements. They also conclude real oil prices have significant forecasting power for exchange rates. In contrast, Ferro et al. (2012) investigate whether oil prices have a reliable and stable out-of-sample relationship with the Canadian/U.S dollar nominal exchange

rate. They find little systematic relation between oil prices and the exchange rate at the monthly and quarterly frequencies. However, they find the existence of such relationship at daily frequency. Beckman and Czudaj(2012) employ a multivariate Markov-Switching vector error correction model (MS-VECM) and test on bidirectional causality between oil prices and exchanges rates. They contribute to literature in two aspects. First, they investigate the relation between oil prices and nominal exchange rates. Secondly, they are able to discriminate between long-run and short run dynamics by using MS-VECM. They conclude different and also time-varying causalities results across different countries. In general, their results support the relation between oil price and exchange rates.

On the other hand, not many literatures have investigated the role of exchange rates in the energy-food price transmission. Baek and Koo (2009) investigated the short- and long-run effects of market factors (prices of energy, agricultural commodities and exchange rate) on U.S. food prices using a cointegration analysis. They conclude that agricultural commodity prices play a key role in affecting the short- and long-run behavior of U.S. food prices. They also conclude that energy prices and exchange rate have been significant factor influencing U.S. food prices in recent years in both the short- and long-run. Harri et al. (2009) investigate the relationship between oil price, exchange rates and commodity prices. Using time series VECM model, they conclude that oil price, corn price and exchange rates are interrelated. They also identified long-run relationships (cointegrations) between oil prices and all agricultural prices except wheat. Nazlioglu and Soytas (2011) use panel cointegration method to model exchange rate, energy and commodity prices. They conclude that considering the exchange rate there is strong evidence of transmission from world oil prices to several agricultural commodity prices. They also conclude that the exchange rate has an impact on agricultural prices.

Real Income

Gohin and Chantret (2009) employ a world Computable General Equilibrium (CGE) model to investigate macro-economic linkages in the long-run impact of energy prices on world agricultural markets. They find that the introduction of the real income may indeed imply a negative relationship between world food and energy prices. They also conclude that both supply and demand factors are important in the long-run evolution of energy prices.

GDP

Hamilton (2009) summarized previous studies and concludes that income and price elasticity of the demand of petroleum are both below unity. Price inelasticity implies that if the price of oil goes up, total expenditure on oil go up; while income inelasticity means that as GDP goes up, the share of oil expenditures should fall. He mentions that U.S. data show that as GDP per person goes up, the income elasticity declines. This further implies the share of oil expenditure declines. Hamilton also concludes in this article that a large range of macro-economic factors (commodity price speculation, strong world demand, time delays or geological limitation on increasing production, OPEC monopoly pricing and scarcity rent) would affect crude oil price, though he concludes the three most important factors to explain the high price of oil in 2008 are low price elasticity of demand, the strong growth of demand from newly industrialized economies and yet the failure of global production of increase.

Risk Premia

As Hamilton (2009) mentioned in his paper, the unobservable risk premia is an important reason why the crude oil price is mostly unpredictable. Hamilton and Wu (2013) also investigate risk premia in crude oil futures prices. They studied the interaction between hedging demands and risk aversion

on the part of the arbitrageurs. They show that this interaction can produce an "affine factor structure" to commodity futures prices. In this paper they also develop new algorithms for estimating such models.

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