

THE THEORY OF "SUPPLY-MULTIPLIER"
IN REFERENCE TO
THE POSTWAR ECONOMIC SITUATION IN JAPAN

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The terminology "supply-multiplier" does not appertain to the common property of economics, but the author is compelled to use it to explain the disinflationary process in the postwar economic situation in Japan. The term is applied to the situation of structural under-production as against the Keynesian "investment multiplier" applied to that of structural over-production.

I

As a result of the war and the surrender, Japan lost 44% of her territory, and about 30% of the total structures in Japan proper, including factories and dwellings were destroyed or burnt down by air-raids and subsequent fires. The index of production (mining and industry) fell to 31.7% in 1946 (average of 1933-35=100), and the acreage of the arable land in Japan proper diminished from about 5,800,000 chobu in 1941 to 5,200,000 chobu. Rice fields decreased from 3,180,000 chobu to 2,800,000 chobu (1 chobu=about 2 acres), reducing the rice crops from 55,000,000 koku to 39,000,000 koku (1 koku=about 5 bushels) in 1946. On the other hand, the population in Japan proper increased from 73,000,000 in the year 1940 to about 80,000,000, being augmented by repatriates from the lost territories and foreign countries. Under these conditions of under-production, especially the food shortage, inflation was inevitable. But there was also a considerable volume of unemployment due to the closing of factories and plants engaged in the production of war munition. In these circumstances the government was confronted by two urgent tasks, namely, to re-employ the workers shut out of the closed factories and arsenals as well as to tide over the inflation. In 1946 the Minister of Finance insisted in the 90th Diet on a swollen budget, pointing out that large investments would be necessary in order to attain full employment. "An increase of money and

the soaring of prices under conditions of under-employment is not inflation, even if considered so in the usual sense, and can never be subdued by deflation policies. The main objective under the circumstances, in which the unemployment of workers and other factors of production exist, is to mobilize these factors and recommence productive activities. In order to attain this objective, money inflation is not only not detrimental, but provides the means of a truly sound budget." Although the Minister's intention was prevented by the attacks of anti-inflationists, the opinion he advanced deserves attention because his argument was based on the authority of Keynes, of whom he is an ardent admirer.

Post-war inflation in Japan was almost halted during the second half of the year 1948, although the decisive check appeared to come from the balanced budget and the formulation of the policy sponsored by Mr. Dodge in 1949. The real reasons for overcoming the inflation were, in my opinion, the increase of production and importation of foodstuffs and other material aid from the *Garioa* Fund and *Eroa* Fund of the United States. Production and the excess of imports increased each year as follows:

	(Production 1933-35=100)			Import Excess (million dollars)
	Combined	Mining	Industry	
1945	50.5	65.4	49.5	
1946	31.7	58.6	28.9	202.1*
1947	41.6	78.1	37.2	352.6
1948	57.5	100.0	52.5	424.3
1949	75.8	112.1	71.7	390.7

* From Sept. 1945 to Dec. 1946.

II

The post-war economic situation in Japan, and of other countries which endured war, has been entirely contrary to that from which the Keynesian theory of investment multiplier was derived. Even if there had been considerable unemployment in post-war Japan, larger investments would have been ineffective or effective only in increasing prices, because of the serious shortage of materials and foodstuffs, making production elasticity almost zero. As to the theory of foreign trade multiplier of Mr. Harrod analogous to the investment multiplier, the value of an export or export surplus in these conditions will not generate real income, larger exports increasing the money income but producing also a proportionate rise in prices. Multiplier theories are only effective under conditions of over-production and structural unemployment, and the practical effect

which the theory intends to attain is to create effective demand. The multiplier theory of Keynes, therefore, should rather properly be called the theory of demand multiplier. In the contrary case of uner-production and shortage of materials, the supply side must naturally be taken into consideration and there can be perceived something like the multiplier theory, creating effective supply, and subsequently real income and employment.

