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Distortions in Factor Markets and Structural Adjustments in the Economy

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Abstract

In this paper, we carry out qualitative and quantitative analyses of impacts of factor market distortions on Japan's economic stagnation in the 1990s, thereby showing that resolution of structural impediments is essential for sustained economic growth to be restored in the future. Distortions in factor markets lead the economy to exhibit inefficient resource allocations, resulting in an inward shift of the nation's production possibility frontier and decline in its attainable output. Our estimation results reveal that the deterioration of distortions in factor markets is attributable to 0.5% of the decline in real GDP growth (–3.6%) after the bursting of the asset price bubble. This confirms that the exacerbation of structural impediments in factor markets is one of the major causes of the prolonged economic stagnation after the bursting of the asset price bubble. Moreover, given that autonomous resolution of factor market distortions through market mechanism is hardly expected, it is important to take measures to achieve a more efficient allocation of productive resources. Without such measures, monetary and fiscal policies cannot push the economy back to a sustainable growth path.

Key words: Structural Problems; Heckscher-Ohlin Model; Specific Factor Model; Production Possibility Frontier; and Total Factor Productivity (TFP).

JEL classification: E6, F11, O47

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I. Introduction

In this paper, we carry out qualitative and quantitative analyses on the impacts of factor market distortions on Japan's economic stagnation in the 1990s. Our analyses suggest that the resolution of the structural impediments is essential to restore sustained economic growth in Japan.

In the "lost decade" of post-bubble in Japan, the average economic growth rate substantially dwindled to 1.2% between 1991 and 2002 from 5.0% in the period from 1986 to 1990. Under such circumstances, many economists conducted theoretical and empirical studies to identify significant factors hampering sustainable economic growth in Japan. In this line of research, it is often argued that major factors behind the long-lasting economic stagnation were the failure of monetary and fiscal policies, and the problem of non-performing loans that led to malfunctioning financial intermediation triggered by the bursting of the asset price bubble. In addition, structural impediments were also pointed out as other major factors, although their definition varies from person to person.

Regarding structural impediments, Maeda, Higo and Nishizaki (2001) categorize sources behind the problems into four categories: (1) rigid corporate governance;[1] (2) inefficiency of the non-manufacturing sector; (3) the issue of non-performing assets associated with the generation and bursting of the asset price bubble; and (4) the savings-investment imbalance.[2] They argue that all of these factors are "factors preventing the efficient allocation of resources," based on detailed analysis of individual factors behind structural impediments.

In this paper, we turn our attention to macroeconomic aspects of the problem by focusing on "inefficient allocation of resources resulting from factor market distortions" itself, rather than individual factors behind the structural impediments. More precisely, we present qualitative and quantitative analyses of the impact of inefficient factor

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1 Regarding this issue, Kameda and Takagawa (2003) compare the distribution of returns on assets (ROA) for Japanese companies with that for Western and Asian companies. They show that the ROA distribution for Japanese companies has a lower variance and a steeper kurtosis than that of foreign companies and conclude that this pattern is evidence of the lack of corporate governance in Japanese companies.

2 Maeda, Higo and Nishizaki (2001) give a more comprehensive analysis on structural problems. Unfortunately, this paper is only available in Japanese.

allocation induced by factor market distortions on Japan's economy. To this end, we rely on theoretical studies in trade theory on the effects of distortions in the economy, especially focusing on factor market distortions. Many trade theory economists conducted intense theoretical studies on the effect of distortions in the economy, including imperfect competition, externality of production and consumption, and factor market distortions, as well as policy measures to resolve such distortions, during the 1960s and the 1970s.

We first survey developments in trade theory literature, which introduced factor market distortions and shed light on the mechanism through which they affect the macroeconomy.[3] We then extend the conventional growth accounting framework into incorporating the effect of factor market distortions. Based on this framework, we empirically show the extent to which structural problems have been responsible for post-bubble economic stagnation since the 1990s. Finally, we explore how structural problems cannot be resolved autonomously through the market mechanism and discuss its policy implication.

This paper is structured as follows. In Section II, we review trade theory research conducted during the 1960s and the 1970s, which studied the impact of factor market distortions on the production possibility frontier of the economy. In Section III, we examine the development of factor market distortions in Japan after the bursting of the asset price bubble, and conduct a quantitative analysis of their effects on Japan's economic stagnation. In Section IV, we summarize previous studies on the impact of factor market distortions on factor prices, and then investigate whether such distortions can be resolved autonomously through the market mechanism. In Section V, we offer a concluding discussion emphasizing implications for monetary policy.

II. Effects of Factor Market Distortions on the Production Possibility Frontier

In this section, we explore the effects of factor market distortions on the economy's production possibility frontier, based on the theoretical development in trade theory

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[3] This paper offers an analytical framework designed only to quantify the impact of factor market distortions on the macroeconomy. For a more comprehensive explanation of trade theory, see textbooks such as Caves, Frankel and Jones (1996).

during the 1960s and the 1970s. We then examine the relationship between changes in the production possibility frontier induced by factor market distortions and total factor productivity (TFP).

The effects of various types of distortions on the economy were intensively studied in trade theory during the period from the 1960s through the 1970s. The distortions examined in these studies were imperfect competition, externalities of production and consumption, and factor market distortions. In addition, policy measures to resolve such distortions were also studied in this line of research.

Among the aforementioned distortions, this paper focuses on the factor market distortions.[4] Major distortions in factor markets, addressed in the previous studies, are (1) factor immobility and (2) intersectoral differentials in factors' marginal productivity (factor prices).[5] The existence of such factor market distortions modifies the theoretical conclusions derived under the assumption of perfect factor markets.

Below, we employ the Heckscher-Ohlin model (hereafter referred to as "H-O model"), in which a perfect factor market and efficient resource allocation are assumed, as a benchmark case to show how a distortion-free economy adjusts to changes in relative prices.[6] We then introduce factor immobility and intersectoral differentials in

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[4] Trade theory research has examined many issues related to economic distortions including factor market distortions. For example, Bhagwati (1971) studies the measures to resolve distortions, and demonstrates that an optimal policy is one that directly attacks the source of each distortion. That is, the optimal policy for the case of wage differentials is a factor tax-cum-subsidy. Moreover, some economists studied the relationship between economic distortions and immiserizing growth. Immiserizing growth denotes a situation where growth in a large country due to technological progress leads to sufficiently acute deterioration in its terms of trade, which imposes a loss of real income outweighing the primary gain in real income due to its growth (Bhagwati [1958]). Bhagwati (1968), however, demonstrates that even in a small country with economic distortions, immiserizing growth can occur although it cannot influence world goods' prices.

[5] Harberger (1962) addresses intersectoral factor price differentials, by analyzing the effect of a corporate income tax on factor prices and income distribution. Johnson and Mieszlowski (1970) study the impact on factor prices of a wage increase in one sector relative to others. Furthermore, Johnson (1966) demonstrates that factor price differentials influence the shape of the production possibility frontier of the economy. Jones (1971b) synthesizes these studies to theoretically show that factor price differentials influence factor prices and the production possibility frontier. See B. of this Section for the details of Jones (1971b).

