Welfare Evaluation of VERs with Fiscal Policy

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Obstfeld and Rogoff (1995) endeavor to investigate the international welfare spillovers with monopolistic competition and sticky output prices in a flexible exchange rate system. This paper applies their framework to analyze the macroeconomic effects of voluntary export restraints (VERs) with fiscal policies, generating plenty of results. The particular contribution of this paper to the welfare effects of country sizes on policy lies in the cases of numerical simulations. The discussions of spillover effects, numerical simulations, and imperfect competition to export quotas as well as fiscal policies abroad fill in the gaps on the literature. Then it takes a further step on international macroeconomics.

Key words: Imperfect competition, voluntary export restraints, welfare effects, population weights.

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1. Introduction

A VER (voluntary export restraint) is a quota on trade imposed from the exporting country’s side instead of the importer’s. The most famous example is the limitation, enforced by Japan, on auto exports to the United States after 1981. Some voluntary export agreements cover more than one country. Such multilateral agreement is the Multi-Fiber Arrangement, an agreement that limits textile exports from 22 countries. For certain political and legal advantages, VERs become preferred instruments of trade policy in recent years.

The empirical literature has increasingly emphasized the importance of quantitative restrictions and imperfect competition in the market for traded goods. Knetter (1989) tested for the degree of pass-through of exchange rate fluctuations in the pricing of these exports based on price discrimination by U.S. and German exporters across different foreign markets. Adams et al. (1994), Anderson (1985), Aw (1992), Berry et al. (1999), El-Agraa (1995), and Flam (1994) developed an empirical model to test for price discrimination in a country export market.

Little, yet has been done to analytically investigate the effects of VERs for the existence of imperfect competition. Exceptions are recent papers by Bouët (2001), Moore and Suranovic (1993), and Chao and Yu (1996), indicating that the degree of product differentiation and the nature of competition should change the profits of the foreign firm. These papers nevertheless are deficient in examinations of goods varieties being subject to VERs as well as the role of country sizes.

Obstfeld and Rogoff (1995) have developed an important perspective on the international welfare spillovers through a global macroeconomic framework based on monopolistic competition and sticky nominal output prices. It is commonly recognized as the contribution that launched this new wave of research. In essence it offers a theory to explain both
exchange rate dynamics and the intertemporal approach of the current account. The exchange rate adjustment process, as well as the need for and effects of macroeconomic policy. In the last five years a substantial literature has developed extending the Obstfeld and Rogoff model in a number of directions, surveyed by Lane (2001). The literature yet paid attentions on the investigation of exchange rate behavior.

Then, the discussions of spillover effect, numerical simulations, and imperfect competition to such quantitative restrictions will fill in the gaps on the research. The present context addresses the following issues: first, in the presence of monopoly power, the responses to an export duty, a VER, and second the nature of the sticky-price fiscal multiplier compared to the corresponding long-run multiplier. This paper is organized as follows. Section 2 provides the explanations for a two-country model of VERs. Section 3 examines, taken together or separately, the effects of voluntary export restraints and fiscal policy. Section 4 evaluates the international welfare transmission through numerical simulation. Section 5 concludes.

2. The model

This section lays out the microeconomic underpinnings of the model. The problems of the agents are solved. Consider a two-country, one differentiated (non-storable) good, and monopolistic competition world. Voluntary export restraints are modeled by assuming that prices of restrained goods rise. VERs are generally negotiated with, and imposed by exporting countries. A VER will be equivalent to the tariff or import quota resulting in the same import level except that it artificially restricts supply. Importers (home countries) and exporters (foreign countries) will bid up or negotiated the price of the restricted goods until the
premium on scarce imports is fully imputed to the exporters. The importing country will thus have to pay a higher price for the imported good under a VER than under an import quota or tariff.

Briefly, there are two sets of agents in the world: households and the government. Two assets exist: domestic and foreign currencies, $M$ and $M^*$. We now illustrate and solve the problems faced by each household and the government.

