Artificially Low Interest Rates as Export Promotion Policy

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Abstract

This paper reconsiders the use of an artificially low interest rate as an export-promotion policy and investigates the mechanism through which this policy improves national income and welfare in a middle developed small country. We define an artificially low interest rate policy as a combination of an interest rate ceiling and a rationing rule that assigns priority-lending status to an export sector. We show that when an interest rate ceiling is enforced without a rationing rule, credit rationing occurs and the policy does not increase national income. In contrast, artificially low interest rate policy enhances the competitiveness of domestic firms and improves national income and welfare.

JEL Classifications: E13; G28; O25
Keywords: Artificially low interest rate policy; Interest rate ceiling; Export-promotion policy; Credit rationing

1 Introduction

Interest rate ceilings have been widely observed in many developing and middle developed countries, especially during the 1950’s and 1960’s. Under this policy governments enforce low interest rates by establishing a ceiling for deposit and/or lending interest rates through legislation and intervention. The purpose of an interest rate ceiling is the creation of an environment in which private banks finance domestic firms at low interest rates. Consequently, these firms promote capital accumulation, and as a result the country develops economically.

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Interest-rate ceilings, however, create excess demand on financial markets, called *credit rationing*. This causes a distortion in financial markets and a decrease in the funds available for capital accumulation. McKinnon (1973) and Shaw (1973) assert that interest rate ceilings are unfavorable because they create *financial repression*, and conclude that the distortion in financial prices reduces the real growth rate and inhibits financial *deepening*. Governments should liberalize their financial market. Their criticisms are persuasive, and many economists agree with their argument.

While a trend in financial liberalization has been observed since the 1970’s, interest rate ceilings have been implemented in several countries. In particular, over a period spanning from the 1950’s to the early 1970’s, the Japanese government created a financial system based on interest rate ceilings. The government controlled most interest rates, instituted various regulations on financial transactions and intervened to concentrate the lending of funds to particular manufacturing sectors. Moreover, financial transactions with foreign countries were strictly regulated under the *Foreign Exchange and Foreign Trade Control Law* and the *Foreign Capital Law*. The package of these policies is called artificially low interest rate policy. As a result of these policies, there was credit rationing in the Japanese fund market, particularly from the late 1960’s to the early 1970’s.\(^1\)\(^2\)

Based on the criticism from McKinnon and Shaw, we may infer that the artificially low interest rate policy is harmful for economic development. However, this period is often referred to as “the era of rapid economic growth”; the Japanese economy achieved a real economic growth rate of more than 10 percent per year. Exports in manufactured products grew rapidly, and total exports began to dominate total imports towards the end of the 1960’s. Economists agree that Japan achieved export led economic development.

Can an interest rate ceiling policy promote exports and if so through what mechanism does export-promotion occur? In this paper, we distinguish between the concepts of interest rate ceiling policy and artificially low interest rate policy. An interest rate ceiling is regulation that keeps the interest rate of lending funds less or equal to the ceiling level. On the other

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\(^1\) Tsutsui (1982) and Ito and Ueda (1982) estimate the size of excess demands in this period.

\(^2\) Demetriades and Luintel (2001) suggest that the government of South Korea had adopted such policy from mid-1960 to mid-1990. Priory sectors, which were mainly exported-oriented industry, received inexpensive bank credit. Demetriades and Luintel conclude that this financial restraint has positive and large effect on financial development in South Korea.
hand, we define an artificially low interest rate as a policy package consisting on an interest rate ceiling and a rationing rule which assigns priority-lending status to a particular sector.\(^3\) Examining a small country model in an overlapping-generations setting, we compare the differences in between these policies. Decreasing the lending interest rate by setting a ceiling leads to an increase in fund demand from the exportable manufacturing sector. Since the savings of households do not increase, however, this sector faces credit rationing. This credit rationing is a new resource constraint for the sector, and as a result, an interest rate ceiling that is implemented without a rationing rule will not be effective. On the other hand, when the rationing rule provides enough funds to the export sector at a low interest rate, the sector increases its exports through a rent-shifting effect. At the same time, other sectors in this country struggle with a dearth of funds. We show, however, that if the rent-shifting effect sufficiently drives up national income, national welfare is improved by an artificially low interest rate policy.

