Welfare effects of monetary policy in an economy with vertical production and trade: An analysis based on the perspective of local currency pricing ☆

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A B S T R A C T

By incorporating the factor of firms' asymmetric price setting behavior into the two-country model with vertical production and trade, we analyze how one country's monetary policy affects the welfare of both countries. We show that an expansionary monetary policy has (i) a beggar-thyself effect if the ratio of the non-expanding country's intermediate goods firms that set their export prices in the local currency is significantly low and (ii) a prosper-thy-neighbor effect in our model regardless of the ratio of either country's intermediate goods firms that set their export prices in the local currency.

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1. Introduction

Few studies analyze the effect of monetary policy on welfare by incorporating trade in intermediate goods into the new open economy macroeconomics (hereinafter referred to as "NOEM") model. The purpose of this paper is to examine the effects of monetary policy on welfare in a world where both final goods and intermediate goods are traded using the two-country model proposed by Corsetti and Pesenti (2001) — a paper representative of NOEM. In particular, a novel feature of the model is that it takes into account the asymmetric price setting behavior of intermediate goods firms in the home and foreign countries. In this model, the price setting behavior of intermediate goods firms determines the effects of monetary policy on consumption and employment, which are the real parts of the representative household's utility. We show that an expansionary monetary policy has (i) a beggar-thyself effect if the ratio of the non-expanding country's intermediate goods firms that set their export prices in the local currency is significantly low and (ii) a prosper-thy-neighbor effect in our model regardless of the ratio of either country's intermediate goods firms that set their export prices in the local currency.

One of the questions raised in this paper is how the expansionary monetary policy of a country affects the welfare of both countries under an economy with vertical production and trade, taking into account firms' price setting behavior. However, the volume of literature on NOEM analyzing the welfare effects of expansionary monetary policy under such an economy is relatively small. Berger (2006) examines the effects of home monetary expansion on the welfare of both countries using the two-country model with a vertical chain of production and trade. However, his model does not deal with final goods trade or firms' price setting behavior. So far, there has been considerable research on firms' price setting behavior. Knetter (1993), which is a representative research paper in this field, finds that approximately half of all Japanese firms set their export prices in the local currency, while almost all U.S. firms set their export prices in their own currency.[1] It is, therefore, appropriate that a two-country model taking into account firms' price setting behavior should be adopted to examine the effects of expansionary monetary policy.

On the other hand, by incorporating firms' behavior of setting their export prices in local currency into the two-country model without a vertical trading chain, Betts and Devereux (2000) examine the effects of a country's monetary expansion on the welfare of both countries.

[1] The other literatures besides Knetter (1993) also find that many firms in major developed countries other than the U.S. set their export prices in the local currency; for example, Marston (1990), Parsley (1993), Athukorala and Menon (1994), ECU institute (1995) and Gagnon and Knetter (1995).

However, because they assume that the fraction of exporters who set prices in local currency of sale is symmetric across countries, like Berger (2006), they cannot consider how the difference in home and foreign firms' price setting behavior affects the effects of expansionary monetary policy on the welfare of both countries. In addition, by incorporating firms' asymmetric price setting behavior into the model of Corsetti and Pesenti (2001), Michaelis (2006) examines the effects of home monetary expansion on the welfare of both countries. However, because he also adopts the model without the vertical trading chain, like Betts and Devereux (2000), he cannot consider how the price setting behavior of intermediate goods firms affects the effects of home monetary expansion on the welfare of both countries.[2] Recently, the scale of vertical trade has increased rapidly in both emerging and developed economies. Using data from 10 OECD and four emerging economies, Hummels et al. (2001) calculate that vertical trade within total exports accounts for 21% of these countries' exports and grew 28% between 1970 and 1990. In addition, they find that growth in vertical trade accounts for 30% of the growth in these countries' exports.[3] Therefore, we believe that it is not appropriate to analyze the welfare effects of expansionary monetary policy using the model without vertical trade.[4]

Further, Huang and Liu (2006) examine the effects of home monetary expansion on the welfare of both countries using the two-country model with multistage production process, taking into account firms' pricing setting behavior. However, they assume that all home and foreign firms set their export prices in either their own currency or the local currency. Based on this extreme assumption, they find that an increase in the stage of production and trade tends to make the home monetary expansion beneficial for the home and foreign countries regardless of pricing behavior. Therefore, they do not analyze the welfare effects of expansionary monetary policy by focusing on the difference in asymmetric price setting behavior of home and foreign firms.

Our contribution to the literature is to present a simple formal analysis incorporating vertical trading and asymmetric price setting behavior among home and foreign firms engaged in intermediate goods trade, and to show how it can be used to shed light on issues such as the above, which cannot be handled by models that are more conventional. These include the relationship between the difference in home and foreign intermediate goods firms' price setting behavior and the welfare effects of expansionary monetary policy, and the role of the expansionary monetary policy, which has various effects on the real parts of the representative household's utility.