[6] The H-O model was proposed by Heckscher (1949) and Ohlin (1933) and named after these prominent economists.

factors' marginal productivity into the H-O model to explore how factor market distortions change the shape of the production possibility frontier and influence economic adjustments in response to changes in relative prices.

In the discussion below, the economy we assume consists of two sectors, an *M*-commodity sector and an *N*-commodity sector. We also assume that both sectors use capital and labor to produce each commodity under perfect competition.[7]

A. Perfect Factor Markets

The H-O model assumes perfect factor markets and complete factor mobility. Thus, it can be regarded as a long-term economic situation.

In the H-O model, the economy's production possibility frontier --- the locus of efficient production points --- is smoothly concave. If the relative price of *M* and *N* change, the combination of output of *M* and *N* moves along the production possibility frontier. The production expands with a relative price increase and falls with when relative price declines, since capital and labor move to a sector with increased relative price from a sector with declined relative price.

B. Factor Market Distortions

1. Factor immobility

In contrast to the H-O model's assumption of perfect factor mobility of both capital and labor, let us assume labor moves freely between the two sectors, while capital is a specific factor to each sector. That is, capital is fixed in a distinctive sector in the short term, but can move between the two sectors over time. This model is called the specific factor model (Jones [1971a]).

Suppose factor endowment is identical in the H-O model and the specific factor model. Then, the maximum output of the two commodities in the specific factor model is less than that in the H-O mode, since the specific factor model assumes factor immobility. This implies that the economy's production possibility frontier of the specific factor model is located inside the H-O model.

Formally, the H-O model's production possibility frontier is the envelope of the

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[7] We also assume that each production function exhibits constant return to scale and is homogenous of degree one, and that each goods is produced in a distinctive production process, i.e., no joint production.

specific factor model (see Figure 1).[8] While the H-O model represents a long-term economic situation, the specific factor model can be regarded as a shorter-term economic situation where labor, but not capital, moves freely between the sectors.

When a relative price between two commodities changes, capital and labor move to the sector with increased relative prices in the H-O model but only labor can move in the specific factor model. Thus, the change in the output of each commodity in response to a given change in a relative price in the specific factor model is less than that in the H-O model.

Figure 1 shows the above point as well. We can see from the figure that the efficient allocation is achieved at point *A* under the current relative price. If the relative price of commodity *M* to *N* increases, then the economy shifts from point *A* to point *C* in the H-O model, while, in the short-term, it just shifts to point *B* in the specific factor model.[9]

2. Intersectoral differentials in factors' marginal productivity

We regard the differentials in factors' marginal productivity across sectors as an indicator of the degree of factor market distortions, including the aforementioned factor immobility. When factor markets are perfect and the quality of productive factors is the same across sectors, factor's marginal productivity is equalized across sectors. Moreover, when factor markets are imperfect due to reasons such as regulations, differences in the bargaining power of labor unions across sectors, or factor immobility, marginal productivity is not equalized across sectors.[10]

We summarize the effect of factor price differentials on the production possibility frontier, based on Johnson (1966) and Jones (1971b). They analyze how the shape of the production possibility frontier is influenced by intersectoral

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[8] Production decisions under the H-O model can be interpreted as the following optimization problem: output maximization under the constraint of constant relative prices. Meanwhile, in the specific factor model, production is determined by output maximization under the two constraints of (1) constant relative prices and (2) constant capital endowment in each sector. Thus, the envelope theorem proves the H-O model's production possibility frontier is the specific factor model's envelope.

[9] Note that in the case of perfect factor immobility, the production possibility frontier can be drawn as a rectangle with point *A* as one of the apexes (the Leontief production function). In this case, even if the relative price of each commodity changes, the output of each commodity remains constant.

[10] See Section IV on this point.

differentials in factor prices caused by regulations or labor unions.

Figure 2 depicts the Edgeworth box diagram for the two-commodity (commodities *M* and *N*) and the two-factor (labor and capital) case. In the construction of this diagram, the lengths of the vertical and horizontal axes correspond to labor and capital endowments, respectively. *M* is assumed to be capital-intensive sector and *N* the labor-intensive one.[11] *MM* and *NN* are isoquants. The distance from O_M (O_N) to *MM* (*NN*) corresponds to the output of *M* (*N*). Tangency occurs at point *A*: relative factor prices for labor and capital are equal between the two sectors *M* and *N*, and the *MM* and *NN* curves are tangent to one another. Efficient allocations are achieved on the locus of tangencies, or the contract curve O_MAO_N.[12]

If factor prices differ between two sectors due to regulations or other reasons, then short-term equilibrium is achieved at point *B*, the intersection, not tangency, of the *M′M′* and *NN* curves. The output of *N* at point *B* equals that at point *A*, since both points are on the same isoquant *NN*. The output of *M* at point *A* is less than that at point *B*, because the *M′M′* curve is closer in distance to O_M than the *MM* curve. This indicates that the intersectoral factor price differentials induce an inward shift in the production possibility frontier.

Let us closely examine the shape of the production possibility frontier under the intersectoral factor price differentials. When either *M* or *N* is being solely produced, the output is the same regardless of whether factor prices differ or not between the sectors. Therefore, as Figure 3 shows, if factor price differentials exist, the production possibility frontier becomes less concave, compared with that of the H-O model, or, in a more extreme case, it becomes convex rather than concave to the origin.[13]

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[11] In this paper, capital-intensive commodity and labor-intensive commodity are defined as follows. Let us denote capital and labor input necessary to produce one unit of commodity *M* as a_{KM} and a_{LM} respectively (the same is applicable to commodity *N*). Accordingly, $a_{KM}/a_{LM} > a_{KN}/a_{LN}$ means commodity *M* is capital-intensive and commodity *N* is labor-intensive. That is, when capital input necessary to produce one unit of one commodity exceeds that to produce the other, the commodity is capital-intensive. In addition, when labor input necessary to produce one unit of one commodity exceeds that to produce the other, the commodity is labor-intensive.

[12] The contract curve is above the diagonal O_MO_N, since commodity *M* is capital-intensive and commodity *N* is labor-intensive.

[13] Johnson (1966) simulates the effect of factor price differentials on the shape of the production possibility frontier. Jones (1971b) theoretically demonstrates these changes. He shows that in the

C. Implications for TFP Measurement

The aforementioned argument that factor market distortions induce an inward shift in the production possibility frontier has an important implication for the measurement of TFP in growth accounting.

The conventional framework of growth accounting assumes perfect factor markets, and regards differences between realized economic growth and the contribution of growth in productive factors as TFP. Thus, if factor market distortions actually exist, they are most likely to overestimate the contribution of productive factors. In such cases, estimated TFP is the sum of the true effect of technological progress and the negative effect of factor market distortions to economic growth.[14]

For example, Hayashi and Prescott (2002) implicitly assume perfect factor markets and calibrate the Japanese economy using a Cobb-Douglas aggregate production function. Their estimation results show that a decline in working hours and TFP growth can account for Japan's long-lasting stagnation in the 1990s. They conjecture that the decline in TFP growth results from a policy that subsidizes inefficient firms and declining sectors.