- **The household**

Households are indexed by $j \in [0,1]$, which have uniform distribution over $[0,n]$ and $(n,1]$ for domestic and foreign households respectively. The index presents not only the production share in the world goods market but also the measure of relative size of the home economy. The smaller the $n$, the smaller is the home economy. Household $j$ supplies labor of variety $j$ as well as derives utility from consumption, real money balances, and output whose only input is work effort. The household is infinitely-lived, and then in discrete time the utility function of domestic resident is

$$U_t = \sum_{k=-t}^{\infty} \delta^{k-t} \left[ \alpha \ln C_k + (1 - \alpha) \ln \frac{M_k}{P_k} - \frac{\mu}{2} \sigma \right]$$

Here, $\delta$ measures the rate of time preference or subjective rate of discount, which reflects the rate that future utility is discounted by the individual. The utility function of foreign household is defined analogously variables pertaining to the foreign country will be denoted by an asterisk throughout. The first term in utility is a consumption index $C$, which presents the effect of the consumption of goods on utility. That is

$$C = \left[ \int_0^1 c(j)^\sigma dj \right]^{\frac{1}{\sigma}}$$

$0<\sigma<1$

$c(j)$ denotes the consumption of household $j$, and $C$ is a CES (constant elasticity of substitution) function of $c(j)$. Foreign households have the analogous consumption index. The parameter $\sigma$ is the elasticity of substitution between goods in utility and the restriction,
on the demand elasticity makes it certain that there is one equilibrium. The greater the \( \sigma \), the higher is the degree of substitutability between different variety goods. When \( \sigma \) is equal to one, the goods market becomes perfect competition. However, Obstfeld-Rogoff (op.cit., pp. 627) used \( \theta-1/\theta \), indicating the same meanings in goods market indirectly. When \( \theta \) approaches infinity, the goods market becomes perfectly competitive. We assume that all agents have the same tastes for varieties.

The second term in utility is the effect of real money balance on utility. Nominal money balance, \( M \), is deflated by the nominal price index, \( P \) that is associated with \( C \), consumption index. Home producers indexed by \( j \in [k, n] \) are subject to \( VERs \) at rate \( \gamma \); the remainder, those indexed by \( j \in [0, k) \) without \( VERs \). Being symmetrical among households, the price index of home country is given by

\[
P = \left[ \int_{0}^{1} p(j) \frac{1}{\theta} dj \right]^\theta
\]

\[
= \left( \int_{0}^{k} p(j)^{1/\theta} dj + \int_{k}^{n} [p(j)(1 + \gamma)]^{1/\theta} dj + \int_{n}^{k} [Ep^*(j)df]^{1/\theta} \right)^\theta
\]

(3)

where \( \theta \) is defined as \((\sigma-1)/\sigma\). Then the corresponding price index of foreign country is given by

\[
P^* = \left[ \int_{0}^{1} p^*(j) \frac{1}{\theta} dj \right]^\theta
\]

(4)

where \( p(j) \) denotes the nominal output price of firm \( j \) and \( p^*(j) \) is the foreign nominal output price of the same good. Because \( VERs \) do not change the elasticity of demand faced by producers, free movement of goods implies that the law of one price holds for all producer prices:

\[
p(j) = Ep^*(j)
\]

(5)

However, the law of one price will not hold for consumer prices of \( VER \) set goods. Through solving techniques, for each product \( j \), the demand function is solved as
The demand functions of foreign households are:

\[
c_t^*(j) = C^*[\frac{P_t^*}{p_t^*(j)}]^{\frac{1}{1-\sigma}} \quad \text{for} \quad j \in [0, k) \text{ and } j \in [n, 1)
\]

\[
c_t^*(j) = C^*[\frac{P_t^*}{p_t^*(j)(1+\gamma)/E_t}]^{\frac{1}{1-\sigma}} \quad \text{for} \quad j \in [k, n)
\]

The third term in the utility function gives the disutility from effort used in producing product; \(\mu\) is a productivity parameter. The household maximizes profit under imperfect competition given the production function:

\[
y(j) = f(l) = l^{\frac{1}{\mu}}, \quad 0 < \frac{1}{\mu} < 1
\]

We use a exponent form in that the marginal productivity of labor diminishes. Each household takes the price index as given, inputs labor to produce its own variety of product, and chooses \(p(j)\) to maximize its output revenue. The maximization problems however are subject to budget constraints, in each period, which are given by

\[
M_t = p_t y_t + M_{t-1} - P_tC_t - P_tT_t \quad (8)
\]

and

\[
M_t^* = p_t^* y_t^* + M_{t-1}^* - P_t^*C_t^* - P_t^*T_t^* \quad (9)
\]

where \(T\) in equation (8) is the real tax paid to domestic government. The above expression states that the amount of money the consumer has at the end of period \(t\) equals the amount of money from previous period plus product revenue minus the consumption expenditure and taxation paid to domestic government. The economy contains only one asset-money.
• *The government*

