

Global general equilibrium consequences of import substitution: a new trade theory perspective

Toshihiro Atsumi

Faculty of Economics, Meiji Gakuin University

Discussion Paper No.23-02

2024 年 3 月

Global general equilibrium consequences of import substitution: a new trade theory perspective

Abstract

This paper offers a simple theoretical account of import substitution by applying the basic framework of new economic geography based on the tradition of new trade theory, which introduces monopolistic competition to explain differentiated goods trade. The global consequences of import substitution policy are explained. When a developing country blocks imports of the modern sector to establish its own modern sector to supply domestically and replace imports, it requires resource reallocation from the traditional sector to the modern sector within the developing country, resulting in a contraction of the traditional sector. In turn, international trade in the traditional sector induces the rest of the world to increase production of traditional goods, which is accompanied by a contraction of the modern sector. Welfare loss due to this global decoupling of the modern sector is mostly borne by the developing country, but welfare is also reduced in the rest of the world.

1. Introduction

Import substitution as a development strategy is a topic covered not only in development economics but also in the field of international trade. For example, the textbook on international trade by Krugman, Obstfeld, and Melitz (2018) devotes a chapter to trade policy in developing countries, where import-substituting industrialization is reviewed.

During the post-WWII era, particularly in the 1950s and 1960s, industrialization through import substitution was one basic component of economic development strategy. For example, Chenery (1955, p. 51) comments “Industrialization consists primarily in the substitution of domestic production of manufactured goods for imports,” and Bruton (1998, p. 907) explains that “many students and policy makers in much of the world believed that the appropriate strategy for development was to replace imports from the rich North with their own domestic production.” Krueger (1997, p. 12) points out that “the premises underlying import substitution policies were so widely accepted that developing country exceptions were even incorporated into the GATT articles.”

What was import substitution? Essentially, it involved countries prioritizing domestic production of manufactured goods over reliance on imports. In this article, I aim to provide a straightforward theoretical explanation of import substitution to enhance understanding of its consequences. To elucidate the impact of import substitution, I employ a theoretical framework based on new economic geography, as outlined by Krugman (1991), drawing from the principles of new trade theory, which incorporates monopolistic competition to explain trade in differentiated goods. Specifically, import substitution is conceptualized as a scenario wherein a country, typically a developing nation, impedes imports of modern goods with increasing returns to scale, while establishing its own modern sector to meet domestic demand and replace imports.

Through formal analysis, this process is shown to necessitate a reallocation of resources from the traditional sector to the modern one within the developing country, resulting in a contraction of the former. As highlighted by Bruton (1998, p. 914), import substitution often entails the “squeezing” of agriculture to finance burgeoning manufacturing activities. Consequently, international trade dynamics in the traditional sector stimulate increased production of traditional goods elsewhere in the world, leading to a concomitant contraction of the modern sector and impacting global welfare.

In the next section, I present a two-sector international trade model with a modern, increasing returns to scale sector and a traditional sector producing a homogeneous good, characterized by the following asymmetry: the developing country exports the homogeneous good while importing differentiated goods from the modern sector in the rest of the world. In section 3, I analyze the global general equilibrium effect of the developing country turning to import substitution, followed by concluding comments.

2. Trading equilibrium of a developing country and the rest of the world

2.1 Assumptions

The developing country

The developing country produces only a homogeneous good in the traditional sector. It exports the homogeneous good to the rest of the world to import differentiated goods produced by the modern sector in the rest of the world.

Consumer preferences

There are two types of goods. Differentiated goods and a homogenous good. All consumers are assumed to have the same preferences. These preferences are described by the following two-tier structure:

$$U = M^m T^{1-m} \quad (0 < m < 1) \quad (1a)$$

$$M = \left[\int_0^n z(i)^\rho di \right]^{\frac{1}{\rho}} \quad (0 < \rho < 1) \quad (1b)$$

(1a) is a Cobb-Douglas function of the consumption of an aggregate of differentiated varieties (M) and the homogeneous good (T). (1b) then defines M as a constant elasticity of substitution (CES) function, and $z(i)$ is the consumption of each variety i , and n is the total mass of variety. The elasticity of substitution between any variety is $1/(1 - \rho) \equiv \sigma$ ($\sigma > 1$).

Production technology and market structure

On the production side, a firm in the modern sector producing a particular variety requires a unit of resource and c units of resource per unit output.¹ The firm thus faces increasing returns to scale. Its total cost for producing a given amount, q is then

$$C_M(q) = r + crq, \quad (2a)$$

where r is the return for the resource. It is assumed that this industry is monopolistically competitive.