There are many studies that positively evaluate interest rate ceiling policy and criticize the financial repression literature.\(^4\) Considerable empirical evidences show that financial restraints including interest rate restrictions have positive effect on financial development (e.g. Demetriades and Luin.tel 2001; Arestis et al. 2002; Arestis et al. 2003). Moreover, Hellmann et al. (1996, 1997) discuss the possibility that interest rate ceilings reduce the problem of asymmetric information in financial transactions and promote economic development. Demetriades and Devereux (2000) show a case that the restriction of lending rate pushes up long-run equilibrium aggregate capital stock. Daitoh (2003) studies the relationship between interest rate ceilings and unemployment in developing countries. In contrast, our study sheds light on the trade policy aspects of interest rate ceiling policy. We show that a rationing rule is necessary to improve national income.

This paper is organized as follows. In section 2, we examine interest rate ceiling policy. In section 3, we analyze artificially low interest rate policy. Section 4 provides conclusions.

\(^3\)Teranishi (1982) and Horiuchi (1984) point out that artificially low interest rate policy in Japan refers not only to a policy of keeping the interest rate low (interest rate ceiling), but also includes other systematic financial policies.

2 Interest Rate Ceiling Policy

2.1 The Model

There are two economic regions: a middle-developed small country (home) and the rest of the world (foreign). The exchange rate is fixed at unity. The home country has a household sector and a financial intermediate sector, and two production sectors: primary and manufacturing. We assume there are two factors of production: labor and capital (the rate of capital depreciation is 100%). Capital is supplied through the investment of household savings in the financial intermediate sector. While the manufacturing sectors use both labor and capital in production, the primary sector only uses labor. The primary good is sold in a perfectly competitive world market with no trade costs. We assume that one unit of the primary good is produced from one unit of labor by a constant return to scale technology, and choose the primary good as numeraire. Then the wage rate equals one in equilibrium.⁵

In the economy, there are $N$ types of manufacturing goods ($n = 1, \cdots, N$) that are sold in integrated world markets. We assume that the home small country has only one manufacturing firm in the first type of manufacturing sector ($n = 1$), and call it firm $h$. This firm sells its products to an integrated world market that is characterized by a Cournot duopoly. The rival firm in the rest of the world is called firm $f$.

The interest rate ceiling policy is a regulation on the financial intermediate sector. By setting an upper-limit on the lending interest rate, the government in the home country keeps the lending interest rate down for firm $h$. In the following sub-sections, we provide further details of our model.

2.1.1 Households

We consider a household sector with overlapping generations. The population of each generation is constant and normalized to one; there is no population growth. We assume that households are internationally immobile, and live for two periods: young and old. Time is denoted by $t = 0, 1, \cdots$. Each household inelastically supplies one unit of labor in their young period only. For simplicity, we assume that the household does not consume in the young period and deposits all wage income in the financial intermediate sector for consumption in the old period. Since the wage is kept at one from the assumptions of the primary sector, the value of total deposits in the home

⁵The main purpose of considering a primary sector is to set the wage to one and to simplify the labor market. See Dixit and Grossman (1986).
country is one. In period \( t + 1 \), the old household receives the principal and interest \( i^t \), which is the gross interest rate on deposits. Moreover, the household inherits shares in firm \( h \) in the manufacturing sector from parents at the end of young period. The dividends from shares equal firm \( h \)'s profit \( \pi_h \). Therefore, an old household’s income in period \( t + 1 \), \( I^{t+1} \), is

\[
I^{t+1} = i^t + \pi^t_h. \tag{1}
\]

The preferences of a household in generation \( t \) are given by

\[
U^t = \eta_X \log X^{t+1} + \eta_y \log y^{t+1}, \tag{2}
\]

where each \( \eta_j (j = X, y) \) is a positive constant and \( \eta_X + \eta_y = 1 \), \( y \) is consumption of primary goods, and \( X = X(x_1, \cdots, x_N) \) represents the consumption of each manufacturing good \( x_n (n = 1, \cdots, N) \). Because we only analyze the stationary equilibrium, we omit the superscript \( t \) in the following.