The governments' preferences have been assumed to be identical to those of households, and hence their spending allocation processes are the same as previously mentioned. It is easy to show that domestic government's demand for the product of variety \( j \) is:

\[
G_t(j) = G_t \left[ \frac{P_t(j)}{P_t} \right]^{\frac{1}{\gamma - 1}}
\]

(10)

The foreign government has the same demand function. We assume that the finance of all government expenditure is by means of real taxation from domestic households. Then the budget constraints of governments are (in real terms):

\[
T_t = G_t
\]

(11)

and

\[
T_t^* = G_t^*
\]

(12)

Combining the budget constraints of the governments with those of the households yields per capita savings as

\[
(m_t - m_{t-1}) = \frac{p_t}{p_t^*} y_t(j) - G_t - C_t
\]

(13)

and

\[
(m_t^* - m_{t-1}^*) = \frac{p_t^*}{p_t^*} y_t^*(j) - G_t^* - C_t^*
\]

(14)

Adopting population weights and adding up private as well as government demands, the world demand curve for domestic product \( j \) is:

\[
n c_t(j) + (1 - n)c_t^*(j) + n g_t(j) + (1 - n)g_t^*(j) = y_t(j)
\]

(15)

Using equations (6), (7) and (10), it becomes:

\[
y_t^d(j) = \left( \frac{p_t}{p_t^*} \right)^{\frac{1}{\gamma - 1}} (C_t^w + G_t^w) + (1 - n)(k - n)[(1 + \gamma)^{\frac{1}{\gamma - 1}} - 1] \frac{p_t^*}{p_t^*} C^*
\]

(16)
The world demand curve for foreign goods is

$$y^*_i(t) = \left( \frac{P^*_i}{P_i} \right)^{\frac{1}{\sigma - 1}} \left( C^W_i + G^W_i \right)$$  \hspace{1cm} (17)

Equations (16) and (17) have made use of the definitions of world private and government demand; that is

$$C^W_i = nC_i + (1-n)C^*_i$$  \hspace{1cm} (18)

$$G^W_i = nG_i + (1-n)G^*_i$$  \hspace{1cm} (19)

This completes our explanations of the agents' behavior. After solving relevant optimisation conditions, it implies that the steady state values of per capita consumption are:

$$\overline{C} = \overline{P} \overline{y} - \overline{G}$$  \hspace{1cm} (20)

and

$$\overline{C}^* = \overline{P}^* \overline{y}^* - \overline{G}^*$$  \hspace{1cm} (21)

The time subscripts of steady states have been dropped and overbars stand for the steady state values. Given the assumption that real government expenditure in the initial steady state equals zero, the initial steady state values of domestic as well as of foreign outputs are

$$\overline{y}_0 = \overline{y}_0^* = \left( \frac{\alpha \sigma}{\mu} \right)^{\frac{1}{2}}$$

where the subscript zero means initial steady state. Combining optimisation conditions and setting $r^* = \bar{r}_0 = 1 - \delta / \delta$, we derive the initial steady state values of real money balance as:

$$\overline{m}_0 = \frac{1-\alpha}{\alpha(1-\delta)} \overline{y}_0$$

and

$$\overline{m}_0^* = \frac{1-\alpha}{\alpha(1-\delta)} \overline{y}_0^*$$
2.1. Log-linearized

To investigate the policy effects and welfare evaluations, following Obstfeld and Rogoff (1995), we denote percentage changes from initial steady state for any variable by hats, and then take the relevant log-linearizations as follows. For sticky prices, the general price indexes for two countries are:

\[
P_t = n\hat{p}_t + (1-n)\hat{p}^*_t + (1-n)\hat{E} + (n-k)dr
\]

\[
P_t^* = n\hat{p}_t + (1-n)\hat{p}^*_t - n\hat{E}
\]

Taking into account population weights, the global goods market equilibrium condition will be

\[
\hat{C}_t^w = n(\hat{p}_t + \hat{y}_t - \hat{P}_t) + (1-n)(\hat{p}^*_t + \hat{y}^*_t - \hat{P}^*_t) - dG^w
\]