The traditional sector is a constant returns to scale sector also using the same resource as a factor of production. A unit of the resource produces a unit of the homogeneous good. Therefore, the total cost of producing a given amount of the homogeneous good (q^T) is

$$C_T(q^T) = rq^T. \quad (2b)$$

Factor endowment

Total world resource for production is R . A fraction, sR ($0 < s < 1$), exists in the developing country and $(1 - s)R$ exists in the rest of the world. The resource is not mobile internationally.

2.2 Consumer behavior

For a given income Y , a given price for the traditional good p^T and a given price $p(i)$ for each modern-sector variety, the consumers problem is to maximize her utility, subject to the budget constraint

$$\int_0^n p(i)z(i)di + p^T T = Y. \quad (3)$$

The standard results for the demand for differentiated varieties and the homogeneous good are

$$z(j) = mp(j)^{-\sigma} G^{\sigma-1} Y \quad (4)$$

and

$$T = \frac{(1-m)}{p^T} Y, \quad (5)$$

respectively. σ is the price elasticity of demand and G is called the price index:

$$G \equiv \left[\int_0^n p(i)^{\frac{\rho}{\rho-1}} di \right]^{\frac{\rho-1}{\rho}} = \left[\int_0^n p(i)^{1-\sigma} di \right]^{\frac{1}{1-\sigma}}. \quad (6)$$

¹ Resource here includes labor and other factors of production.

2.3 Firm behavior in the modern sector

Because of the infinite number of potential varieties and increasing returns to scale at the firm level, each firm becomes a sole producer of a differentiated variety. The first-order condition of profit maximization is then the equalization of marginal revenue and marginal costs. Since the demand elasticity that each firm faces is σ , firms will exhibit the following mark-up pricing behavior

$$p \left(1 - \frac{1}{\sigma}\right) = cr, \quad (7)$$

and the price index of differentiated goods is

$$G = (np^{1-\sigma})^{\frac{1}{1-\sigma}} = n^{\frac{1}{1-\sigma}} p. \quad (8)$$

Hereafter (i) is dropped to focus on a typical firm.

2.4 Equilibrium

Equilibrium requires market clearing in the goods and factor markets, and zero profit of firms as a result of free entry.

Traditional sector

Because perfect competition leads to marginal cost pricing in the traditional sector,

$$p^T = r. \quad (9)$$

Choosing the traditional good as the numeraire and setting the return to resource equal to 1,

$$p^T = r = 1. \quad (10)$$

Modern sector

In the modern sector, zero profit due to free entry requires operating profits to equal fixed cost. That is,

$$pq - crq = r. \quad (11)$$

Then, because there are no profits in equilibrium, given (10),

$$Y = R. \quad (12)$$

Market clearing conditions

The market clearing conditions for the differentiated goods and the homogeneous good are

$$q = mp^{-\sigma} G^{\sigma-1} R. \quad (13)$$

and

$$(1 - m)R = R - ncq - n, \quad (14)$$

respectively. The left-hand-side of (14) is world demand for the homogeneous good and the right-hand-side of (14) is the resource available for the traditional sector, which is equal to world supply of the homogeneous good. Therefore, (14) is also the full employment condition of resources.

Equilibrium firm size, firm mass and real return

Using (10) and (11), we have

$$q = \frac{\sigma-1}{c}, \quad (15)$$

and using (7), (8), (13) and (15), we have

$$n = \frac{mR}{\sigma}. \quad (16)$$

It can be confirmed that (15) and (16) satisfy condition (14). Then, equilibrium real return for resource (γ) is

$$\gamma = \frac{r}{G^m p^{T^{1-m}}} = \left[\frac{(\sigma-1) \left(\frac{mR}{\sigma} \right)^{\frac{1}{\sigma-1}}}{\sigma c} \right]^m. \quad (17)$$

This level of γ is achieved globally because there are no trade costs.

3. Import substitution by the developing country

3.1 Assumptions

Import substitution is modeled in the following way: the developing country blocks imports of differentiated goods from the rest of the world. The isolated local market allows infant modern firms to supply the domestic market using local resources. The modern sector of the developing country is technologically disadvantaged. Specifically, it is assumed that $\tilde{c} > c$, where $\tilde{c}$ represents the marginal input requirement of resources in the developing country. Hereafter, variables with tildes represent those of the developing country. The newly created modern firms in the developing country are unable to export, which could be due to factors such as lack of marketing and/or sales channels or higher production costs.

3.2 Trading equilibrium under import substitution

Traditional sector

The homogeneous good is still tradable between the developing country and the rest of the world. Therefore, (9) and (10) still hold.