2.1.2 The Manufacturing Sector

There are only two firms, firm \( h \) in the home country and firm \( f \) in rest of the world, capable of producing the manufacturing good with index \( n = 1 \). These firms engage in Cournot competition in the integrated world market. We omit the subscript 1 of \( x \) when considering only the \( n = 1 \) manufacturing sector in the following. Each firm has a Cobb-Douglas production function:

\[
x = ak^\alpha l^{1-\alpha}, \tag{3}
\]

where \( k \) and \( l \) are capital and labor inputs respectively, \( a \) is a positive constant, and \( \alpha \in (0, 1) \). From (3), we obtain the capital demand function \( k_h \):

\[
k_h = a^{-1}\alpha^{1-\alpha}(1-\alpha)^{-1}(1-\alpha)r^{-(1-\alpha)}x_h, \tag{4}
\]

where \( r \) is the lending interest rate for the manufacturing sector in the home country. Note that the wage rate is one. The inverse demand for products in the world market is given by:

\[
P_x = P_x(x_h + x_f), \text{ with } P_x' < 0. \tag{5}
\]

Of course, demand depends on total world income. From the small country assumption, however, the policy of the home country does not affect world income. Thus, we consider world income as a constant.
2.1.3 The Financial Intermediate Sector

The financial intermediate sector consists of several identical banks that carry on Bertrand competition, and act as financial intermediates between firms and households. For simplification, we do not consider the cost function of banks. Note that, because the government controls the lending interest rate, firm \( k \) does not have monopolistic power in the lending market.

The interest rate in the rest of the world \( R \) is constant because home is a small country. If the home country can trade funds with the rest of the world with negligible transaction costs, the deposit and lending rates must equal the world interest rate, i.e., \( i = r = R \), because of the small country assumption. Here, we assume that the government enforces a restriction on foreign exchange.\(^6\) Suppose that a transaction cost \( \tau \) per unit of funds is incurred by agents who transact funds overseas. This transaction cost \( \tau \) includes costs of administration procedures for the transaction of foreign exchange and foreign investment as well as communication and agency costs. The government can increase this transaction cost by setting various regulations on foreign exchange.\(^7\) Therefore, we have the interval of these interest rates in equilibrium:

\[
i, r \in [\max\{R - \tau, 1\}, R + \tau],
\]

where the lower limit is at least one because we consider a gross interest rate. This interval contracts with a decrease in \( \tau \). Note that this restriction does not only prevent capital flight associated with a low interest rate but also prevents the inflow of foreign funds.

Next, we consider the level of the interest rate ceiling \( \bar{r} \) in the lending market for the manufacturing sector. The interest rate ceiling prevents banks from lending funds to the manufacturing sector at an interest rate higher than \( \bar{r} \). If \( \bar{r} > r^* \), where the asterisk is used to represent the Laissez-Faire economy, this regulation is not effective. If \( 1 \leq \bar{r} < R - \tau \), this policy may lead to capital flight. Thus, we find the range of for \( \bar{r} \) which the interest rate ceiling binds:

\[
\bar{r} \in [\max\{R - \tau, 1\}, r^*).
\]

\(^6\)In both financial repression and artificially low interest rate, restrictions on international funds flow are required in order to control domestic interest rates. Giovannini and de Melo (1993) define financial repression as a combination of controls on international capital flows with restrictions on domestic interest rates.

\(^7\)In Japan between the 1950’s and the early 1980’s, financial transactions with foreign countries were strictly regulated under the Foreign Exchange and Foreign Trade Control Law and the Foreign Capital Law.
International capital flows are blocked by the restriction on foreign exchange. Because the savings of households equal one and the capital demand function is downward sloping from (4), this policy leads to excess demand in the lending market. Thus, the available capital for firm \( h \) is fixed as one, i.e.,

\[
\bar{k}_h = 1,
\]  

(8)

where the upper-bar is used to denote that an interest rate ceiling has been implemented. In this section, the deposit interest rate equals the lending interest rate by the zero profit condition for banks:

\[
\bar{i} = \bar{r}.
\]  

(9)

Because we consider the case where domestic gross interest rates are in the range of (6), there is no flow of international funds in equilibrium. Moreover, the exchange rate is fixed, and the volumes of exports and imports for primary goods are determined by the balance of payments.

In the next subsection, we analyze the effects of interest rate ceiling policy.