Keynes recognized the situation of "true inflation" when new investment is continuously added after *full employment is attained*. Such investment is not only ineffective but injurious because it merely encourages inflation. In the case of over-production and chronic unemployment, monetary investments and an export surplus generate effective demand and create employment. "If the Treasury were to fill old bottles with banknotes, bury them at suitable depths in disused coal-mines which are then filled up to the surface with town rubbish, and leave it to private enterprise on well-tried principles of *laissez-faire* to dig the notes up again,... there need be no more unemployment and, with the help of the repercussions, the real income of the community, and its capital wealth also, would probably become a good deal greater than it actually is."¹ This is a typical formulation of the theory of demand multiplier. In the usual case of Keynes it is assumed that the elasticity of production is greater than unity, and therefore the multiplier effect of investments becomes weaker as the elasticity of production becomes smaller until it has no effect in the case of true inflation. Harrod's foreign multiplier, expressed as $Y=(X+V)\frac{1}{m+s}$, is also ineffective under inflationary conditions.² Aggregate income Y is greater as the multiplicand X (value of exports) is larger and as m (the propensity to import) is smaller. But in true inflation such a condition will raise prices as well as money income, leaving real income unchanged, and if there is some export surplus the real income will be diminished. In this case it can be said that exports may be a loss, and imports an addition to the real national income.

III

If there arises a condition of true inflation due to a shortage of materials and motive power resulting in unemployment, it is necessary to

¹ J. M. Keynes, *The General Theory of Employment, Interest and Money* (London, 1936), p. 129.

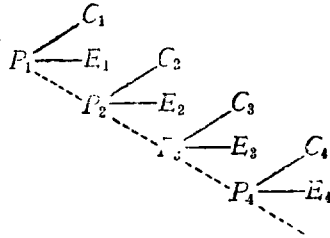
² D. H. Robertson, "Mr. Clark and the Foreign Trade Multiplier," in: *The Economic Journal*, June 1933, pp. 354-356. Here the formulation of Harrod in his *International Economics* is expressed with different indications.

supply such raw materials and means of production through home production, and especially through importation, when the home production of such materials is difficult owing to the lack of capital goods and materials. Here we must consider first the import effect of the materials for production. Some raw materials, it is assumed, are imported on foreign credit. Labour and other factors of production combined with these materials are employed to produce commodities in the first stage of production. Of the manufactured goods of the first stage, some will be directly consumed as consumption goods, such as cotton yarn produced from raw cotton is consumed as sewing-thread, other yarn will be exported, and the remaining part will be utilized in the next stage of production as intermediary goods, thereby labour and other factors are again employed to produce some more complicated manufactured goods. The second stage of production produces commodities of added value, for example, cotton cloth, of which some part will be consumption goods, some part will be exported and the remaining part will be utilized in the third stage of production, in which this process will be repeated. As these processes continue from the first stage of production to higher stages, the imported raw materials diminish in relative value of the whole product, and at last will be extinguished. Then the process which originated from the importation of raw materials comes to an end, having employed much labour and other factors at each stage of production, which would not have happened unless the original materials had been imported.

The process of propagative production at continuous stages can be conceived as unlimited, although it is usually limited to a number of stages of vertical productive processes. Raw cotton is transformed into cotton yarn, then raw cloth—bleached and refined cloth—printed and fancy cloth—cotton dresses, reaching the last stage of consumable goods, the process appearing to have gone through a limited number of vertical stages. But cotton yarn may be transformed into many other productive goods, for example, into fishing nets, which in turn transform their value into fish and fish oil which can be used again as material of production, or into needle cloth applied to comb raw cotton or into tires for motor cars. The original raw cotton imported transfers its value to numerous products produced in unlimited or circulating stages, but with a diminishing ratio of the total value of the new products, until at last, it becomes negligible. This propagative process can be started from raw materials or equipment or some intermediary products, and the real productive processes are composed of several series—cotton series, iron series, coal and electric power series, or some imported machines series.