Modern sector

Analogous to the modern firms in the rest of the world, pricing behavior of the modern firms in the developing country is

$$\tilde{p} \left(1 - \frac{1}{\sigma} \right) = \tilde{c}r, \quad (18)$$

and the corresponding price index of differentiated goods in the developing country becomes

$$\tilde{G} = (\tilde{n}\tilde{p}^{1-\sigma})^{\frac{1}{1-\sigma}} = \tilde{n}^{\frac{1}{1-\sigma}}\tilde{p}. \quad (19)$$

Now that the modern sector exists both in the developing country and the rest of the world,

$$\tilde{p}\tilde{q} - \tilde{c}r\tilde{q} = r. \quad (20)$$

is required in addition to (9).

Market clearing conditions

Market clearing in the homogeneous good requires

$$(1-m)R = R - \tilde{n}\tilde{c}\tilde{q} - \tilde{n} - ncq - n. \quad (21)$$

Market clearing in the differentiated goods in the rest of the world requires

$$q = mp^{-\sigma}G^{\sigma-1}(1-s)R, \quad (22a)$$

and in the developing country

$$\tilde{q} = m\tilde{p}^{-\sigma}\tilde{G}^{\sigma-1}sR \quad (22b)$$

is required.

Equilibrium firm size, firm mass and real returns

Because (10) and (11) still hold, size of a typical firm in the modern sector in the rest of the world remains unchanged, that is, $q = (\sigma - 1)/c$. Using (10) and (20), we have

$$\tilde{q} = \frac{\sigma-1}{\tilde{c}}, \quad (23)$$

meaning that modern sector firms are smaller in the developing country. Substituting q and $\tilde{q}$ into (22a) and using (7) and (8), we obtain

$$n = \frac{m(1-s)R}{\sigma}. \quad (24a)$$

Similarly, substituting (23) into (22b) using (18) and (19) respectively, we have

$$\tilde{n} = \frac{msR}{\sigma}. \quad (24b)$$

Finally, using (15) and (24a) the real return in the rest of the world is expressed as

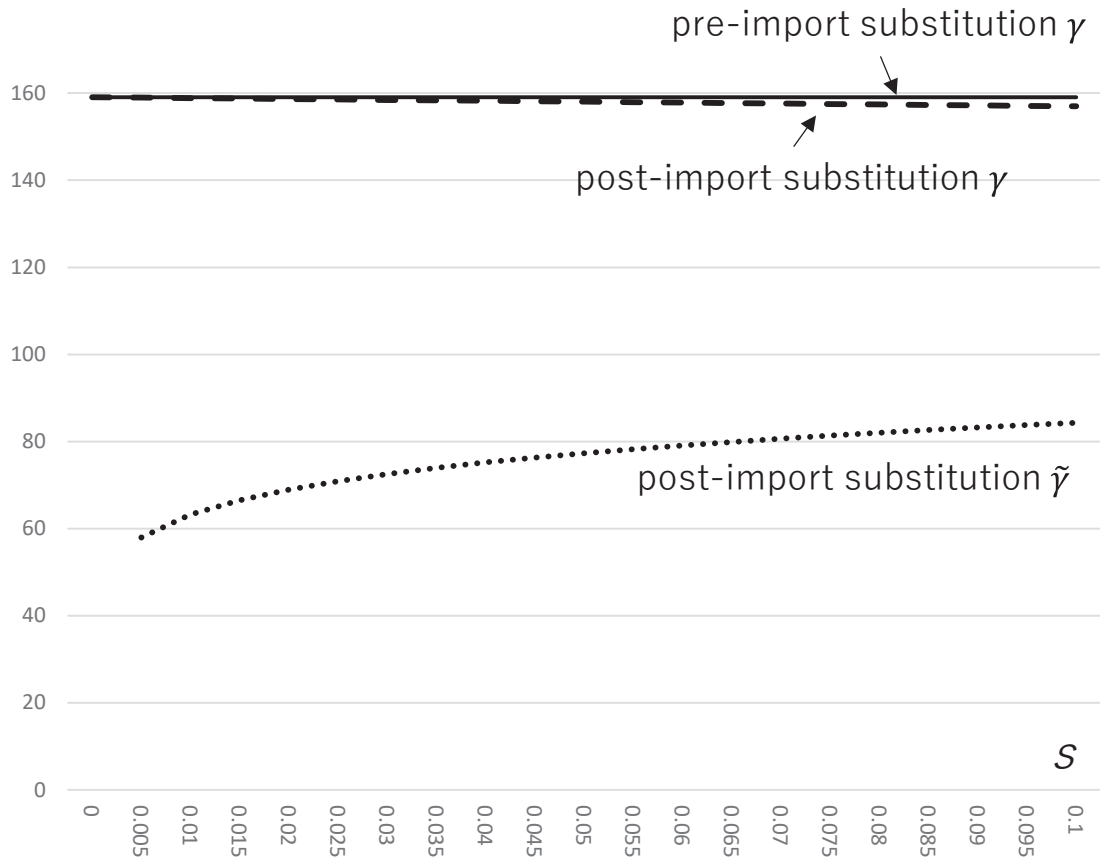
$$\gamma = \frac{r}{G^m p^{1-m}} = \left[\frac{(\sigma-1) \left[\frac{m(1-s)R}{\sigma} \right]^{\frac{1}{\sigma-1}}}{\sigma c} \right]^m. \quad (25a)$$