### 2.2 Effects of Interest Rate Ceiling

First, we derive the cost functions of both manufacturing firms. Firm \( f \) minimizes its total cost \( C_f = l + Rk \) subject to the production function (3). The cost function of firm \( f \) is

\[
C_f = a^{-1} \alpha^{-\alpha} (1 - \alpha)^{-(1-\alpha)} R^\alpha x_f,
\]  

(10)

On the other hand, firm \( h \) minimizes its total cost \( C_h = l + \bar{r}k \) subject to two constraints: the production function (3) and the resource constraint from credit rationing (8). Thus, we obtain the cost function of firm \( h \) as follows:

\[
C_h = a^{1-\alpha} x_h^{1-\alpha} + \bar{r}.
\]  

(11)

Since the capital input is fixed by credit rationing, (11) has the same form as the short-run Cobb-Douglas cost function. From (11), since \( \frac{\partial C_h}{\partial \bar{r}} = 1 \), the decrease in the interest rate ceiling reduces the total cost of firm \( h \). However, since \( \frac{\partial^2 C_h}{\partial x_h \partial \bar{r}} = 0 \), we find that the interest-rate ceiling does not change the marginal cost of firm \( h \).
The profits of firm $h$ and $f$ are $\pi_h = P_x x_h - C_h$ and $\pi_f = P_x x_f - C_f$ respectively. The first order conditions for profit maximization are

$$P'_x x_h + P_x - a^{-\frac{1}{\alpha}}(1 - \alpha)^{-1}x_h^{\frac{\alpha}{1-\alpha}} = 0,$$

(12)

$$P'_x x_f + P_x - a^{-1}\alpha(1 - \alpha)^{-(1-\alpha)}R^\alpha = 0$$

(13)

Solving (12) and (13) yields outputs and profits. By total differentiation of (12) and (13) with respect to $\bar{r}$, we have

$$\begin{pmatrix} D_{hh} & D_{hf} \\ D_{fh} & D_{ff} \end{pmatrix} \begin{pmatrix} \frac{\partial \pi_h}{\partial \bar{r}} \\ \frac{\partial \pi_f}{\partial \bar{r}} \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

We assume that $D_{ij} = P'_x x_i + P'_x < 0$ and $D_{ii} = P''_x x_i + 2P'_x < 0$ for the stability conditions of Cournot competition ($i, j = h, f$). Therefore, we find that $\frac{\partial \pi_h}{\partial \bar{r}} = 0$ and $\frac{\partial \pi_f}{\partial \bar{r}} = 0$. That is, the interest rate ceiling has no effect on the market share in Cournot duopoly because the policy does not change marginal cost.

Next we consider the effect of the interest rate ceiling on national income. In this model, the wage income earned by young households is one. Old households accrue the dividend from firm $h$, $\pi_h$, and income from deposit interest $\bar{\pi}$ because $\bar{\pi}$ is the gross interest rate. Therefore, national income in period $t$ is $\bar{\pi} + \pi_h$, which equals expenditure in the old period as (1). Since $\frac{\partial \pi_h}{\partial \bar{r}} = -1$, this policy increases the profit of firm $h$ and household income derived from dividends because it reduces the fixed capital cost. On the other hand, from (9) we have $\frac{\partial \bar{\pi}}{\partial \bar{r}} = 1$. This implies that the interest rate ceiling on the lending market reduces the deposit interest rate. From (1), national income remains unchanged when the interest rate ceiling policy is implemented. Furthermore, since the policy does not change the price of the manufacturing good, welfare remains unaltered. The above results are summarized as the next proposition.

**Proposition 1** Suppose there is no rationing rule. In this case, the interest rate ceiling does not change national income or welfare.

### 3 Artificially Low Interest Rate Policy

In previous section, we found that an interest rate ceiling without a rationing rule has no effect on national income. In this section, we extend our model to show that an artificially low interest rate policy can improve national income and welfare.
3.1 The Extended Model

We introduce an extra production sector, called the service sector, into our model. Firms in the service sector only supply their services to the perfectly competitive domestic market. Then the preferences of households are rewritten as

\[ U^t = \eta_X \log X^{t+1} + \eta_y \log y^{t+1} + \eta_z \log z^{t+1}, \]  

(14)

where \( z \) is consumption of services, \( \eta_z \) is a positive constant, and \( \eta_X + \eta_y + \eta_z = 1 \). From (1) and (14) the demand for services is

\[ z = \frac{\eta_z (i + \pi_h (\bar{r}))}{P_z}, \]  

(15)

where \( P_z \) is the price of services.