The conventional growth accounting framework, however, cannot offer a 'true' quantitative account for the slowdown in technological progress and the aggravation of structural problems, thereby overstating the decline in TFP growth. In exploring the causes of Japan's economic stagnation in the 1990s onwards and implementing necessary economic policies, it is important to gauge to what extent structural problems are responsible for the economic stagnation.

Below, we extend the conventional framework of growth accounting to incorporate the effects of structural impediments in the form of factor immobility as

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extreme case where factor price differentials are so large that the labor share of capital-intensive *M* is higher than that of labor-intensive *N*, production of the commodity with the increased relative price falls while production of the commodity with the declined relative prices expands. In other words, the production possibility frontier becomes convex to the origin. Furthermore, he clarifies that in the case where factor price differentials are not so large that the labor share of capital-intensive *M* is smaller than that of labor-intensive *N*, production of the goods with rising (falling) relative prices increases (decreases) more than indicated by the H-O model. It implies that in this case, the concavity of the production possibility frontier is smaller than that in the case with perfect factor markets (the H-O model).

[14] Therefore, in this framework of analysis, if TFP is narrowly interpreted to represent only technological progress, it underestimates the contribution of technological progress to economic growth.

well as factor price differentials. Then, we show the estimation results on Japan's economic stagnation in the 1990s onwards, based on this framework.

III. Empirical Analysis on Factor Market Distortions and Their Effects

In this section, we first examine changes in factor immobility and intersectoral differentials of factor's marginal productivity after the bursting of the asset price bubble. In addition, we extend a conventional growth accounting framework to incorporate the negative effects of factor market distortions. We then employ an extended growth accounting framework to estimate the impacts of such distortions on Japan's economic stagnation.

A. Factor Market Distortions in Japan

In this subsection, we use Japan's data to examine changes in intersectoral factor mobility and differentials in factor's marginal productivity after the bursting of the asset price bubble.

1. Factor immobility

Miyagawa (2003) analyzes intersectoral labor mobility based on the measure proposed by Lilien (1982) (Lilien's index),[15] and shows that labor mobility has continued to decline after a temporary increase in the early 1990s (Figure 4).[16] We also compute Lilien's index for capital mobility and show that it has continued to decline since the

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[15] The Lilien's index is defined as follows:

$$\sigma_L = \left[\sum_{i=1}^{n} S_i \left(\frac{\Delta L_i}{L_i} - \frac{\Delta L}{L} \right)^2 \right]^{1/2}.$$

Here, S_i and L denote the share of labor input used in sector i and the total labor input in the economy, respectively. Thus, σ_L indicates the extent to which changes in labor input used in individual sectors diverge from changes in the total labor input in the economy. Note that Lilien's index has its limitation that it only shows the extent of relative divergence of changes in labor input shares used in individual sectors compared with that of the economy. Thus it may not be a useful index in the presence of shocks whose effects are different from period to period.

[16] Labor mobility during the bubble period and during the post-bubble period are almost the same. Their effects on the economy are, however, completely different. That is, during the post-bubble period, the non-manufacturing industry, whose productivity is relatively low, increase employment. Therefore, it follows that the labor allocation during the post-bubble period became less efficient than during the bubble period. This point will be discussed in detail later in this paper.

early 1990s (see Figure 5). As shown in these figures, factor immobility, particularly in capital, has worsened and productive factors have become locked-in after the bursting of the asset price bubble.

2. Intersectoral differentials in factor's marginal productivity

Next, we examine the intersectoral differentials in factor's marginal productivity.[17] Suppose the production function of each sector is homogeneous of degree one and is defined by the equation,

$$Y_i = A_i F_i(K_i, L_i),$$

where the subscript i denotes sector, and Y, A, K, and L represent output, TFP, capital stock, and labor input, respectively. Dividing the above equation by labor input yields labor productivity ($y = Y/L$) which can be expressed by the capital-labor ratio ($k = K/L$) as follows:

$$y_i = A_i f_i(k_i),$$

where $f_i(k_i)$ is $F_i(K_i/L_i, 1)$.[18] Since the ratio of wages (w_i) to rate of return on capital (r_i) in sector i is equal to the ratio of labor's marginal productivity to capital's marginal productivity, the following equation holds:

$$\frac{w_i}{r_i} = \frac{f_i(k_i) - f_i'(k_i)k_i}{f_i'(k_i)}. \tag{1}$$

The labor share in sector i (α_i) equals $1 - f_i'(k_i)k_i / f_i(k_i)$, and the capital share ($1-\alpha_i$) equals $f_i'(k_i)k_i / f_i(k_i)$. Using these, equation (1) can be transformed as follows:

$$w_i / r_i = a_i k_i, \tag{2}$$

where a_i corresponds to $\alpha_i/(1-\alpha_i)$. Under perfect factor markets, the ratios of wage to rate of return on capital are identical in all sectors. In the discussion below, we assume the ratio of wage to rate of return on capital for sector i is $1/\gamma_i$ times that of the base

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[17] The following measurement approach of intersectoral factor price differentials is based on Johnson (1966). Johnson (1966) assumes the production functions for each sector to be Cobb-Douglas functions, while this paper assumes they are more general functions that are homogeneous of degree one.

[18] In the following discussion, it is assumed that the Inada's condition holds, i.e., if $k_i \to 0$, $f'(k_i) \to \infty$ and if $k_i \to \infty$, $f'(k_i) \to 0$.

sector (i=1, γ_1=1). In this case, the ratio of relative factor prices in sector i to the base sector can be expressed as follows:

$$a_1 k_1 = \gamma_i a_i k_i . \tag{3}$$

γ_i =1 implies that the marginal condition holds between these sectors. If γ_i exceeds unity, then sector i has a lower capital-labor ratio than the base sector. That is, labor input is too large and/or capital stock is too low. Conversely, if γ_i is less than unity, it means capital-labor ratio of sector i is too high.

Figure 6 compares the estimates of γ for each sector between the bubble period and the post-bubble period.[19] In this figure, we employ the electric machinery industry as the base sector to compute γ, based on our presumption that the electric machinery industry is the most efficient among all the industries in Japan. It should be noted, however, that basic results are generally unaffected by changes in the definition of base sector.[20]

We can see from the figure that the estimates of γ for the manufacturing industry, except food products/beverages, remain almost unchanged. In contrast, those for many sectors in non-manufacturing industry, such as agriculture/forestry/fishing, construction, wholesale/retail trade, financial/insurance, and services activities, are much higher than unity. Moreover, their deviations from unity increase in the post-bubble period. This observation implies that the capital-labor ratios for these sectors remain considerably below the optimum level that the marginal condition indicates (either capital accumulation has been too small or labor input has been too

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[19] In this paper, the bubble period is defined as the period between 1986, following the Plaza Accord (1985), and 1991 when land prices peaked. The post-bubble period is defined as the years after that.

[20] We examined the robustness of our estimates of γ against the two alternative definitions of base sector. The first alternative definition is the time trend of ak for the electric machinery industry. Estimates of ak for each industry generally move upward and downward around the linear trend. This reflects trend component of capital deepening over time and temporal component of short-term shocks to each industry. Thus, the time trend of ak for the electric machinery industry reflects the efficient state of capital deepening after removing the effects of temporal shocks. When we employ the estimates of γ based on this definition of base sector, the results shown in Figure 6, however, remain almost unchanged.