Using (23) and (24b) the real return in the developing country is

$$\tilde{\gamma} = \frac{r}{\tilde{G}^m p^{1-m}} = \left[\frac{(\sigma-1) \left(\frac{msR}{\sigma} \right)^{\frac{1}{\sigma-1}}}{\sigma \tilde{c}} \right]^m. \quad (25b)$$

Comparison of (24a) and (24b) with (16) indicates that the global mass of modern firm remains unchanged. That is, modern firms newly operate in the developing country but the modern firms in the rest of the world is reduced by the same mass. Resource in the developing country moves from its traditional sector to the modern sector, thereby reducing output of the homogeneous good. (The reduction in homogeneous good output in the developing country is $\tilde{n}\tilde{c}\tilde{q} - \tilde{n} = msR$.) The reduced amount of the homogeneous good, msR , needs to be produced in the rest of the world, by reducing use of resource in the modern sector.

A numerical example of the global consequence of import substitution is shown in Figure 1. In this example, when $s = 0.025$ (size of the developing country is 2.5% of the world), real return is reduced by 55.4% in the developing country, and the rest of the world experiences 0.32% real return loss compared to the pre-import substitution situation. The cost of import substitution is mostly borne by the developing country, but it also harms the rest of the world because the traditional sector in the developing country shrinks as resource is diverted from the traditional sector to the modern sector, requiring the rest of the world to reduce the firm mass or differentiated varieties in the modern sector to increase production in the traditional sector.



Note: graph drawn with $\sigma = 5$, $m = 0.5$, $R = 1000$, $c = 0.0001$, $\tilde{c} = 0.0002$

Figure 1: Numerical example of real return to resource, under various levels of s

4. Concluding Comments

What does import substitution achieve? From the perspective of new trade theory, which focuses on differentiated goods trade, import substitution effectively entails an international decoupling of the modern sector. Trade between the modern sectors in the developing country and the rest of the world does not occur, while trade in the traditional sector induces the rest of the world to adjust to the decreased output of the traditional sector in the developing country by reallocating resources from the modern sector to the traditional sector. This results in welfare losses not only in the developing country but also in the rest of the world.

Advocates of import substitution industrialization supported the policy, particularly for developing countries with large domestic markets. However, as the example shows, while a larger size of the developing country may mitigate the loss from the decoupling of modern sectors, the loss from stopping imports of modern-sector goods would usually be too significant to be compensated by local market size alone.

The infant industry argument for trade protection was well aware of such losses from import substitution. During the period of protection, welfare loss is unavoidable, but it was expected that

the modern sector would grow and later compensate for the loss incurred during protection. However, empirical evidence has shown that such future development of the protected industry is difficult to anticipate. Luzio and Greenstein (1995) illustrate this with the case of Brazilian computers. While computer firms were established during protection in Brazil, they never caught up with existing manufacturers in developed countries. More generally, theoretical considerations by Baldwin (1969) do not support using import tariffs for local industrial development.

References

- Baldwin, Robert E. 1969. "The Case against Infant-Industry Tariff Protection" *Journal of Political Economy*, Vol.73 No.3.
- Bruton, Henry J. 1998. "A reconsideration of import substitution" *Journal of Economic Literature*, Vol.36. No.2.
- Chenery, Hollis B. 1955. "The Role of Industrialization in Development Programs" *American Economic Review*, Vol. 45, No. 2.
- Krueger, Anne O. 1997. "Trade policy and economic development: how we learn" *NBER Working Paper* 5896.
- Krugman, Paul. 1991. "Increasing Returns and Economic Geography" *Journal of Political Economy*, Vol. 99, No. 3.
- Krugman, Paul R., Maurice Obstfeld, and Marc J. Melitz. 2018. *International Economics Theory and Policy*, Pearson.
- Luzio, Eduardo, and Greenstein, Shane. 1995. "Measuring the performance of a protected infant industry: the case of Brazilian microcomputers" *The Review of Economics and Statistics*, Vol.77, No.4.