The *Jyokou Aishi* Story:
An Inconvenient Truth under the Light of General Equilibrium Analysis

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Two seemingly disparate stylized facts exist in Japan's early development period of the 1920s: real wages increasing despite the then WW I depression and the steel industry as engine for economic development diminishing. A simple two-sector general equilibrium model *a la* Hecksher-Ohlin-Stolper-Samuelson (HOSS) is used to interpret these 'observational premises' (Basmann, 1975). We show that if output decreases in the (capital-intensive) steel industry and increases in the other textile industry, the real wages tend to increase. Japan's experiences in the early 1920s and our related empirically interpreted theory may be of particular relevance to the contemporary economic developments in Asia.

Key Words: *Jyokou Aishi*, Japan's economic history and development, capital-labor ratio, general equilibrium theory

JEL Classification Numbers: econ history (N3), econ development (O1), general equilibrium theory (D5)

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I. Introduction

In 1925, Wakizou Hosoi (Japanese male worker, 1897-1925) published a book entitled *Jyokou Aishi*. *Jyokou* means female textile workers, and *Aishi* means pathetic life. Therefore, *Jyokou Aishi* means the miserable life of female textile workers.

The book, if interpreted in terms of economic history, reported the exploitation of labor in effect by capital, and slammed Jokou's low-wage as discriminatory. *Jyokou Aishi* remains as a classic in print, has been a textbook example of how Japan achieved economic development, and has become synonymous with modern poor female workers. In the preface of his book the author Hosoi, a male textile worker himself, mentions that he also worked as a mere 'piece of common slaves'.

The book was very popular and available at school libraries in this writer's youngster days. He would since be kept convinced the Japanese workers in the 1920s had lower disposable income as wages, and capitalists, by contrast, during the same decade had strictly higher income as interests or returns on capital.

In the preface of Hosoi's book the following is also mentioned: 'I'd say the actual situation of Japanese workers must be much/profoundly severer than the situation I am in'. This seems to be a symbolic testimony of the then Japanese sentiment on presumably poor and miserable workers, especially female ones.

Amazingly, the then Japanese workers in the 1920's supposedly poor and miserable were in fact richer than capitalists! Even if wages kept going down with consumer prices then, real wages need not go down. If that was the case, then it may not be so surprising. But what actually was happening was that even nominal wages were rising when consumer price indexes were declining! See Table 1, and Table 2 below.

[Table 1 here]

Nominal or real wages aside, what happened to *relative* factor prices? To answer this more relevant question let us now consider the ratio of nominal wages to interests in the 1920s. It is easily obtained by dividing the nominal wage rates w by the nominal interest r as shown by Table 2.

[Table 2 here]

In short, the Japanese workers in the recession after World War I may have been richer and presumably *luckier* indeed than the so-called capitalists. It is evident from the observation that the ratio of wage to rental income in the factor market increased in the 1920s despite the deep recession that Japan was undergoing. The objective of this paper is to present rationale for those surprising observational premises aforementioned.

We focus attention on the following statement. Japanese economic historian Jyurou

Hashimoto (1996, p.32) stated that the rise in relative wage was made possible because the labor-intensive industry had a comparative advantage after WW I. As asserted by this historian, historical facts remain as follows.

In one example, the output of textiles such as raw silk increased after World War I. See Table 3 below.

[Table 3 here]

According to another Japanese economic historian Takafusa Nakamura (1993, p. 105) the most powerful industry at that time was the textile centering on the production of cotton and silk, and an increasing number of firms entered in the textile industry. That industry had a low barrier to entry and strong domestic demand in the 1920s.

For another example, the output of iron ore in the main islands of Japan decreased after WW I. See Table 4 below.

[Table 4 here]

All these data and the presumably miserable states of workers during this particular period appear surprising and hard to understand, to this writer at least, thereby calling for interpretation. The prime objective of this paper therefore is to apply 'empirically interpreted theory' (Basmann, 1975) to the observational premises aforementioned. In particular we do this within the confines of the two-sector model of general equilibrium *a la* classic HOSS theory while following (Ohta, 2012). We show in particular that if output in the capital-intensive goods sector declines and output in the labor-intensive goods sector increases, the ratio of nominal wage rates to nominal rental rates necessarily increases.

The rest of this paper proceeds as follows. Section 2 presents the basic assumptions of the proposed model. Section 3 presents our analysis and related findings of particular interest. Section 4 concludes with some remarks on possible ferment germ or Biblical 'mustard seeds' of Japan's early economic development.