Another alternative definition is the average of all industries for each year. It should be noted that the degree of distortion in base sector varies over time when we employ this definition. Particularly, considering the fact that distortion in non-manufacturing industry worsens in the 1990s, it is most likely to underestimate the worsening of distortions in non-manufacturing industry.

large).

Significant rises in the estimates of γ for food products/beverages, and some sectors in the non-manufacturing industry in the post-bubble period seem to be related to regulations. In fact, these sectors are still protected by many regulations, i.e., import restrictions in agriculture/forestry/fishing and food products/beverages, and entry restrictions and other anti-competitive policies in non-manufacturing industry. As a result of such regulations, the rates of return on capital of these sectors are higher and the capital-labor ratios of these sectors are lower (estimates of γ are higher) than those of many sectors in the manufacturing industry.[21] In contrast, advances in deregulation and globalization enhance domestic and international competitive pressures in the manufacturing industry.

B. Empirical Analysis of the Effects of Distortions

1. Previous research

As mentioned in the preceding subsection, most empirical studies on Japan's economic stagnation since the early 1990s are generally based on the assumption of perfect factor markets, and ignore the effect of worsening factor market distortions. To cope with this problem, Miyagawa (2003) employs Syrquin's (1986) methodology to decompose labor productivity into three factors: capital accumulation, TFP and intersectoral labor immobility.

Suppose there are n sectors in the economy. Then, labor productivity, y ($=Y/L$), is expressed as follows:

$$y = \sum_{i=1}^{n} y_i S_i ,$$

where S_i denotes the share of labor input in sector i. Transforming the above equation into the growth rate yields equation (4) below:[22]

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[21] As discussed later, the fact that estimates of γ in food products/beverages and some sectors in the non-manufacturing industry show no sign of improvement may reflect that the factor market distortions cannot be resolved autonomously.

[22] In deriving equation (4), the production functions for individual sectors are assumed to be homogeneous of degree one as discussed in subsection *A* of this section.

$$\begin{aligned}\frac{\Delta y}{y} &= \sum_{i=1}^{n} \frac{\Delta y_i}{y} S_i + \sum_{i=1}^{n} \frac{y_i}{y} \Delta S_i \\ &= \sum_{i=1}^{n} \frac{Y_i}{Y} \frac{\Delta y_i}{y_i} + \sum_{i=1}^{n} \frac{y_i}{y} \Delta S_i \\ &= \sum_{i=1}^{n} \frac{Y_i}{Y} \left((1-\alpha_i) \frac{\Delta k_i}{k_i} + \frac{\Delta A_i}{A_i} \right) + \sum_{i=1}^{n} \frac{y_i}{y} \Delta S_i \,,\end{aligned} \tag{4}$$

where k, A, and α represent the capital-labor ratio, TFP, and labor share, respectively. This equation shows that changes in labor productivity of the economy depend not only on changes in the accumulation of capital (where labor input is fixed in each sector) and TFP in each sector, but also on changes in the labor input share among sectors. It also implies that a shift of labor reallocation to higher labor productivity sectors raises aggregate labor productivity.

Miyagawa (2003) decomposes labor productivity based on equation (4) to show that the decline in aggregate labor productivity growth in Japan in the 1990s is attributable not only to a lower TFP growth in individual sectors, but also to the deterioration of labor mobility (Table 1).

2. Effect of factor market distortions on GDP growth

In addition to declined labor mobility, noted by Miyagawa (2003), misallocation of productive factors is also likely to be another root for long-lasting stagnation in Japan. In fact, any misallocation of productive factors induces intersectoral differentials in factors' marginal productivity, thereby causing an inward shift of the production possibility frontier and lowering labor productivity.

Next, we consider incorporating the effects of intersectoral differentials of the marginal productivity of capital as well as the decline in labor mobility within a growth accounting framework. In doing so, although Miyagawa (2003) uses the number of workers as labor input, we alternatively use a product of the number of workers and their average work hours as labor input for greater accuracy. Thus, in our analysis below, S_i in equation (4) indicates the share of labor input in sector i on a man-hour basis.

In the discussion below, we first present a conventional formulation of GDP growth decomposition incorporating no distortions in factor markets. Then, we offer an extended formulation with distortions in factor markets. By comparing these two formulations, we can clearly see the influence of factor market distortions on GDP

growth decomposition as well as TFP, with or without factor market distortions.

GDP (Y) is expressed using labor input of the economy, labor input share of each sector, and labor productivity of each sector, as follows:

$$Y = \sum_{i=1}^{n} Y_i = \sum_{i=1}^{n} LS_i A_i f_i(k_i), \tag{5}$$

where Y_i and L denote real output of sector i and labor input of the economy, respectively. In addition, the production functions of each sector are assumed to be homogeneous of degree one. Transforming equation (5) into a growth rate form yields equation (6) below:

$$\frac{\Delta Y}{Y} = \sum_{i=1}^{n} \frac{Y_i}{Y} \frac{\Delta A_i}{A_i} + \frac{\Delta L}{L} + \sum_{i=1}^{n} \frac{LS_i A_i f_i(k_i)}{Y} \frac{\Delta S_i}{S_i} + \sum_{i=1}^{n} \frac{LS_i A_i f_i'(k_i) k_i}{Y} \frac{\Delta k_i}{k_i}. \tag{6}$$

The capital-labor ratio for the economy, k, is expressed as the labor input share weighted average of capital-labor ratios of an individual sector. The sum of labor input shares of every sector is equal, by definition, to unity. Therefore, equations (7) and (8) are derived as:

$$k = \sum_{i=1}^{n} S_i k_i, \tag{7}$$

$$\sum_{i=1}^{n} S_i = 1. \tag{8}$$

Since the wage (w) and the rate of return on capital (r) are identical in all sectors where there are perfect factor markets, equations (9) and (10) hold.

$$f_i'(k_i) = r, \tag{9}$$

$$f_i(k_i) - k_i f_i'(k_i) = w. \tag{10}$$

Substituting equations obtained through total differentiation of equations (7) and (8), and equations (9) and (10) into equation (6) yields the following equation that breaks down GDP growth rate, in the case for a perfect factor market:

$$\frac{\Delta Y}{Y} = \sum_{i=1}^{n} \frac{Y_i}{Y} \frac{\Delta A_i}{A_i} + \frac{\Delta L}{L} + (1-\alpha) \frac{\Delta k}{k}, \tag{11}$$

where α denotes the labor share of the economy. Equation (11) shows that GDP growth rate can be divided into TFP growth effects of each sector, and an increase in

labor input and capital stock of the economy if the factor markets are perfect.