For the sake of simplification we must extract one series, in which we can express the process as follows, indicating original materials as P_1 , successive intermediary products as P_2, P_3, P_4, \dots and part of the products

which disappear as direct consumption goods as $C_1, C_2, C_3, C_4, \dots$ and those which disappear as export goods as $E_1, E_2, E_3, E_4, \dots$. We can assume that the original imported materials may also be in part directly consumed and exported.



We assume, furthermore, that the value ratio of direct consumption to the value of the products is equal in all stages, or we can take the average ratio of consumption to the whole value of production. Similarly we assume the average ratio of the exported part of the products. We indicate

$$\frac{C_1}{P_1} = \frac{C_2}{P_2} = \dots = h, \quad \frac{E_1}{P_1} = \frac{E_2}{P_2} = \dots = e.$$

Then $1-(h+e)=p$ indicates the ratio of the remaining intermediary goods, and we have the unlimited process of production originated by the imported materials.

$$P_1, P_1\{1-(h+e)\}, P_1\{1-(h+e)^2\}, P_1\{1-(h+e)^3\}, \dots$$

If we indicate the whole value of production throughout the unlimited stages of production as P , we obtain the following formula:

$$P = P_1 \frac{1}{h+e}.$$

The aggregate production P is greater as $h+e$ is smaller or the supply multiplier $\frac{1}{h+e}$ is larger. If $h=\frac{1}{3}$, $e=\frac{1}{3}$, and the value of P_1 is 100, then $P=100 \times \frac{3}{2}=150$. It may be said, therefore, that the materials P_1 imported on credit add more value than 100 to the national supply, from which real national income and employment are derived. The larger supply-multiplier means a longer round-about production, in which process the same material transforming itself into numerous intermediary goods repeatedly provides chances for production employing labour and other factors. Longer round-about production makes the average ratio h and e smaller and $1-(h+e)$ larger. If the products of earlier stages are largely exported or consumed, and do not create further production at higher stages, the average ratio of e and h will be high and the supply multiplier becomes smaller, reducing the value of the whole production and the volume of employment.

As goods for export and consumption consist more and more of refined goods of the higher stages, the average ratio of h and e become smaller, and the supply multiplier larger, producing a higher standard of employment and national income. Naturally in the case of an inflationary situation, fewer exports and larger home consumption will be desirable to suppress inflation and increase real national income. From the above mentioned example, we obtain the value of 150 for the whole process of production, of which one third or 50 is exported, another 50 is consumed, the whole value of the original materials having thus been extinguished. The remaining 50 is the surplus produced over and above the original value, which can be consumed or remain as intermediary goods. As we assumed that the original materials are imported through credit, the real balance of credit may be 50, exporting 50 of the whole product. But in true inflation, the smaller the amount exported the greater the national income.

In the foregoing formulation of the supply-multiplier, the value added to the product at each stage of production is implicitly considered. Intermediary goods transferred to the next stage are transformed into other goods, the value of which is increased by the labour and other factors employed at that stage. There must be also a certain amount of monetary investment to employ such factors of production. This monetary investment is properly the additional investment in the sense of Keynes, having the effect of investment-multiplier increasing effective demand. For convenience we neglect now this monetary investment, but it is important to note that the monetary investment at each stage of production is not autonomous, but is only induced by the additional supply of materials for intermediary goods, without which there can be no opportunity to invest for new production. We assume that at each stage of production a proportion of the given or transferred value of materials is added by the newly employed labour and other factors. Then the value of P_1 at the first stage is added by aP_1 and transformed into $P_1 + aP_1 = P_1(1+a)$. Taking off $h+e=c$ from each stage, the next stage becomes

$$P_1(1+a)(1-c) + aP_1(1+a)(1-c) = P_1(1+a)^2(1-c)$$

then follows

$$P_1(1+a)^3(1-c)^2, P_1(1+a)^4(1-c)^3, \dots$$

Thus the whole production

$$P = P_1(1+a) \frac{1}{1-(1-c)(1+a)}$$

Net production

$$aP = aP_1 \frac{1}{1-(1-c)(1+a)}$$

(stability condition is $0 < (1-c)(1+a) < 1$).