Next we reconsider the financial sector and the relevant regulations. As in the previous section, the interest rate ceiling leads to excess demand in the lending market. Suppose the government establishes a rationing rule that orders all banks to lend funds advantageously to the manufacturing sector. That is, all banks must lend a certain fraction of their funds to firm \( h \) in order to satisfy the capital demand of firm \( h \) at \( r = \bar{r} \). Once the manufacturing sector has obtained enough funds, banks can lend the remaining funds to the service sector at another interest rate \( r_z \). We assume \( r_z \in [\max\{R - \tau, 1\}, R + \tau] \). Therefore, the amount of capital available (capital supply) in the service sector, \( S_z(\bar{r}) \), is determined as a residual of the savings from the capital demand of the manufacturing sector (4). Therefore, the capital supply for the service sector is

\[ \bar{S}(\bar{r}) = 1 - k_h(\bar{r}). \]  

(16)

Under these regulations, the lending market will be segmented: for firm \( h \) and for the service sector. Hence the lending rates may differ between the two sectors.

The production function of the service sector is also Cobb-Douglas: \( z = bk^{\beta l_{1-\beta}} \), where \( \beta \in (0, 1) \) and \( b \) is a positive constant. From the cost minimization problem, we have the cost function \( C_z \) and the capital demand function \( k_z \):

\[ C_z = b^{-1} \beta^{-\beta}(1 - \beta)^{-1} r_z^{\beta} z, \]  

(17)

\[ k_z = b^{-1} \beta^{1-\beta}(1 - \beta)^{-1} r_z^{(1-\beta)} z. \]  

(18)
Note that the service sector does not face credit rationing because the government does not regulate the lending interest rate to the service sector and \( r_z \) is decided by the lending market equilibrium condition.

Since this sector is perfectly competitive, price equals marginal cost. From (17), we have the horizontal supply curve for services as
\[
P_z = b^{-1} \beta - \beta (1 - \beta)^{-(1-\beta)} r_z^\beta.
\] (19)

Therefore, from (15) and (19), the equilibrium volume of services is
\[
z = \frac{\eta_z (\bar{r} + \pi_h (r))}{b^{-1} \beta - \beta (1 - \beta)^{-(1-\beta)} r_z^\beta}.
\] (20)

The market equilibrium condition of lending funds for the service sector is \( \tilde{k}_z = \tilde{S}_z \), so (4), (16), (18), and (20) yield the lending interest rate as follows:
\[
\bar{r}_z = \frac{\beta \eta_z \left[ \bar{r} + \pi (\bar{r}) \right]}{1 - a^{-1} \alpha^{1-\alpha} (1 - \alpha)^{-1-\alpha} \tilde{x}_h (\bar{r})}.
\] (21)

The deposit interest rate is \( \bar{i} \) decided by the zero profit condition for banks, which is given by
\[
\bar{i} = \bar{r} k_h (\bar{r}) + \bar{r}_z k_z (\bar{r}_z, \bar{i}; \bar{r}),
\] (22)

where the left hand side of (22) is the interest payments for household deposits and the right hand side is banks’ revenue from lending.

3.2 Effects of an Artificially Low Interest Rate

We now consider the effect of an artificially low interest rate policy. First, we focus on the effects in the manufacturing sector. By the rationing rule, the artificially low interest rate policy is just a policy for this sector that reduces the lending interest rate without causing credit rationing. Therefore, the cost function of firm \( h \) becomes \( C_{h} = a^{-1} \alpha^{-\alpha} (1 - \alpha)^{-1-\alpha} \bar{r}^\alpha x_h \), and the policy decreases marginal cost:
\[
\frac{\partial \bar{C}_{h}}{\partial x_h \partial \bar{r}} = a^{-1} \alpha^{-\alpha} (1 - \alpha)^{-1-\alpha} \bar{r}^{\alpha-1} > 0.
\]

The first order condition for profit maximization by firm \( h \) is
\[
P'_x x_h + P_x - a^{-1} \alpha^{1-\alpha} (1 - \alpha)^{-1-\alpha} \bar{r} = 0.
\] (23)

From (23) and (13), we have the following result.
Proposition 2 An artificially low interest rate policy increases the output and profit of firm \( h \), i.e., \( \frac{\partial x_h}{\partial r} < 0 \) and \( \frac{\partial \pi_h}{\partial r} < 0 \). 