Next, we break down GDP growth rate where factor markets are distorted. Suppose the ratio of wage to return on capital of sector i is $1/\gamma_i$ times as high as that of the base sector as in subsection A of this section. In this case, equations (9) and (10) do not hold but equation (3) holds. From equations (3) and (7), the capital-labor ratio of sector i can be expressed by k, γ, and S as follows:

$$k_i = k \Big/ \sum_{m=1}^{n} S_m \frac{\gamma_i a_i}{\gamma_m a_m}. \tag{12}$$

Here, γ_1=1 holds by definition. Equation (12) indicates that given labor shares in each sector, the capital-labor ratio of each sector is determined by the capital-labor ratio for the economy, intersectoral factor price differentials, and share of labor input in each sector.

In differentiating equation (12) with respect to k and all γ_i and S_i and using a growth rate of k_i, we obtain the following equation (13):[23]

$$\begin{aligned}\frac{\Delta k_i}{k_i} = \frac{\Delta k}{k} - \left\{ \frac{\Delta \gamma_i}{\gamma_i} - \sum_{j=1}^{n} \left(\frac{S_j}{\gamma_j a_j} \Big/ \sum_{m=1}^{n} \frac{S_m}{\gamma_m a_m} \right) \frac{\Delta \gamma_j}{\gamma_j} \right\} \\ - \sum_{j=1}^{n} \left(\frac{S_j}{\gamma_j a_j} \Big/ \sum_{m=1}^{n} \frac{S_m}{\gamma_m a_m} \right) \frac{\Delta S_j}{S_j}.\end{aligned} \tag{13}$$

Substitution of equation (13) into equation (6) yields the following equation showing the break down of GDP growth rate where factor markets are distorted.[24]

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[23] The first term on the right side of equation (13) indicates the effect of capital accumulation when γ remains unchanged, that is, when structural impediments measured by intersectoral factor price differentials remain unchanged. The second term represents the sum of the direct effect of change of sector i's own γ on capital allocation and the indirect effects of changes in γ in sectors other than sector i on capital allocation, where the economy's capital-labor ratio is constant. Finally, the third term shows the indirect effect of changes in labor input shares in individual sectors on the capital-labor ratio. Intuitively, since a rise in sector i's γ indicates a growing capital stock shortage in this sector, it works to lower the actual effect of capital accumulation. On the other hand, a higher γ in sectors other than sector i indicates a growing capital stock shortage for i, and works to increase i's capital as k is held constant.

[24] In this paper, we conduct quantitative analyses using sectoral data on the effect of factor market distortions on GDP. Derivation of this equation requires the assumption of perfect competition in each sector. On the other hand, Basu and Fernald (2002) focus on the negative effect of imperfect competition on economic growth. They break down GDP growth rate using the markup ratios of each sector, which indicate the degree of imperfect competition, and conduct quantitative analysis on the US

$$\frac{\Delta Y}{Y} = \sum_{i=1}^{n} \frac{Y_i}{Y} \frac{\Delta A_i}{A_i} + \frac{\Delta L}{L} + (1-\alpha)\frac{\Delta k}{k}$$
$$- \sum_{i=1}^{n} \frac{Y_i}{Y}(1-\alpha_i)\left\{ \frac{\Delta \gamma_i}{\gamma_i} - \sum_{j=1}^{n} \left(\frac{S_j}{\gamma_j a_j} \Big/ \sum_{m=1}^{n} \frac{S_m}{\gamma_m a_m} \right) \frac{\Delta \gamma_j}{\gamma_j} \right\} \qquad (14)$$
$$- \sum_{i=1}^{n} \frac{Y_i}{Y} \left[(1-\alpha_i)\left\{ \sum_{j=1}^{n} \left(\frac{S_j}{\gamma_j a_j} \Big/ \sum_{m=1}^{n} \frac{S_m}{\gamma_m a_m} \right) \frac{\Delta S_j}{S_j} \right\} - \frac{\Delta S_i}{S_i} \right].$$

The first to third terms on the right side of equation (14) are identical to equation (11) without any distortion, while the fourth and fifth terms show the effect of factor market distortions. The fourth term represents the impact of intersectoral capital allocation induced by changes in γ when the capital-labor ratio for the economy is held constant. The fifth term indicates the effect of changes in labor input share.[25]

Comparing TFP growth rates in equations (11) and (14), we see that the TFP growth rate in equation (11) equals the sum of the TFP growth rate and the effect of factor market distortions in equation (14). This relationship indicates that the TFP growth rate estimated under the assumption of perfect factor markets is not "true" TFP growth rate, because it ignores the negative effects of factor market distortions.

C. Break Down of GDP Growth Rate in Japan's Economy

Table 2 summarizes the results of the break down of Japan's GDP growth rate based on equation (14).[26,27] In this analysis, changes in labor input are broken down into

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economy using industrial data from 1959 to 1989. Their estimation results show that the negative effect of imperfect competition is not so large for the measured period.

[25] The effect of changes in labor input share consists of two parts. One is the indirect effect of changes in labor input on the GDP growth rate through changes in capital-labor ratio of individual sectors. The other is the direct effect of labor input share changes among high and low labor productivity sectors on the GDP growth rate.

[26] The following data are used in breaking down GDP growth rate. *Y*: real gross domestic product (Source: "Report on National Accounts"), *L*: products of the number of workers and their average work hours (Source: "Report on National Accounts"), *K*: products of real capital stock and capacity utilization (Source: JIP database), α: nominal employee compensation divided by nominal domestic factor income (Source: "Report on National Accounts"). For details of the JIP database, see Fukao *et al*. (2003). Since data for capital stock and capacity utilization is released only up to 1998 in the JIP database, the estimation is conducted using data up to 1998.

[27] In breaking down GDP growth rate, the qualities of labor input are assumed to be identical among every sector. It follows that labor reallocation from low labor productivity sectors to high labor

changes in number of workers and their average work hours. On the one hand, during the bubble period (1986-1991), the real GDP growth rate increases remarkably, reflecting the alleviation of factor market distortions as well as a higher TFP and capital stock, regardless of the negative effect of fewer work hours. On the other hand, during the post-bubble period (1992-1998), GDP growth rate decelerates mainly due to a decline in positive contributions of both accumulations in capital and TFP. Moreover, the positive effect of the changes in labor input share declines and the effect of intersectoral differentials in factor's marginal productivity turns negative.

Table 2 also demonstrates that the worsening of the factor market distortions lower GDP growth rate since the bursting of the asset price bubble.[28] From the bubble period to the post-bubble period, the contribution of the changes in distortions in factor markets is estimated at −0.5% of the total declines in GDP growth of −3.6%. Thus, the worsening of factor market distortions can account for 1/7 of the decline in GDP growth rate from the bubble period to the post-bubble period.

We further break down the effects of the changes in factor markets distortions into manufacturing and non-manufacturing industries in Table 3. Focusing first on the effect of changes in labor input share, the total effect lowers the GDP growth rate, because the negative effect in the manufacturing industry exceeds the positive effect in the non-manufacturing industry. The negative effect in the manufacturing industry reflects the lower labor input share in sectors with high labor productivity. In contrast, the positive effect in the non-manufacturing industry reflects the higher labor input share in sectors with a high capital-labor ratio, particularly in construction and real estate. The total effect of changes in labor input share becomes negative, because labor productivity in the non-manufacturing industry is lower than that in the manufacturing industry and the labor input increases in some sectors with particularly

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productivity sectors results in increased labor productivity for the economy. In reality, however, the quality of labor input and know-how necessary for production activities varies among firms and sectors. Thus, the shift of labor allocation to sectors that require different know-how could lead to wasted human capital and a decrease in labor productivity. Referring to the above limitations, careful consideration may be needed to interpret the results of this empirical analysis.