From the world demand for domestic output, equation (16), we get

\[
\hat{y}_t = \frac{1}{\sigma-1}(\hat{p}_t - \hat{P}_t) + \hat{C}_t^w + dG^w + \frac{(k-n)}{\sigma-1} d\gamma
\]

Similar equation of the demand for foreign output is

\[
\hat{y}_t^* = \frac{1}{\sigma-1}(\hat{p}^*_t - \hat{P}^*_t) + \hat{C}_t^w + dG^w
\]

From equations (25) and (26), we can find that the higher substitution between goods, the more responsiveness of output demand to prices and more competitive of goods market. Next, differentiating relevant first order optimization conditions, the following log-linearized forms are obtained. They describe the relations between real output producing world demand, equations (27) and (28), as well as households’ intertemporal marginal rates of substitution between future and current consumption, equations (29) and (30).

\[
\hat{y}_t = \frac{-\hat{C}_t}{2-\sigma} + \frac{1-\sigma}{2-\sigma}[\hat{C}_t^w + dG^w + (n-k)d\gamma]
\]
\[ \hat{y}_t^* = \frac{-1 - \sigma}{2 - \sigma} \frac{\hat{C}_t^*}{\sigma} + \frac{1 - \sigma}{2 - \sigma} \left( \hat{G}_t^* + \frac{dG_t^*}{C_t^*} \right) \]  

(28)

\[ \hat{C}_{t+1} = \hat{C}_t + (1 - \delta) \hat{r}_t \]  

(29)

\[ \hat{C}_{t+1}^* = \hat{C}_t^* + (1 - \delta) \hat{r}_t^* \]  

(30)

The log-linear forms of money demand equation become

\[ \hat{M}_t - \hat{P}_t = \hat{C}_t \]  

(31)

and

\[ \hat{M}_t^* - \hat{P}_t^* = \hat{C}_t^* \]  

(32)

We have completed a brief explanation of this model. The analyses of VERs, policy effects of an increase in government spendings, simulations and welfare evaluations will be based on this description.

3. Policy effects

In this section we investigate the effects of imposing voluntary export restraints with fiscal policies under the situations of sticky and flexible output prices. Given that the initial steady state value of the government spending is zero, consider the effects of imposing voluntary export restraints with unanticipated and permanent increases in domestic as well as in foreign government spending.
3.1. Impact effects

With sticky output prices and flexible exchange rates, considering changes away from an initial steady-state equilibrium without \( \text{VERs} \), from equations (13) and (14), the approximations of short-run changes of per capita consumption are given by

\[
\hat{C} = (n - 1)\hat{E} + (k - n)d\gamma + \hat{y} - dG
\]

and

\[
\hat{C}^* = n\hat{E} + \hat{y}^* - dG^*
\]

where the time subscripts have been dropped for simplicity. By the assumption that individuals enter at period \( t \) and through direct solving techniques, the changes of relevant variables are:

\[
\hat{y} = (1 - n)(n - k)d\gamma + \frac{(1 + n)}{2}dG + \frac{1 - n}{2}dG^*
\]

\[
\hat{y}^* = -n(n - k)d\gamma + \frac{n}{2}dG + \frac{2 - n}{2}dG^*
\]

\[
\hat{C} = d\mu = \frac{(\sigma^2 - 2\sigma - 1)(1 - n)(n - k)}{\sigma - 1}d\gamma + \frac{(1 - n)(\sigma - 2)(dG - dG^*)}{2}
\]

\[
\hat{C}^* = d\mu^* = -n(\sigma^2 - 2\sigma - 1)(n - k)\sigma - 1d\gamma - n(\sigma - 2)(dG - dG^*)
\]

and

\[
\hat{C}^w = 0
\]

\[
\hat{P} = (2 - n)(1 - \sigma)(n - k) + \frac{(1 - \sigma)(1 - n)}{2}(dG - dG^*)
\]

\[
\hat{P}^* = -n(1 - \sigma)(n - k) - \frac{n(1 - \sigma)}{2}(dG - dG^*)
\]