Now if we take $\frac{2}{3}$ for c , 1 for a , 100 for P_1 ,

the whole production = $100 \times (1+1) \times 3 = 600$,

the net production = $100 \times 1 \times 3 = 300$.

aP is the value added in the process of successive production by additional investments, but could not be created if there were no added supply of materials. The remaining part of the whole production consists of the user's cost (in the sense of Keynes) repeatedly applied at successive stages of production, though transformed into various kinds of intermediary goods. This implies not merely the addition in value of the original materials, but the inducement of investments which generate employment and multiply the effective supply. This is the multiplier effect on the supply side just as the total amount of income added of the same income series derived from an investment is conceived as multiplied income in the Keynes' theory.

In the supply-multiplying process we can at least distinguish two cases; one where there exist already plants and equipment for the higher stages of production, but owing to the lack of materials they are at a standstill; another is the case where new establishments start production at higher stages. In the former case, for example, plants and the equipment in the cotton industries from spinning to higher weaving processes are there, but they cannot work due to a shortage of raw cotton. In that case through the additional supply of raw cotton, the different stages of production can successively go into operation, enlarging employment. When energy, as coal and electric power, is lacking, the plants can be vitalized by the supply of the power energy. But in the second case when plants and equipment must first be established, it takes longer to propel production to other stages and a very long time is needed to complete the supply-multiplying process originated by the supply of materials for constructing plants. Thus the supply-multiplier process in the latter case is a process of structural rehabilitation or structural development, enlarging the round-about method of production and the volume of employment.

IV

In times of true inflation as those just experienced in Japan, it is necessary at first to increase the supply of consumption goods. In reality Japanese post-war inflation has been subdued through the importation of foodstuffs through aid from the United States. The real Japanese national income has been increased in a measure as foodstuffs were increasingly imported, thus checking the advance in prices of consumption goods. In this case we may say that the national income Y is composed of home production H of consumption and productive goods $H_c + H_p$, and importation M of consumption and productive goods, deducting exportation X ,

this is $Y=H_c+H_p+M-X$, contrary to Harrod's exposition $Y=H+X+K$, the exposition derived from the back-ground of over-production in the Thirties. K indicates new investment, the effect of which is home production of productive goods H_p . Under conditions of over-production exportation generates not only monetary but also real income, but under inflationary conditions, importation enhances real income even if foreign payments must be made.

The import of consumption goods enhances the national real income under conditions of under-production, but has no multiplier effect according to the theory of the supply-multiplier, say, of productive materials. Ultimate consumption is the leakage of successive intermediary goods. But from another point of view, we can conceive a multiplier effect of consumable goods added by importation. Additional consumable goods increase real income and welfare, which in turn enhance efficiency or productivity of labour, as experienced in post-war Japan. Under post-war conditions labour efficiency was at a very low level compared with the prewar period. Low productivity of labour is partly due to the lack of equipment and materials, but the lack of efficiency of labour was mostly due to a shortage of foodstuffs; wage earners and salaried men were often compelled to go to farmers in the countryside, instead of to their workshops and offices, to get something to eat, or they themselves had to cultivate small patches of land around their houses or anywhere they could find some soil uncultivated. They were both physically and mentally inactive in work and therefore less efficient.

As the ration of foodstuffs increased, and black market prices of food (people could not live on controlled rations) went down, the worker's livelihood became more stable, wages advancing more rapidly than prices. Thus efficiency became gradually higher, as workers could devote themselves to their task without having to search for foodstuffs in exchange for some clothing they really needed for themselves and their family members. When the efficiency of labour increases, production rises, and the greater supply will augment real income and welfare, thus real income and efficiency react on each other successively as cause and effect.