[28] Table 2 also shows that the contributions of changes in distortion are positive both in the period of 1980-1985 and that of 1986-1991. This implies the reduction of distortion in factor markets in these periods.

low labor productivity in non-manufacturing industry, such as the construction.[29]

The effect of changes in intersectoral differentials in factor's marginal productivity reduces GDP growth rate, especially in the non-manufacturing industry. As Figure 6 shows, a negative effect arises because estimates of γ in the non-manufacturing industry considerably worsen since the bursting of the asset price bubble, while that for many sectors in manufacturing industry remain unchanged.

There is less flexibility in factor markets in the midst of a shift toward a services-oriented economy, as shown in the aforementioned Figure 5. Resource misallocation worsens especially in the non-manufacturing industry and the labor input share increases in low labor productivity sectors such as construction. Such deterioration of structural problems significantly lowers the GDP growth rate of Japan's economy.

IV. Persistence of Factor Market Distortions

In previous sections, we showed an inward shift of the production possibility frontier induced by factor market distortions and offered a quantitative analysis of their effect on real GDP growth rate, from the standpoint of an investigation of their short-term effects.

Another important issue regarding structural problems related to the form of factor market distortions is whether they can be resolved autonomously through the market mechanism. If they cannot be resolved autonomously and the misallocation of productive factors persists over the long-term, a temporal increase in effective demand stemming from monetary and fiscal policies alone will be unable to push the economy back to a sustainable growth path. Thus, economic stagnation will continue so long as policy measures are not taken to directly address the structural problems.

Below, we examine this issue, using trade theory introduced in Section II, from the viewpoint of changes in factor prices influencing factor reallocations across sectors, to demonstrate that factor market distortions cannot be resolved autonomously. We consider the question of whether factor immobility can be rectified autonomously by comparing changes in factor prices under perfect factor mobility (the H-O model) with

[29] This result implies that aggressive public investment during the post-bubble period might result in increased labor employment in construction and therefore public investment might exacerbate structural problems in the Japanese economy. See Maeda, Higo and Nishizaki (2001) for this argument.

those under imperfect factor mobility (the specific factor model).[30]

In the discussion below, commodity *M* is assumed to be capital-intensive and commodity *N* labor-intensive.

A. Factor Immobility and Changes in Factor Prices

The relationship between commodity prices and factor prices in the specific factor model converges to the H-O model, if factor immobility is rectified, since the H-O model assumes no factor market distortions. If some factor owners lose by fixing factor market distortions, they have an incentive to resist resolving structural impediments behind factor market distortions. As a result, factor market distortions cannot be resolved through the market mechanism.

Below, we derive the relationships between changes in commodity prices and factor prices under the H-O model and the specific factor model. Then, we compare them to examine the question of whether the factor immobility can be rectified autonomously.

1. Changes in factor prices under the H-O model

Under the H-O model with perfect factor markets, the following simple relationship can be derived regarding the effect of relative prices of commodities on factor prices:

$$\hat{r} > \hat{P}_M > \hat{P}_N > \hat{w}, \tag{15}$$

where *r* and *w* denote rate of return on capital and wage, and ^ represents relative changes in variables. Equation (15) shows that an increase in a commodity price raises the price of the factor that is intensively used to produce the commodity (the Stolper-Samuelson theorem) and that factor price changes are magnified reflections of commodity price changes (magnification effect).[31]

The intuition that equation (15) holds with respect to the relationship between changes in commodity prices and changes in factor prices is as follows. In the case of no factor mobility between sectors, an increase in the price of *M* raises the wage and

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[30] In trade theory, some researchers focus on the downward rigidity of nominal wages induced by minimum wage rates as a factor market distortion. Although full employment is realized under flexible wages, some labor is unemployed due to the downward rigidity of nominal wages. Thus, the production possibility frontier shifts inward. See Brecher (1974) for further discussion of this issue.

[31] See Jones (1965) for this point.

rate of return on capital in sector *M*. It follows that labor and capital are reallocated from sector *N* to sector *M*. Since sector *M* is capital-intensive, however, the amount of capital sector *M* wishes to acquire exceeds the amount sector *N* is willing to yield. Excess demand for capital in the economy as a whole therefore raises the rate of return on capital. Similar reasoning applies to labor, and this leads to reduced wages.

Let us explain details of the mechanism of the magnification effect. Since perfect competition is assumed, income from the production of commodities is fully paid to workers and capital owners with zero excess profit. Thus, the following equations relate to prices of *M* and *N*:

$$a_{LM} w + a_{KM} r = P_M , \tag{16}$$

$$a_{LN} w + a_{KN} r = P_N , \tag{17}$$

where a_{ij} denotes the quantity of productive factor *i* that is necessary to produce one unit of commodity *j*.

The total differential of equation (16) can be written as the following equation (18):

$$a_{LM} dw + a_{KM} dr + w da_{LM} + r da_{KM} = dP_M . \tag{18}$$

Since the assumption of perfect competition implies that the slope of a tangent line to the isoquant equals the ratio of factor prices, i.e., $w da_{LM} + r da_{KM} = 0$ holds, equation (18) can be expressed as equation (19),

$$\theta_{LM} \hat{w} + \theta_{KM} \hat{r} = \hat{P}_M , \tag{19}$$

where θ_{ij} represents the distribution share for factor *i* in the *j* sector. Further, a similar relationship holds for *N* as well, and thus the following equation (20) can be obtained:

$$\theta_{LN} \hat{w} + \theta_{KN} \hat{r} = \hat{P}_N . \tag{20}$$

Subtract equation (19) from (20) and make use of the fact that the sum of labor share and capital share in the same sector equals unity to obtain

$$(\theta_{LN} - \theta_{LM})(\hat{r} - \hat{w}) = \hat{P}_M - \hat{P}_N . \tag{21}$$

Because *M* is capital-intensive and *N* is labor-intensive, $0 < \theta_{LN} - \theta_{LM} < 1$ holds. Thus, equation (21) shows that relative changes in factor prices exceed those in goods prices, that is, the magnification effect of commodity prices on factor prices. Note that

equation (21) shows that relative sizes of labor share in each sector influence the relationship of changes in commodity prices and factor prices.

2. Changes in factor prices under the specific factor model

The effect of changes in commodity prices on factor prices under the specific factor model is modified from equation (15), which is obtained under the H-O model, to the following equation (22),

$$\hat{r}_M > \hat{P}_M > \hat{w} > \hat{P}_N > \hat{r}_N , \tag{22}$$

where r_M and r_N are the rates of return for specific factors in sectors *M* and *N*, respectively. Equation (22) shows two points: first, the rates of return on specific factors are most radically influenced by changes in commodity prices; and, second, changes in wage rate stay between price changes in two commodities. That is, the return on mobile factor (labor) rises relative to the price of *N*, and falls relative to the price of *M*.