Proof. Total differentiation of (23) and (13) with respect to \( r \) yield

\[
\begin{pmatrix}
D_{hh} & D_{hf} \\
D_{fh} & D_{ff}
\end{pmatrix}
\begin{pmatrix}
\frac{\partial x_h}{\partial r} \\
\frac{\partial x_f}{\partial r}
\end{pmatrix} =
\begin{pmatrix}
-a^{-1} \alpha ^{1-\alpha} (1-\alpha)^{-\alpha} r^{-\alpha -1} \\
0
\end{pmatrix}.
\]

Solving this, we have

\[
\frac{\partial x_h}{\partial r} = \frac{a^{-1} \alpha ^{1-\alpha} (1-\alpha)^{-\alpha} r^{-\alpha -1} D_{ff}}{|D|} < 0, \tag{24}
\]

\[
\frac{\partial x_f}{\partial r} = -\frac{a^{-1} \alpha ^{1-\alpha} (1-\alpha)^{-\alpha} r^{-\alpha -1} D_{fh}}{|D|} > 0, \tag{25}
\]

where \( |D| = D_{hh} D_{ff} - D_{hf} D_{fh} > 0 \). Furthermore, differentiating the profit of firm \( h \) with respect to \( r \), we have

\[
\frac{\partial \pi_h}{\partial r} = \frac{\partial x_h}{\partial r} \frac{\partial x_f}{\partial r} - a^{-1} \left( \frac{\alpha}{1-\alpha} \right) r^{1-\alpha} x_h < 0.
\]

This result illustrates a rent-shifting effect (e.g. Brander and Spencer 1985). It is widely known that subsidies can enhance the competitiveness of domestic firms, and furthermore, increase domestic welfare under imperfect competition. Generally speaking, however, it is hard for developing and middle-developed countries to carry out such subsidy policies because of the government’s budget constraint. It is often noted that the opportunity costs of government spending in these countries are high (Brander, 1995) because government has a number of problems to solve, e.g. poor infrastructure, education, medical services, and so on. On the other hand, an artificially low interest rate can enhance the competitiveness of domestic firms and does not require as much budgetary spending.

Next we consider the effect of an artificially low interest rate policy on the deposit interest rate, which is determined by (22). From (4), (18), (20), and (22), we have

\[
\bar{r} = \frac{1}{1-\beta \eta_z} \left[ A \bar{r}^\alpha x_h(\bar{r}) + \beta \eta_z \pi_h(\bar{r}) \right], \tag{26}
\]

where \( A \equiv a^{-1} \alpha ^{1-\alpha} (1-\alpha)^{-\alpha} \). Note that \( \bar{r} \) is a political parameter which is decided by the government. From (26), we find that \( \bar{r} \) does not depend on
The increase in has two effects on banks’ revenue. It raises the interest yield per unit of funds and reduces capital demand from the service sector. These opposing effects are cancelled out, however, because of the Cobb-Douglas production function. Thus, (26) does not depend on \( \bar{r}_z \). From (26), we obtain

\[
\frac{\partial \hat{i}}{\partial \bar{r}} = \frac{1}{1 - \beta \eta_z} \left[ \alpha A \bar{r}^{\alpha-1} x_h(\bar{r}) + A \bar{r}^\alpha \frac{\partial x_h}{\partial \bar{r}} \right] + \frac{\partial \pi_h}{\partial \bar{r}} \frac{\partial \theta}{\partial \bar{r}}
\]