II. The Model

The 2x2 general equilibrium model is predicted upon the following assumptions:

1) There exist two aggregate sectors of production: a capital-intensive goods sector, called *C*-sector and the other good/labor-intensive goods sectors, called *O*-sector.

2) The heavy industry such as steel belongs to the *C*-sector, and the light industry such as textile belongs to the *O*-sector.

3) Two factors of production, say, capital K and labor L, exist and are used for production of the two goods: C and O.

4) Both endowments of capital K and labor L are given.

5) L units of labor and K units of capital are fully employed for the economy.

6) The economy is competitive everywhere so both product and input markets are characterized by $MU_C/MU_O = P_C/P_O$, where MU_i is the marginal utility, P_i price, respectively, of i (= C, O); and $MP_L / MP_K = w / r$, where and MP_j is the marginal productivity of j (=L, K), in each sector i, w is the rate of wage, and r is the rate of interest everywhere in either labor or

capital markets.

7) The production functions in the two sectors are of constant-returns-to-scale.

8) The marginal rate of technical substitution of capital for labor $\mathrm{MRTS} = -dK/dL$ in each sector of production decreases as the amount of labor increases.

9) The utility function U as a social welfare function depends only on C and O, which is strictly *quasi*-concave.

10) The marginal rate of substitution of C for O $\mathrm{MRS} = -(dC/dO)_{\mathrm{U=constant}}$ is diminishing.

11) The marginal rate of transformation O into C for the society $\mathrm{MRT} = -(dC/dO)_{(K.L)=\mathrm{constant}}$ is increasing.

The assumptions above depict a contract curve CC in the Edgeworth Box Diagram EBD and a production possibility set PPS as below along with relevant/representative iso-utility and iso-quant curves.

[Figure here]

It goes without saying that the final general equilibrium condition of MRS = MRT is required to identify both optimum product mix and factor allocation on PPF and CC curves.

III. Analysis

We are now in position to examine the model set forth above for the purpose of our present inquiry.

Claim: *If output in the steel industry declines and output in the textile industry increases, the ratio of wage rate to rental rate increases.*

Proof:

By Assumption 2) the steel industry belongs to the capital-intensive C-sector, and the textile industry belongs to the other good/labor-intensive O-sector. By Assumption 6), $MP_L / MP_K = w / r$, where w is the rate of wage and r is the rate of interest. These two assumptions combined with Assumptions 4), 5), 7) and 8) yield a *concave* (instead of *convex*) CC curve to slope upward as depicted above. The CC curve in turn combined with the rest of Assumptions 3), 4), 5) and 11) then yields a concave *downward* curve of PPF, also depicted above.

Given these CC and PPF, if output in the steel industry declines and output in the textile industry increases, the white circle point on the contract curve CC must move and relocate toward southwest along the same contract curve CC. If the white circle point moves like that, the slope of a tangent w / r becomes steeper.

(Q.E.D)

IV. Remarks

The contemporary Japanese public appears to be still under the impression that Japanese workers in the 1920s had unambiguously lower disposable incomes as wages than capitalists' counterpart income as interest earnings with higher levels. However, on the contrary, they in fact had enjoyed higher disposable incomes as wages than the then capitalists did as

their counterpart rental income. The life of capitalists and workers would be rugged under the recession. But, the life of capitalists should have been distinctively more miserable than textile workers and the other sector workers, all the more if otherwise protected by regulations, unions, or even other social mores.

If these stylized facts are surprising, our simple theoretical model may sounds more paradoxical than surprising. It shows that if output in the capital-intensive goods sector declines and output in the labor-intensive goods sector increases, then capital-labor ratios in both sectors rise, and the ratio of wage rate to rental rate must increase accordingly. This two-fold proposition in effect requires, however, a proviso that production technologies remain unchanged.

To end this paper, we report a recent case. As reported by Reuters, textile workers in Bangladesh organized demonstrations for higher wages in 2013. Bangladeshi economy may be walking a similar road as Japan did. In 1920s, female textile worker *Jyokou* also went on strikes.

Tables

Table 1

Declining trend in the consumer price index after WW I

Year y	Prices p	y/y	Year y	Prices p	y/y
1919	138		1925	132	1%
1920	144	5%	1926	126	-5%
1921	132	-8%	1927	124	-2%
1922	130	-2%	1928	119	-4%
1923	129	-1%	1929	116	-2%
1924	130	1%	1930	104	-10%

Unit: 1934-1936 prices averaged/normalized to 100

Source: Ohkawa *et al*. (1966, p. 135) estimated.