If we assume that the value C' of consumable goods is imported and increases real income, the efficiency of labour will be enhanced by a portion f of C' which in turn augments the supply of consumable goods by the ratio of $C'f$, the supply will successively be propagated as follows:

$$C' + C'f + C'f^2 + C'f^3 + C'f^4 + \dots$$

The aggregate P_c of the supply propagation of consumption goods by the increase of efficiency f can be formulated as:

$$P_c = C' \frac{1}{1-f}$$

Of course, the efficiency ratio f brought about by the increase of real

income is not constant. The ratio may decrease as real income increases to some tolerable level. But we can, in the abstract, assume the average ratio of efficiency increases in proportion to the income increment. In the supply-multiplying process of productive materials, there occurs an efficiency increase due to the improvement of the worker's living condition as well as the additional supply of raw materials. The effect of higher efficiency will shorten the time necessary for the completion of the multiplying process and foster the turn over of the original materials.

V

Theories of investment multipliers and foreign trade multipliers were suggested from over-production and the industrial structure of advanced countries. There is an abundance of supply power and a lack of effective demand, for the creation of which more investments and more exports are required until full employment is attained. On the contrary, there are entirely opposite conditions of structural inflation due to a shortage of materials, productive and consumable, and also to structural under-production of under-developed countries. If it be allowed to distinguish two opposite economic structures, the demand-multiplier is effective in the former and the supply-multiplier in the latter. As regards the foreign trade multiplier, the larger the volume of export or export surplus as multiplicand and the smaller the propensity to import, the more the advanced countries will be prosperous. In structural over-production, large imports may affect home industries, generating unemployment, because the diversification of home industries may produce every kind of goods which may be competitive with imports. On the contrary, for under-developed countries, where chronic under-production prevails, it is necessary to import productive goods, especially capital goods, which will serve to improve the situation and the low level of living. Money investments to create demand will be ineffective, while the productive means are lacking. Moreover, in backward countries an export surplus for the creation of effective demand in the homeland, is unnecessary; to export is only to import, except that the payment of interest and dividends to foreign lenders is postulated. They import as much as they can export.

For advanced countries with structural over-production, a possible export surplus as well as a great volume of export is required from their characteristic economic structure. Keynes' first idea of the foreign trade multiplier put the export surplus as multiplicand, as Robertson formulated it,³ although Harrod's formula indicates the total export as multiplicand. This idea

³ Robertson, *loc. cit.*

derived from the chronic over-production has a savour of mercantilism, as stated by Machlup.⁴

According to the classical theory which presupposed full employment, the gain from foreign trade was the greater importation of goods through exportation than trading countries would otherwise produce in the homeland. This idea of gain by import changed into the idea of gain by export owing to the changed economic structure in advanced countries. But when, as now in England, full employment is attained by domestic policy, mainly after the suggestions of the Keynesian school, it can be said that the theories of the classical school as regards the foreign trade have been reestablished. There is no more over-production and it is not necessary to acquire an export surplus so long as domestic investments and fiscal expenditure can maintain a condition of full employment. Under such conditions imports rather than exports are more essential for the welfare of the people. Exports must, of course, be encouraged in order to have imports, and in these circumstances the supply (=import) multiplier, which creates supply, may be more important and effective than the foreign trade (=export) multiplier which generates demand. Both multipliers of demand and supply are together operating in the usual condition, bringing both demand and supply into equilibrium on a given price level. But under over- or under-production each multiplier has a different effectiveness, and both multipliers, it can be said, are equally effective in both advanced and less advanced countries to achieve full employment on a moderate scale.

The new world order of the United Nations has created new ideas of full employment and the development of backward areas, and has been preparing a new organization, such as the *I. T. O.* to bring about a steadily expanding and balanced world economy. Full employment entails and must entail enlarged importation, while development policies promote export from advanced and imports to backward countries. An expansive equilibrium of the world economy can not be attained without augmenting importation by each country. In such a new post-war world, the foreign trade (=export) multiplier theory, which advocated greater exports and fewer imports cannot be justified without the theory of the supply (=import) multiplier which ensure the multiplying effects of imported goods on the raising of employment and standard of living. The theory of the export-multiplier only cannot be a basis of the expansive equilibrium of the new world economy.