Figure 7 provides an intuitive explanation as to why equation (22) holds under the specific factor model. In the construction of Figure 7, the commodity *N* is used as numéraire, and vertical and horizontal axes represent nominal wages and labor inputs, respectively. The length of the horizontal axis shows the total labor supply, with the distance from O_M indicating the labor input in sector *M* and the distance from O_N that in sector *N*. $VMPL_M(P_M^0)$ is the value of labor's marginal product in sector *M* with the price of *M* being P_M^0. When the price of commodity *M* is P_M^0, nominal wages are determined by w^0, the intersection of $VMPL_M(P_M^0)$ and $VMPL_N$.

Suppose the price of commodity *M* rises to P_M^1. Then, $VMPL_M(P_M^0)$ shifts upward to $VMPL_M(P_M^1)$ by the margin of the rise in price, leading to an increased wage of w^1. Note that since $VMPL_N$ remains constant, the new equilibrium wage does not rise as much as the price of *M*. Therefore, it rises relative to the price of *N* but falls relative to the price of *M*.

Further, the rate of return on the specific factor is shown by the triangular region between the wage line and the respective value of labor's marginal product curves. As mentioned earlier, since wage does not rise as much as the price of commodity *M*, the rate of return on the specific factor for sector *M* rises more than the price commodity *M*. On the other hand, the rate of return on the specific factor for sector *N* declines because $VMPL_N$ is constant and wages rise.

Next, let us give a formal explanation about why equation (22) holds. Perfect competition in commodity markets is assumed even in the specific factor model as in the H-O model. As a result, the following equations hold for *M* and *N* prices:

$$a_{LM} w + a_{KM} r_M = P_M , \tag{23}$$

$$a_{LN} w + a_{KN} r_N = P_N . \tag{24}$$

The difference between the above equations and equations (16) and (17) in the H-O model is that the rates of return on capital in both sectors do not coincide with each other. Using the total differentials of equations (23) and (24) as well as the property of perfect competition featuring the slope of a tangent line to the isoquant equals the ratio of factor prices, we obtain the following equations, which are dual to equations (19) and (20) in the H-O model,

$$\theta_{LM} \hat{w} + \theta_{KM} \hat{r}_M = \hat{P}_M , \tag{25}$$

$$\theta_{LN} \hat{w} + \theta_{KN} \hat{r}_N = \hat{P}_N . \tag{26}$$

Since labor is fully employed, then

$$L = a_{LM} M + a_{LN} N = \frac{a_{LM}}{a_{KM}} K_M + \frac{a_{LN}}{a_{KN}} K_N , \tag{27}$$

also holds. Here, *M* and *N* denote the quantities of the production of *M* and *N*, K_M and K_N are the specific factors used in sectors *M* and *N*. Note that we use two relationships, $M=K_M/a_{KM}$ and $N=K_N/a_{KN}$, to yield the right-hand side of equation (27).

By totally differentiating equation (27) and using the assumption that the labor and capital endowment is constant, equation (27) can be rearranged as follows:

$$\lambda_{LM} (\hat{a}_{LM} - \hat{a}_{KM}) + \lambda_{LN} (\hat{a}_{LN} - \hat{a}_{KN}) = 0 , \tag{28}$$

where λ_{ij} represents the share of factor *i* used in sector *j*.

Let us denote the elasticity of labor's marginal product curve in sector *M* as γ_{LM}. Then, γ_{LM} can be expressed as follows:

$$\gamma_{LM} = -\frac{\hat{a}_{LM} - \hat{a}_{KM}}{\hat{w} - \hat{P}_M} .$$

γ_{LN}, the elasticity of labor's marginal product curve in sector *N* is similarly defined. Substitute these equations for equation (28) and rearrange it to derive the following

equations linking changes in wages with changes in commodity prices,

$$\hat{w} = \frac{\lambda_{LM}\gamma_{LM}}{\lambda_{LM}\gamma_{LM} + \lambda_{LN}\gamma_{LN}}\hat{P}_M + \frac{\lambda_{LN}\gamma_{LN}}{\lambda_{LM}\gamma_{LM} + \lambda_{LN}\gamma_{LN}}\hat{P}_N . \tag{29}$$

Equation (29) implies that $\hat{P}_M > \hat{w} > \hat{P}_N$ holds when the price of *M* rises more than the price of *N*. Furthermore, since the assumption of perfect competition means changes in commodity prices are equal to the weighted-average of factor price changes, (29) also demonstrates the validity of equation (22).

B. Possibility of Autonomous Resolution of Factor Immobility

When capital does not move between sectors (the specific factor model), factor price changes induced by changes in the relative price of commodity *M* are shown as equation (22), i.e., as $\hat{r}_M > \hat{P}_M > \hat{w} > \hat{P}_N > \hat{r}_N$. On the other hand, in the case of perfect capital mobility in the long-term (the H-O model), the relationship is $\hat{r} > \hat{P}_M > \hat{P}_N > \hat{w}$, as shown in equation (15). Is the adjustment mechanism from the short-term to the long-term compatible with the above factor price changes in the specific factor model and the H-O model?

When capital is immobile, the rate of return on capital in sector *M* rises relative to sector *N*. Where capital is mobile, the capital of sector *N* moves to sector *M* in response to the difference in rates of return on capital. Since commodity *M* is capital-intensive, the increase in demand for labor induced by the shift of capital to sector *M* falls short of the decrease in demand for labor associated with the outflow of capital in sector *N*. Excess labor supply in the economy therefore lowers wages. Further, since commodity prices remain constant after the initial change, the rate of return on capital rises in both sectors due to declined wages. Because commodity *N* is labor-intensive, however, the rate of return on capital in sector *N* rises more than it does in sector *M* and the rate of return on capital for both sectors finally converge. Thus, $\hat{r} > \hat{P}_M > \hat{P}_N > \hat{w}$, shown in equation (15), holds.

To sum up, when commodity *M* is capital-intensive, workers gain in terms of the price of commodity *N* if capital does not move at all. As capital moves over time, however, wages decline in terms of the price of *M* as well as the price of *N*. On the

other hand, the owners of capital gain as a result of capital movement.[32]

When the relative price of a commodity changes, at least owners of one factor, who temporarily gain as a result of capital immobility, suffer losses due to capital movement over time (Mussa [1974], Neary [1978]). It follows that the factor owners, in due course, have an incentive to resist the shift of capital induced by changes in the relative price of a commodity. Table 4 summarizes these relationships. Hence, it suggests that factor market distortions in the form of factor immobility cannot be resolved autonomously through the market mechanism.[33]

One of the major causes of Japan's long-term stagnation since the early 1990s is forbearance lending to inefficient firms that finally deteriorated the soundness and efficiency of Japan's economy (Sekine, Kobayashi and Saita [2003], Caballero, Hoshi and Kashyap [2003]). Continued forbearance lending that permits zombie firms to exist indicates the existence of incentives to resist factor reallocation, even though economic adjustment is necessary for the economy to return to its long-term sustainable growth path.