Table 2

Relative wages increasing despite the then depression

Year	Nominal Rate of Interest r	Nominal Wages w	w/r
1918	91	166	1.82
1922	131	348	2.66
1926	125	364	2.91
1930	93	327	3.52
1934	78	307	3.94

Unit: 1910-1914 prices averaged/normalized 100

Source: Okazaki (1993, p. 21) estimated data on wage and interest.

Table 3

Output of raw silk increasing after WW I

Year	Output	Year	Output
1917	5317568	1924	7577170
1918	5795542	1925	8284317
1919	6359761	1926	9101310
1920	5833854	1927	9880306
1921	6238796	1928	10584232
1922	6397704	1929	11292399
1923	6756040	1930	11365026

Unit: Kan (=3.75kg)

Source: Estimated by Ministry of Agriculture and Forestry (1933, p. 60)

Table 4

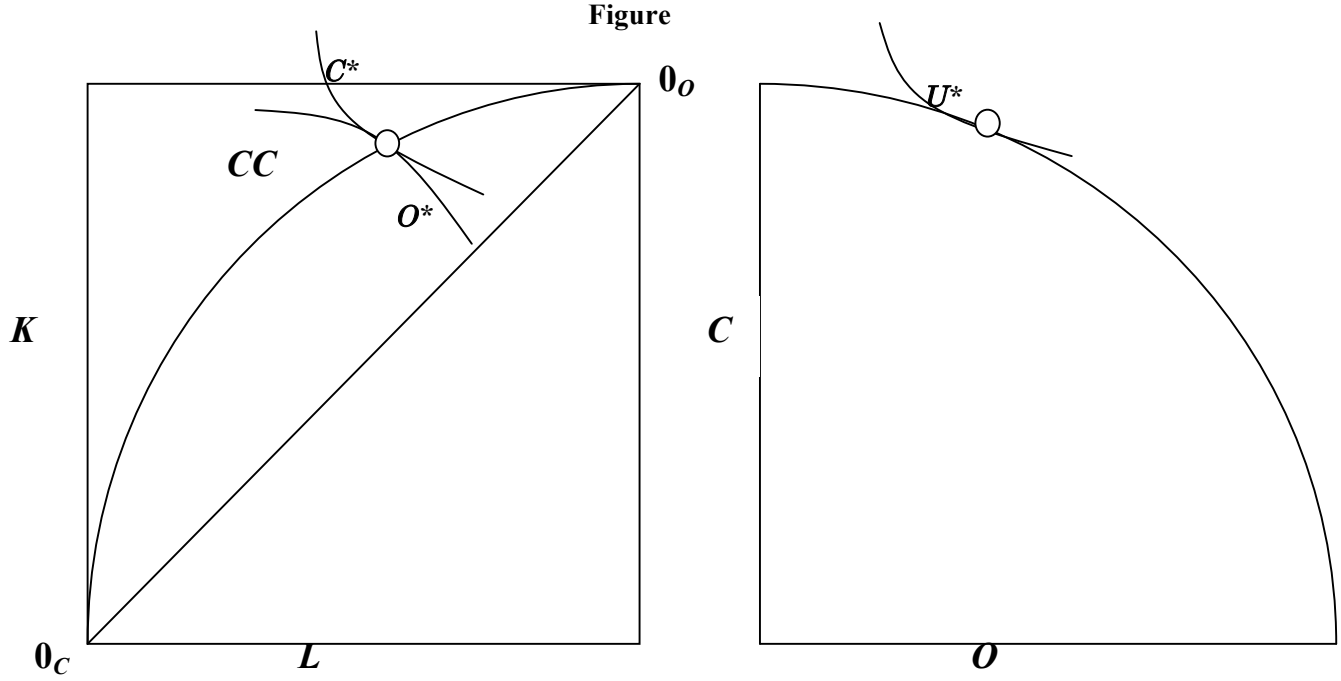
Output of iron ore decreasing after WW I

Year	Output	Year	Output
1917	267594	1924	57922
1918	378114	1925	75765
1919	362949	1926	130420
1920	314858	1927	159005
1921	86977	1928	157706
1922	39744	1929	177556
1923	55174	1930	245991

Unit: Ton

Source: Estimated by Mine Office of Department of Commerce and Industry (1935, p. 1)

Figure



(a) CC and an Optimal Allocation of Inputs (b) PPF and an Optimal Mix of Outputs

Figure **EBD and PPS**

Figure (a) shows that both capital K and labor L are efficiently allocated between the two sectors in the productions of C^* and O^*. Figure (b) shows that the consumers maximize utility U^* by choosing their (national) optimal bundle (C^*, O^*).

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