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The effects of purchasing and price subsidy policies for agricultural products under target zones

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ABSTRACT

A good harvest usually leads to a collapse of agricultural prices since the price elasticity of agricultural products is relatively low. To stabilize the market and protect farmers, many countries have introduced a target zone policy, together with product purchasing or price subsidy strategies. This article analyzes the effect of a target zone with different strategies operating in a coordinated manner. The results show that a target zone policy with agricultural product purchases does not necessarily stabilize agricultural product wholesale prices, but is able to stabilize manufacturing product prices, if the price effect is smaller than the sum of the wealth and asset effects for agricultural products and the price effect is larger than the interest rate effect for manufacturing products. On the contrary, a target zone policy with an agricultural product price subsidy will generate the "honeymoon effect" for agricultural product wholesale prices, but will result in unstableperformance of manufacturing product prices.

1. Introduction

The biological characteristics of agricultural products, together with their lower supply and demand elasticity and climate sensitivity, give rise to a relatively high degree of variation in agricultural prices, which will hurt farmers' income and damage the economy. Even though there is evidence suggested limited success of price band provisions and stockholding obligations in reducing the volatility of the commodity prices (e.g. Gilbert, 2011), most governments, including those of developed and developing countries, adjust their agricultural prices using stabilization policies and support policies (Helmberger and Chavas, 1996). For example, Loening et al. (2009)suggest the authorities to make policies taking into account the cereal sector so as to reduce the impact of agricultural supply shocks on domestic inflation; Chen et al. (2013)argue that the target zone policy can stabilize the agricultural product wholesale price and the farmer's nominal income; Bellemare et al. (2014)conclude that price stabilization yields net welfare gains in rural Ethiopia. How to keep a stable price has been one of the central issues in the field of agricultural economics. Quiggin and Anderson (1981) suggest the authority to stabilize the agricultural price by using buffer stock scheme or buffer fund scheme.

A buffer stock scheme raises the price by decreasing the market supply through purchasing and storing an excess of agricultural products. When there are economic shortages and consequently a higher agricultural price in the economy, these stores are sold. Instead of the commodity purchasing mechanism in a buffer stock scheme, a buffer fund scheme uses the price subsidy mechanism. When the market supply is low and the agricultural price is high, the government imposes the part above the upper bound price and invests in the buffer fund. For example, suppose the upper and lower bounds for banana price are 99 and 33 cents per pound, respectively. There are 6 cents per pound imposed to the buffer fund when the market price rises to 105 cents per pound. Similarly, there are 6 cents per pound subsidized from the buffer fund when the market price declines to 27 cents per pound due to the good harvest. In other words, both schemes set up reasonable upper and lower bounds for prices and intervene in the market with reserve stocks or funds when the prices depart from the interval.[1]

However, it is uncertain if the agricultural price target zone will stabilize the agricultural product wholesale price when it is implemented with a purchasing policy, i.e., buffer stock scheme, as it is with a subsidy policy, i.e., buffer fund scheme. Gouel (2013) proposes a framework for government in a self-sufficient developing country to design the policy

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[1] Some countries have adopted these schemes to stabilize the agricultural price. For example, Australian Wool Commission and Canadian Wheat Board use both schemes to stabilize the prices of wool and wheat, respectively. China provides another example. The money easing policy in the past decade in China incurred a significant impact on food prices (Yu, 2014). To protect farmers from welfare loss, China implements buffer fund scheme on wheat and rice.

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stabilizing food prices by carrying public stock and by applying a state-contingent subsidy/tax to production under the concern of maximizing intertemporal welfare. Different from the single-country competitive storage model adopted in Gouel (2013), this paper will analyze the effect of agricultural price target by using the diagrammatic analysis, which is widely applied in the field of macroeconomics containing agricultural and manufacturing products (e.g. Frankel, 1986; Lai et al., 1996, 2005).

The target zone has been applied in international finance theoretically. Krugman (1991) uses stochastic differential equations to explain that setting an exchange rate target zone will stabilize the volatility, and refers to this impact as the "honeymoon effect". Following his study, many papers, such as Klein (1990), Bertola and Caballero (1992), Beetsma and Van der Ploeg (1998), Kempa and Nelles (1999), Belessakos and Giannikos (2002), and Lai et al. (2008), test the target zone to see if it can stabilize the exchange rate volatility. Lai and Chang (2001), on the other hand, discuss whether there is a honeymoon effect with a price target zone using an aggregate demand and supply diagram, which provides a simple method that is used to analyze the target zone policy.

The target zone has also been introduced in other fields. For example, the inflation target zone has emerged as a powerful and effective monetary policy regime since the early 1990s, both in industrial countries and emerging market economies. Empirically, a large number of researches investigate the inflation target zone effects on inflation dynamics, although the results are not conclusive (e.g. Broto, 2011; Ftiti and Hichri, 2014; Gonçalves and Salle, 2008; Kontonikas, 2004; Mishra and Mishra, 2012; Pierdzioch and Rülke, 2013; Vega and Winkelried, 2005).