\[
\hat{E} = (1 - \sigma)(n - k)d\gamma + \frac{(1 - \sigma)}{2}(dG - dG^*)
\]
From equations (35)–(38), we predict that, without government spending, \( dG=dG^*=0 \), voluntary export restraints, an ‘export tax’ imposed by the exporter (home country), raise home consumption, output and asset accumulation in the short run. Especially, home consumption and asset accumulation increase with the degree of substitution between goods, \( \sigma \), and the country size, \( n \). The more competition, the bigger \( \sigma \), the more increases in home consumption and asset accumulation. In other words, the less competition, the less positive effect on macroeconomy for the exporting country imposing VERs. Moreover, the country size \( n \), and goods being subject to VERs, \( k \), do affect such consequences. The bigger the home country (the exporter), \( n \), or the less the goods being subject to VERs, the more positive effects on home output, consumption and asset accumulation. On impact, with VERs, home produces more due to the expectation of the future increase in output price. With more output revenue, home consumption is on the increase. Nevertheless, a VER is detrimental to the foreign country (the importer). On impact, a VER always reduces foreign output and consumption. The less competition in goods market, the smaller \( \sigma \), or the bigger foreign country, the smaller \( n \), the less vulnerable to foreign output, consumption, and asset accumulation. The changes of consumption price indexes only result from the variation of exchange rate. Moreover, the bigger the home country, (the bigger \( n \)), or the less competition in the goods market, (the smaller \( \sigma \)), the more volatility of exchange rate resulting in a higher home consumption price index but a lower such foreign price index.

The following proposition summarizes the impact effects of VERs:

**Proposition 1:** With imperfect competition of goods market and sticky output prices, the voluntary export restraints imposed by the exporting country (home country) raise its own consumption, output and asset accumulation but reduce the values of respective variables of the importing country (foreign country). The
smaller the exporter or the less competition in the goods market, the less vulnerable to the importer's economy.

About the impact effects of fiscal policy, with the assumption of free trade, $dG=0$, there are four cases discussed as follows. First, we assume $dG>0$ and $dG^*<0$. On impact, an increase in domestic government spending causes excess demand for goods in the world. To satisfy such demand, both countries need to produce more and hence products are on the increase. Obviously, the increase in domestic output is less than that in domestic government spending which is composed of the varieties of one single good produced in the world and is financed through taxation from consumers. Home consumption and assets are thus decreasing. The exchange rate adjusts upward. On the other hand, foreign economy runs output stimulation, consumption increases, and asset accumulation. Moreover, with increased government purchases, the domestic consumption price index rises but such index in the foreign economy falls. However, the whole consumption in the world remains unchanged. An increase in domestic government spending, then, only results in the redistribution of world money supply but stimulates the outputs in both countries.

In the second case, $dG=0$ and $dG^*>0$, the impact effects of an increase in foreign government spending include stimulating outputs of both countries, reducing foreign consumption and raising domestic consumption. The exchange rate adjusts downwards. In the third case, $dG=dG^*>0$, the impact effects of the increases in both government spending should depend on the relative size of home country, $n$. The bigger the $n$, the more likely the effect of an increase in domestic government spending overweighs that in foreign government spending. When domestic economy is relatively large, $n > 1/2$, the impact effects are similar to those of case one. When domestic economy is relatively small, $n < 1/2$, the impact effects are similar to those of case two.
In the fourth case, $dG \neq dG^* > 0$, the impact effects of the increases in both government spending depend not only on the relative size of both countries but also on the relative magnitude of spending. If $ndG > (1-n)dG^*$, the adjustment process is the same as that of case one. If $ndG < (1-n)dG^*$, the adjustment process is similar to that of case two. The following proposition summarizes the impact effects of fiscal policies.

### 3.2. Long-run effects

We specify the steady state changes as the percentage change in a steady-state value, for example, $\hat{y} = \frac{\delta y}{y_0}$ as defined by Obstfeld and Rogoff (1995). To examine the long-run effects of VERs and fiscal policy, an approximation of the steady state change for per capita domestic consumption is given by:

$$\hat{C} = \hat{p}(h) + \hat{y} - \hat{P} - d\bar{G}$$

(43)

The corresponding equation for the foreigner is:

$$\hat{C}^* = \hat{p}^*(f) + \hat{y}^* - \hat{P}^* - d\bar{G}^*$$

(44)

Combining equations (43) and (44) with corresponding comparing steady states, it allows us to solve nine unknowns: $\hat{y}$, $\hat{y}^*$, $\hat{C}$, $\hat{C}^*$, $d\bar{m}$, $d\bar{m}^*$, $(\hat{p} - \hat{P})$, $(\hat{p}^* - \hat{P}^*)$ and $\hat{C}^w$. The solutions for relevant changes are:

$$\hat{y} = \frac{(\sigma - 1)(1 - n)(n - k)}{2} d\gamma + \frac{1 + 2n}{2} d\bar{G} + \frac{1 - 2n}{2} d\bar{G}^*$$