where \( \varepsilon \equiv -\frac{\bar{r}}{x_h} \frac{\partial x_h}{\partial \bar{r}} > 0 \). From the first equality of (27), we find that a decrease in has three effects on the deposit interest rate. The first term represents the reduction in banking profits earned from the manufacturing sector. This effect drives down the deposit interest rate through the zero profit condition of banks, and is positive. The second term denotes the increase in capital demand from the manufacturing sector as a result of the expansion in production (proposition 2). This effect drives up the deposit interest rate, and is negative. Furthermore, from proposition 2, the interest rate ceiling policy increases the profit of firm \( h \). From (1), this raises the income of households, demand for services from (15), and then capital demand from the service sector from (18). The third term represents this effect and is negative. A large \( \varepsilon \) implies that the interest rate ceiling improves the competitiveness of firm \( h \) and increases its capital demand. If \( \alpha < \varepsilon \), the second effect dominates the first effect and the right hand side of (27) is negative.\(^8\) Then we have the following proposition.

**Proposition 3** If \( \alpha < \varepsilon \), an artificially low interest rate policy increases the deposit interest rate, i.e., \( \frac{\partial \hat{i}}{\partial \bar{r}} < 0 \).

Next we consider national income. Propositions 2 and 3 directly yield the following result.

\(^8\)If we assume that household preferences are identical across regions and the first term in (14) has a Cobb-Douglas form, such as \( \eta_X \log X \equiv \sum_{n=1}^N \eta_{xn} \log x_n \), the inverse demand function for \( x_1 \) is \( P_{x_1} = \frac{\eta_{x1} I_W}{x_1 + \sigma_f} \), where \( I_W \) is total world income, which is constant under the small country assumption. In this case, from the definition of \( \varepsilon \) and (24), the condition \( \alpha < \varepsilon \) is rewritten as \( P_x < 2a^{-1} \alpha^{-\alpha}(1 - \alpha)^{-(1-\alpha)} \bar{r}^\alpha \). This implies that the equilibrium price is no greater than double average cost (or marginal cost) of firm \( h \). Therefore, this condition is not extreme.
Proposition 4 If $\alpha < \varepsilon$, an artificially low interest rate policy increases national income, i.e., $\frac{\partial I}{\partial r} = \frac{\partial \hat{i}}{\partial r} + \frac{\partial \pi_h}{\partial r} < 0$.

This result claims that, if the interest rate ceiling sufficiently enhances the competitiveness of firm $h$, the policy raises the interest income of households as well as dividend income from firm $h$.

Here we go back to the lending interest rate for the service sector. If $\alpha < \varepsilon$ is satisfied, from (21) we have

$$\frac{\partial \hat{r}_z}{\partial r} = \frac{\hat{r}_z}{\beta \eta_z \hat{r}^{(1-\alpha)}} \left( \frac{1-\alpha}{\hat{r}} + \frac{\partial \pi_h}{\partial r} \right) < 0. \quad (28)$$

This is an intuitive result. Next we consider the price of services. Since the supply curve is horizontal, from (19) and (28) we have

$$\frac{\partial \hat{P}_z}{\partial r} = b^{-1} \left( \frac{\beta}{1-\beta} \right)^{1-\beta} \hat{r}_z^{\beta-1} \frac{\partial \hat{r}_z}{\partial r} < 0. \quad (29)$$

Thus, we find that the interest rate ceiling pushes up the service price. Finally, let us consider the amount of services. From (19), (20), (21), (28), and (29), we have

$$\frac{\partial \hat{z}}{\partial r} = \eta_z \frac{\partial \hat{I}}{\partial r} - \eta_z (\hat{i} + \pi_h) \frac{\partial \hat{P}_z}{\partial r} \frac{\partial \hat{r}_z}{\partial r} \frac{\partial \hat{P}_z}{\partial \hat{r}_z} \left( \frac{\hat{i} + \pi_h}{\hat{P}_z} \right)^2 < 0. \quad (30)$$

The first term of the first equality of (30) represents the effect for demand; the increase in income raises the demand for services, and this term is negative. The second term is the supply side effect; from (29) the interest rate ceiling drives up the price and this term is positive. Because $\beta \in (0, 1)$, if $\beta$ is sufficiently small, the first term dominates the second term and the policy increases the amount of services supplied. The above results are summarized as follows.