In this paper, we show that a home monetary expansion produces a combination of two noteworthy results on the welfare of both countries: first, a beggar-thyself and prosper-thy-neighbor effect; and second, a prosper-thyself and prosper-thy-neighbor effect. With regard to these results, we find that the factor affecting the welfare of the home country is the ratio of the foreign intermediate goods firms that set their export prices in the local currency. Consequently, we obtain the following relationships with regard to home welfare: if the ratio of the foreign intermediate goods firms that set their export prices in the local currency is significantly low, a home monetary expansion causes the negative effect on welfare from employment to dominate the positive effect on welfare from the consumption of final goods. Thus, home monetary expansion has a beggar-thyself effect in the sense that it

lowers the welfare of the home country. On the other hand, if the above ratio is significantly high, home monetary expansion causes the positive effect on welfare from the consumption of final goods to dominate the negative effect on welfare from employment. Thus, this shows that home monetary expansion has a prosper-thyself effect. With regard to foreign welfare, home monetary expansion always has a prosper-thy-neighbor effect, since it causes the positive effect on welfare from the consumption of final goods to dominate the negative effect on welfare from employment regardless of the ratio of either country's intermediate goods firms that set their export prices in the local currency.

The remainder of this paper is structured as follows. Section 2 presents the model. Section 3 presents the solution of the model and a discussion of the transmission mechanism of expansionary monetary policy on macroeconomic variables of both countries. Section 4 discusses the effects of home monetary expansion on the welfare of both countries. Section 5 summarizes the paper's findings and presents its conclusions.

2. The model

2.1. Various price indexes

The world consists of two countries of the same size, one denoted as the home country and the other as the foreign country. We denote the foreign variables with an asterisk. We assume that each country has two types of firms: final goods firms and intermediate goods firms, and both kinds of goods are tradable. Firms of the first type produce final goods using a composite of domestically produced intermediate inputs and a composite of imported intermediate inputs, while those of the second type produce differentiated products using labor. Final goods firms are competitive producers, and intermediate goods firms are monopolistically competitive producers. We assume that the home final goods firms continuously exist in the interval [0,1] and the foreign final goods firms continuously exist in the interval [1,2], i.e., the numbers of final goods firms of both countries are normalized to unity. On the other hand, although we also assume that the numbers of intermediate goods firms of both countries are normalized to unity, we assume that a fraction s of intermediate goods firms located in the home country and a fraction s^* of intermediate goods firms located in the foreign country set their export prices in the local currency, i.e., they employ local-currency-pricing (hereinafter referred to as "LCP"). The remaining intermediate goods firms located in both countries set their export prices in their own currency, i.e., they employ producer–currency–pricing (hereinafter referred to as "PCP"). This paper adopts a consumption index of the Cobb–Douglas type as the aggregate consumption index,[5] in which case the consumption-based price indexes (CPIs) are defined as follows:

$$P_t = P_t^{H\alpha} P_t^{F 1-\alpha}, \tag{1}$$

$$P_t^* = P_t^{H*\alpha} P_t^{F*1-\alpha}, \tag{2}$$

where $P_t(P_t^*)$ is the CPI of the home (foreign) country, $P_t^H(P_t^F)$ is the home-currency price of the home (foreign) final good, and $P_t^{H*}(P_t^{F*})$ is the foreign-currency price of the home (foreign) final good. This paper assumes that the law of one price holds for final goods in all the periods.

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[2] By incorporating firms' asymmetric price setting behavior into the three-country model proposed by Corsetti et al. (2000), Dohwa (2008) also examines the effect of Japanese monetary policy on the welfare of Asian NIEs. However, he also examines the effect of such a policy using the model without vertical trading chain.

[3] Feenstra (1998) and Yi (2003) also argue that the vertical structure of production and trade is an important feature of today's global production and trade.

[4] The international relocation of firms also has long been considered one of the forms of firms' globalization besides vertical trade. Johdo and Hashimoto (2005, 2009) and Dohwa (2012) examine the effects of a rise in the corporation tax rate of the home country and an increase in the productivity of the foreign non-tradable goods sector, respectively, using the two-country model with such a factor.

[5] According to a formulation very similar to that of Corsetti and Pesenti (2001, 2005) and Michaelis (2006), we use a consumption index of the Cobb–Douglas type as the aggregate consumption index, as shown in Eq. (15). By using a consumption index of the Cobb–Douglas type as the aggregate consumption index, we are able to derive a closed form solution and to analyze the effects of unanticipated monetary policy shocks of large size on macroeconomic variables of both countries.