(45)

and

$$\hat{y}^* = nd\bar{G} + (1 - n)d\bar{G}^*$$

(46)

$$\hat{C} = \frac{(1 - n)(n - k)(\sigma^2 - 3)}{2} d\gamma + \frac{n + (1 - n)(\sigma - 2)}{2} d\bar{G} + (1 - n)d\bar{G}^*$$

(47)
\[
\hat{C}^* = d\hat{m}^* = \frac{(1-\sigma + 2n)(d\bar{G} - d\bar{G}^*)}{2} \tag{48}
\]

\[
\hat{p}(h) - \hat{p} = \frac{(1-n)(n-k)(\sigma^2 - 2\sigma - 1)}{2} d\gamma + \frac{(n-1)(1-\sigma)d\bar{G}}{2} + \frac{1-\sigma}{2} d\bar{G}^* \tag{49}
\]

\[
\hat{p}^*(f) - \hat{p}^* = \frac{(1-\sigma)(d\bar{G} - d\bar{G}^*)}{2} \tag{50}
\]

From equations (45)-(50), without government spendings, with imperfect competition and flexible output prices, VERs will reduce output, consumption, and real balances as well as deteriorate the terms of trade of the home economy (exporting country) but can not change anything in the foreign economy (importing country). We predict that the smaller the \(\sigma\), (the less competition in the goods market), the more vulnerable to the home economy imposing VERs. We also find that the negative effects are increasing with the country size of home country, \(n\), but decreasing with the VERs imposed goods.

About fiscal policies, the above solutions reveal four consequences. First, without VERs, in the long run, an increase in domestic government spending, \(d\bar{G} > 0\) and \(d\bar{G}^* = 0\), will stimulate outputs of both countries as indicated in equations (45) and (46). The expansion in domestic output and work effort associated with a rise in domestic government spending leads to a long-run deterioration in the home terms-of-trade because household can adjust output price according to marginal condition, as described by equations (49) and (50). The home economy suffers current account deficit and per capita consumption reduction. By contrast, the foreign country runs current account surplus in that the real output increases much more than consumption does.

Second, \(d\bar{G} = 0\) and \(d\bar{G}^* > 0\), an increase in foreign government spending stimulates outputs of both countries, improves home terms of trade and current account, raise domestic consumption but deteriorate foreign consumption and current account.
Third, $d\bar{G} = d\bar{G}^* > 0$, the increases in government spending of both countries by the same magnitude will stimulate outputs of them. Fourth, if $d\bar{G} > d\bar{G}^* > 0$, the process is similar to those of case two.

4. Welfare evaluation

From the utility function described in equation (1), the change of welfare, resulting from exogenous shocks, is divided into real and monetary parts. That is, $dU = dU^R + dU^m$. The total effects of voluntary export restraints and fiscal policies on domestic (foreign) welfare are the sum of permanent and temporary effects in real terms as well as those in monetary terms. Through solving techniques, and numerical simulations, it is possible to present the welfare effects of fiscal policy and VERs, taken together or separately.

In reality, we assume domestic economy is small compared with the rest of the world and specify the country size, $n$, as 0.4; furthermore, we set goods being $k$ at 0.2 and the export duty, $\gamma$, at 0.1. Furthermore, we set consumption share in utility $\alpha$ at 0.5, productivity factor $\mu$ at 1.6, time preference rate $\delta$ at 0.8, and substitute elasticity of demand $\sigma$ at 0.8.

Through solving techniques and then substituting the relevant numerical values from Tables 1 and 2 into the real terms of domestic (foreign) utility function, equation (1), given $d\bar{G} = 0$ and $d\bar{G}^* = 0$, we find that with sticky output prices, a VER imposed by exporting country will decrease per capita domestic utility by 0.288 but increase per capita foreign utility by 0.093. In monetary terms, it increases per capita domestic utility by 0.04 but decreases per capital foreign utility by 0.024 and hence, adding population weights, it decreases the global real terms of welfare by 0.0594 but increases monetary terms of welfare.
by 0.0016. In the long run, adding population weights, it increases global real terms of welfare by 0.000192 but decreases global money terms of welfare by 0.000192.