Proposition 5 Suppose $\alpha < \varepsilon$. An artificially low interest rate policy increases the lending rate for the service sector and the price of services. Furthermore, if the service sector is sufficiently labor-intensive (i.e. $\beta$ is small), this policy increases the amount of services.
3.3 The Restriction on Foreign Exchange

In this subsection, we discuss the restriction on foreign exchange. Consider an extreme case of free capital movement, in which there is no transaction cost associated with international financial transactions. In this case, the service sector can borrow funds from the rest of the world with no transaction costs, and the lending rate for the service sector equals the world interest rate $R$. In addition, because banks can borrow funds from the rest of the world at negligible cost, the deposit interest rate also equals the world interest-rate. Moreover, in this case, the government cannot implement a low interest rate policy because banks will incur losses when the lending rate for firm $h$ is decreased to the interest rate ceiling. Therefore, some restriction on foreign exchange is necessary to obtain the results of the previous sections. Alternatively, we have assumed that all domestic interest rates are in the range given by (6). This simplification implies that no agent conducts financial transactions overseas. Of course, this is also an extreme case. In order to adopt the artificially low interest rate policy, it is sufficient to allow domestic interest rates to diverge from the world interest rate. Thus, the propositions of the previous sections should hold as long as some financial transaction cost exists and the flow of international funds is imperfect.

Historically, developing and middle-developed countries with interest-rate ceilings had broadly regulated financial activities including foreign exchange. These regulations create some frictions, that is, increase the transaction costs, and make the policy valid. In the era of rapid economic growth in Japan, the Foreign Exchange and Foreign Trade Control Law and the Foreign Capital Law worked as such distortions. These laws were basically enacted to economize the use of persistently scarce foreign exchange, and may have been effective for the implementation of the interest rate ceiling. Therefore, interest rate ceilings must entail some other financial distortions in the economy.

Recently, there has been a global trend towards financial liberalization. As fund markets move towards an integrated world market, transaction costs in funds markets decrease. Some frictions on financial transactions are necessary for the interest rate ceiling to be effective. If a government considers an artificially interest rate policy, it needs to put severe regulations on financial activities. Therefore, as a result of global financial liberalization, interest rate ceilings would have been used less frequently.

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9In Japan the year when an international fund flow was liberalized in principle in 1980 by a full-fledged revision of the Foreign Exchange and Foreign Trade Control Law.
3.4 Welfare Analysis

Here we consider the welfare effects of an artificially low interest rate policy. Since the utility function is separable from (14), we consider each term separately. Through out this subsection we assume that, i.e., an artificially low interest rate increases national income from proposition 4.

First we rewrite the first term of (14) in an indirect utility form:

\[ \eta_X \log X \equiv \eta_X V_X(\tilde{i} + \pi_h, P_{x_1}, P_{x_2}, \ldots, P_{x_N}). \]  

(31)

Since we suppose that the home country, which is a small country, does not have manufacturing firms with an index \( n = 2, \ldots, N \), the prices of these manufacturing goods, \( P_{x_2}, \ldots, P_{x_N} \), are exogenous parameters. From (24) and (25), we have \( \frac{\partial X_1}{\partial \tilde{r}} < 0 \), where \( X_1 = x_h + x_f \). Since \( P'_x(X_1) < 0 \), decreasing \( \tilde{r} \) increases the quantity and decreases the price of this manufacturing good. Therefore, the policy raises the indirect utility derived from the manufacturing good.

The third term of (14) is the utility from services. From proposition 5, if the service sector is sufficiently labor-intensive, the policy increases the volume of services and then household utility. The second term is the primary good. In our model, the price remains one. Thus, the increase in income drives up the utility derived from this good. The above results are summarized as follows.

**Proposition 6** Suppose \( \alpha < \varepsilon \). If the service sector is sufficiently labor-intensive (i.e. \( \beta \) is small), an artificially low interest rate policy always improves welfare.

4 Conclusions

We have investigated how an interest rate ceiling impacts on the economy. The literature to date has analyzed this policy mainly from the standpoint of economic and financial development. In contrast, we have focused on the trade policy aspects of this policy that have not previously been discussed in the literature. We prove that a policy combination including an interest rate ceiling, a restriction on foreign exchange, and a rationing rule enhances the competitiveness of domestic firms and increases the income of households. We also show that both the restriction on foreign exchange and the rationing rule are necessary for the interest rate ceiling to be effective. The artificially low interest rate policy is, therefore, an all-round intervention in
financial systems by the government.

References