The enlargement of international trade requires that appropriate international divisions of labour shall exist throughout the national economies of the world. There exists no such international division of labour in the present world, as that created by the Industrial Revolution. The present

⁴ Fritz Machlup, *International Trade and National Income Multiplier* (Philadelphia, 1943), p. 212.

world economy consists of national economies which have nearly a homogeneous industrial structure as against the heterogeneous relations between industrial and agricultural countries, which constitute a fundamental international division of labour. Agricultural countries have been, in various degrees, industrialized and industrial countries have proceeded toward reagrization and, in consequence, have led to a world economy of homogenized national economies. Homogeneous industries in the world economy repel each other and lead to mercantile struggles and restraint of international trade.

The way out from this dilemma can be found in a full employment policy in each country, especially in advanced countries through domestic investments and fiscal expenditure. Importation will then increase and some branches of industries will encounter competition of imported goods, and yield a rate of profit below the average rate, although they will benefit by the higher national income and larger effective demand caused by full employment. If import increases are derived from additional effective demand, domestic industries will not suffer by an augmentation of imports. But there will naturally be some prosperous and some less prosperous branches of industries. When there is nearly no unemployment, there gradually occurs a transfer of labour and capital to more prosperous branches, from less prosperous industries, which perhaps are in competition with imports. If there exists considerable unemployment of labour and capital, this shifting of industries cannot happen. Only under conditions of full employment shall we see the transfer of labour and capital from less gainful industries (homogeneous with foreign export industries) to industries (perhaps export industries) of higher profit. This is the structural change according to the theory of the classical school, being the process of the international division of labour, according to which the industrial transfer only occurs from lower profit and wages to higher profit and wages. This process can be called "high transfer" as against "low transfer" which may happen under conditions of large unemployment. Thus we return to the classical theory of international trade if conditions of full employment are attained in each country, where importation is not detrimental but beneficial.

For the less advanced countries, with their economic structure of underproduction, it is a good thing to import as much as they can pay for with exports, or even from borrowings. But they must improve productive methods to increase real income, for which the importation of capital goods is particularly required, if possible, through credits by advanced countries. The round-about process of production brought about by the importation of capital goods is the supply-multiplier effect which generates more employment at the level of higher income. As a consequence of this industrialization in a broad sense, more manufactured goods can be produced, which hitherto were imported from more advanced countries.

The reduced export of manufactured goods of advanced countries is supplemented by the increased export of capital goods and refined goods. For a balanced and expanding world economy it is desirable that the advanced countries shall not emphasize export promotion according to the theory of the foreign trade multiplier, but shall rely upon a domestic policy of full employment which creates a demand for imports and a higher real income, although the supply-multiplier is less effective in advanced than in under-developed countries. At any rate, a balanced and expanding world economy can be created by an increase of importation for which some new theory, as stated above, must be established in place of the theory of the foreign trade multiplier which stresses the importance of exports akin to the theories of mercantilism.⁵

⁵ This article is an extract from the 8th chapter of my book *Structure and Principles of the World Economy* (1950), written in Japanese. The idea of a supply multiplier was first mentioned as "A Proposal of Supply Multiplier—A Critic of the Keynesian Multiplier Theory" in the economic journal *Keizai*, Feb. 1948. In correcting the proof of the present article, I read "Note on the Dollar Shortage" (*American Economic Review*, June 1950, Vol. XL, No. 3, pp. 285-300) by Prof. Wolfgang Stolper, in which the idea of "An Import Multiplier" is put forward. Basically the idea is the same as that of the supply multiplier. I also named the Supply Multiplier Import Multiplier in relation to foreign trade, in contrast with Harrod's foreign trade multiplier, which is named Export Multiplier, just as if the Investment Multiplier were called the Demand Multiplier. I hope in the future to compare Stolper's theory with mine. Here I would like to express my thanks to Assistant Prof. Kiyoshi Kojima for his kind collaboration in formulating the theory.