The increases in government purchases always reduce global welfare either on impact or in the long run. Especially, VERs together with expansionary fiscal policies reduce global welfare much more in comparison to those in the corresponding purchases under free trade except the impact effect on global welfare of an increase in domestic government spending $G = 1$ and $G^* = 0$, which improves the money terms of global welfare by 0.0274. From the numerical examples of welfare evaluation, with imperfectly competitive goods market and sticky output prices, VERs reduce global welfare in both real terms and monetary terms. Moreover, such restraints reduce the global welfare in monetary term but improve that in real term nearly by the same amount. It indicates that an export duty imposing by the home economy reduce global total welfare, the sum of permanent and temporary effects in real terms as well as that in monetary terms. On the other hand, under free trade, with imperfect competition in the goods market and sticky output prices, it might be the case that an increase in government spending of one economy improves the welfare of the other economy. With VERs, expansionary fiscal policies do not necessarily improve or deteriorates the welfare of domestic or foreign economy with sticky and flexible output prices. Especially, in sum they reduce global welfare much more in comparison to that of fiscal policies without VERs either on impact or in the long-run. We summarize the simulation results of welfare effects of VERs and fiscal policies, taken together or separately, as follows.

**Proposition 2:** With imperfect competition, on impact, VERs reduce global welfare but can not affect it in the long run. With VERs, increases in government purchases can not improve the global welfare but deteriorate it much more.
5. Conclusion

Obstfeld and Rogoff (1995) endeavored to investigate the international welfare spillovers with monopolistic competition and sticky output prices. Their model provides a rigorous assessment of policy effects and a significant advance in open economy macroeconomics. Yet it pertains only to the flexible exchange rate system. We apply their framework to the commercial policy of VERs, generating various policy results. In particular, we provide numerical simulations for evaluating large welfare effects of exporting duty, VERs, and fiscal policies, taken together or separately, to assess such restraints.

We derive the result that with imperfect competition as the case for VERs, the exchange rate may be less volatile under flexible prices than under sticky prices. However, under a unified flexible exchange rate system but without VERs, this situation may be reversed (Obstfeld and Rogoff op. cit., pp. 653), a result of possibly some interest. On impact, for the exporting (home) country, VERs have some positive effect on income, consumption, and the current account but worsen the terms of trade. By contrast, VERs reduce the income and consumption in the importing (foreign) country but improve its terms of trade. Nevertheless, VERs exert only transitory expansion effect on domestic macroeconomics. With flexible output prices, the home country experiences the reduction in output and consumption, the current account deficit, and the deterioration of the terms of trade. Especially, in the long run, VERs can not affect either macroeconomics of the importing (foreign) country or the global welfare, the sum of welfare changes in real and monetary terms.

From the proceeding analyses we thus believe that we have generated a number of results of interest and shed further light on international macroeconomic arguments for and against imposing VERs. In the faithful orthodox model, it is unambiguous that the exporting country stands to gain from the policy switch (from tariffs to VERs), and that the importing country may loss. However, as the model is made more realistic, with imperfect competition, the
likelihood for gain by the exporting country decreases or diminishes and that for loss increases. The lower degree of goods substitution or the less competition in the goods market, the less positive effect on macroeconomy for the exporting country imposing VERs. Previous literature is unable to predict long-term adjustments on the welfare losses that VERs impose through distortion to consumption and production efficiency. The theoretical model we have employed does not suffer from the general criticism that it is based on the premise of perfect competition. This structure gives us a good idea of the impact effect of trade as well as commercial and fiscal policies on core macroeconomic variables. It is also able to predict the long-run adjustments or the welfare effects that VERs imposes through affecting consumption and production. Such impacts may further qualify the macroeconomic adjustment benefits that our analysis suggests could be achieved with a carefully chosen mix of commercial and broad government policies.

There is no escaping the conclusion that VERs have become prominent in trade policy not only because of the practical considerations regarding their falling outside the rules of WTO (World Trade Organization) but also the relative ease with which they can be renegotiated, as they often have been. Moreover, the importing countries found their discriminatory nature to be particularly suited to their needs. However, from our theoretical and simulation results, with imperfect competition, VERs should be imposed meticulously and even discontinued or abolished for products and countries.
References


Tables
Table 1  Impact effects of fiscal policy with VERs and under free trade

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Table 2 Long run effects of fiscal policies with VERs and under free trade

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