Most of the discussions about the exchange rate target zone and price level target zone are based on a one-sector model. Nevertheless, the characteristics of agricultural and non-agricultural products are very different in that a two-sector model may describe the market in a better manner when we discuss the effect of an agricultural price target zone. Frankel (1986) is a pioneer in terms of building a two-sector model, including agricultural and non-agricultural products, in a closed economy. Such an approach provides a dynamic analysis of the influence of an unexpected change in monetary policy on agricultural and non-agricultural product prices. Lai et al. (1996) extend Frankel's model and analyze the impact of a monetary policy declaration on agricultural and non-agricultural product prices. Saghaian et al. (2002) further discuss the impact of an unexpected variation in money supply on the foreign exchange rate and product price in an open economy model, under the assumptions of a floating exchange rate system and perfect capital mobility. Lai et al. (2005) investigate the impact of a monetary policy declaration on agricultural and non-agricultural product prices in both an open and closed model. Nevertheless, all of the agricultural literatures mentioned above assume no difference existing between the agricultural product wholesale price and consumer's demand price, which is not true in reality, especially when the governments implement buffer fund scheme. Besides, target zone policies have not been discussed in these articles. Therefore, this study will analyze the effect of setting target zone on agricultural product wholesale price associated with a purchasing policy as it is with a subsidy policy by extending the model in Frankel (1986), Lai et al. (1996), and Lai et al. (2005).

Furthermore, Krugman (1991) obtains a continuous and smooth pasting S-shaped curve that depends on the assumption that the government intervenes in the market continuously and infinitesimally between the upper and lower bounds of the target zone. However, this article applies the diagram analysis method proposed by Lai and Chang (2001), and assumes discrete finite interventions. As Flood and Garber (1991) state: "finite interventions may well be an important part of the story of real-world target zones," which also implies the holding of the smooth pasting condition as the amount of discrete intervention approaches zero. Since the Lai et al. (2008) study, which discusses the influence of the exchange rate target zone on the stabilization of the exchange rate, output and interest rate, results in the same conclusion using diagrammatic analysis as would have been drawn using an S-shaped curve model, we adopt the diagram analysis method and assume discrete finite interventions as well to investigate the influence of the agricultural price target zone. Accordingly, we will discuss policy implications at a normative manner, such as whether the agricultural price target zone should be implemented to attain the social optimum, and under which conditions should the target zone policy be introduced.

The remainder of the paper is organized as follows. Section 2 constructs the theoretical model. Section 3 examines whether there is a honeymoon effect as the government adopts the agricultural product wholesale price target zone when agricultural products are purchased. Section 4 analyzes whether the agricultural product wholesale price will be stabilized when the government introduces the agricultural product wholesale price target zone together with an agricultural price subsidy. Section 5 discusses the policy implication behind the model. Section 6 concludes.

2. Model

This article extends the model built by Frankel (1986), Lai et al. (1996), and Lai et al. (2005), which links the agricultural product market, the non-agricultural product market (or, the manufacturing product market), and the money market. We make the following assumptions: 1. People have rational expectations regarding economic factors; 2. People fully believe the target zone of the agricultural product wholesale price declared by the government; and 3. People can hold money, bonds, and agricultural products. Based on these assumptions, the model can be expressed as follows:

$$-\delta(p_s^c - bs - p_d^m) + \beta(m - p_d^m) + \sigma\left(\frac{E(dp_s^c)}{dt} - k - i\right) + g^c = ap_s^c - a(p_d^m - h\tau) + \varepsilon \tag{1}$$

$$\theta(p_s^c - bs - p_d^m) + \omega(m - p_d^m) - \eta\left(i - \frac{E(dp_d^m)}{dt}\right) + g^m = -xp_s^c + x(p_d^m - h\tau) \tag{2}$$

$$m - p = -\lambda i + \phi y \tag{3}$$

$$p = \alpha(p_s^c - bs) + (1-\alpha)p_d^m. \tag{4}$$

With the exception of the storage cost (k), nominal interest rate (i), and time (t), all other variables are expressed in logarithms. The notations are defined as follows: p_s^c = the wholesale price (or, supply price) of agricultural products; p_d^m = the demand price of manufacturing products; s = the governmental price subsidy for agricultural products; τ = the excise tax on manufacturing products; m = the money supply; g^c = the governmental demand for agricultural products; g^m = the governmental demand for manufacturing products; p = the general price level; y = the aggregate output; $E(dp_s^c)/dt$ = the expected change in the agricultural product wholesale price; $E(dp_d^m)/dt$ = the expected change in the manufacturing product demand price; and ε = the disturbance in the agricultural market.

Eq. (1) represents the equilibrium condition for the agricultural product market, which denotes the equality of the supply and demand for agricultural products.[2] The demand for agricultural products, which is on the left-hand side of the equation, contains the consumption

[2] See Appendix 1.