V. Concluding Remarks

In this paper, we focus on resource misallocation induced by factor market distortions such as factor immobility and intersectoral differentials in factor's marginal productivity, as one of the structural problems that Japan's economy faces. We also conduct

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[32] Conversely, when *M* is labor-intensive, the owners of the specific factor in sector *M* gain if capital does not move at all, but lose if capital moves. The owners of the specific factor in sector *N* lose regardless of capital movement and lose more as the capital moves. Meanwhile, workers certainly gain as a result of capital movement.

[33] This paper examine the possibility of autonomous resolution of such distortions by applying trade theory research to extend classical trade theory with the assumption of perfect factor markets to incorporating factor market distortions. Some researchers, however, investigate this issue from a political economy perspective associated with the introduction of regulations. For example, Krueger (1974) analyzes rent seeking activity to get an export or import quota. She shows that real resources are expended to obtain import or export licenses since monopoly profits can be obtained from them and concludes that resource allocation can be distorted by such activities. Furthermore, Grossman and Helpman (1994) develop a model in which interest groups lobby and contribute to politicians' election campaigns in order to influence government policies and gain rent from them. They then show the emergence of an equilibrium in which anti-competitive policies are enacted, and resource misallocation is not resolved.

qualitative and quantitative analysis on the effect of factor market distortions on the economy.

Distortions in factor markets lead the economy to exhibit inefficient resource allocations, resulting in an inward shift of the nation's production possibility frontier and decline in its attainable output. Under such circumstances, a conventional growth accounting framework that assumes perfect factor markets overestimates the decline in TFP growth. In fact, our empirical results show that the misallocation of productive factors particularly aggravates non-manufacturing sectors after the asset price bubble burst.

We break down Japan's GDP growth rate, paying attention to the effect of factor market distortions, to find that about 0.5% of the decline in real GDP growth rate (–3.6%) since the bursting of the asset price bubble is attributable to the deterioration of such distortions. This implies that worsening of structural problems in the form of factor market distortions is deemed as one of the major causes behind the decade-long economic stagnation.

It should be noted that the aforementioned distortions and resultant misallocation of productive resources cannot be resolved autonomously, because some economic agents suffer losses when the factor market distortions are resolved. Therefore, economic stagnation will continue so long as policy measures are not taken to directly address structural problems.

The above point suggests an important implication for estimation methods for potential growth rate. That is, when factor market distortions cannot be resolved autonomously and the resulting resource misallocation persists for a long time of period, the production function approach is likely to overestimate the potential GDP.[34] Broadly speaking, there are two conventional methods: the production function approach and the filtering approach. The former method computes attainable maximum GDP based on specific assumptions of an aggregate production function, such as the Cobb-Douglas function. The latter method extracts the trend output as the equilibrium level of output (potential GDP) from actual GDP data, assuming that the economy fluctuates around its long-term equilibrium. In other words, the production

[34] As for the various issues concerning the potential growth rate, see Bank of Japan, Research and Statistics Department (2003).

function approach does not account for the factor market distortions, while the filtering approach assumes the real economy is in the neighborhood of short-term equilibrium that entails some distortions.

Let us conclude this paper by examining the monetary policy implications from the perspective of the relationship between potential output and inflationary/deflationary pressures. Figure 8 shows potential output, potential growth rate and the resulting output gap, all of which are estimated by the two types of filters: the Hodrick-Prescott filter (the HP filter) and the Hirose-Kamada filter (the HK filter). The latter filter combines the HP filter with the relationship between potential GDP and the Phillips curve.[35]

Figure 8 shows that the growth path of potential output has declined noticeably since the early 1990s. It also demonstrates that the potential growth rate estimated by both filtering methods declines to around 1% in the latter half of the 1990s from the level of over 4% in the latter half of the 1980s.[36] Moreover, the HK filtered potential growth rate further declines to about 0.4% in recent years. Both of the two series of output gaps obtained by the HP filter and the HK filter recently turn positive, reflecting the gradual slowdown of deflationary pressure in Japan.

As Okina and Shiratsuka (2003) point out, cross-sectional resource misallocation induces intertemporal resource misallocation, and then amplifies a negative impact on the economy. In the situation where inefficient firms survive and the economy's production possibility frontier continues shrinking over the long-term, not only does the trend growth rate fall but downward pressure on asset prices also continues to influence the economy. The relative price of asset prices to general prices means intertemporal relative prices. Therefore, the economic situation where asset prices drastically decline while general prices remains relatively stable can be interpreted as one where downward pressure on the prices of future goods works to

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[35] Hirose and Kamada (2003) build on the HP filter and present a new methodology for estimating potential GDP by simultaneous estimation of potential GDP and the Phillips curve. This new method enables the estimation of potential GDP that is not only the trend of actual GDP but is also the non-accelerating inflation level of output (NAILO).

[36] As mentioned earlier, the filtering approach has an advantage that it can estimate the potential output, taking account of the presence of distortions. Thus, it can be concluded that, based on our analysis, the worsening of distortions lies behind this downward shift of potential GDP estimated by both filtering.

affect intertemporal resource allocation (Figure 9). It follows that downward pressure on the trend growth rate strengthens as capital accumulation in high productivity sectors declines. Cross-sectional and intertemporal resource misallocation interacts to amplify the negative impacts of structural factors on the economy as a whole.

The above observation implies that structural factors are more important than the other cyclical factors in causing the economy to plunge into a deflationary economic situation. It also shows that elimination of structural factors themselves is a more effective policy response than measures taken over a long time that offset cyclical factors. In other words, monetary policy is no panacea for an economic downturn beyond boom-and-bust cycles and is no substitute for policies designed to resolve structural problems that exist on the supply side (Yamaguchi [1999], Shirakawa [2000]).

The basic policy response against structural problems is to attack directly their sources by transferring real resources between the agents gaining and those losing with the structural reform (Bhagwati [1971]).[37] It should be noted that in order to support the structural reform, other policy measures including deregulation should be taken to reduce adjustment costs. That is, it is important to implement effective policies directly influencing adjustment costs by reforming the economic structure itself where adjustment costs rise with the acceleration of structural reform, so that the economy can promptly return to its long-term equilibrium as a result of rational decision by economic agents.[38]

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[37] For more on this point, see footnote 4. Note that Grossman and Helpman (1994), introduced in footnote 32, show that instead of the transfer of funds among economic agents, anti-competitive policies tend to be enacted due to political lobbying. Thus, the need to reform the relation between interest groups and politicians is one of the most important issues in order to enable the transfer of funds among economic agents.

[38] For example, Mussa (1978) builds a dynamic model in which capital is fixed in respective sectors in the short run, while it flexibly moves among sectors in the long run. He then shows the dynamic path for the economy from the short-term to the long-term when some real resources are needed for intersectoral capital movement. He concludes that when the expectations of capital owners concerning future rental rates are rational, the economy's dynamic path is optimal in a sense that it maximizes the present discounted value of the economy's final output. This conclusion implies that since the actual dynamic path diverges from the optimal path when expectations are irrational, any convergence speed differing from the optimal speed is not desirable. Moreover, since convergence speed is also dependent

Needless to say, when policy is carried out to eliminate structural problems, temporal but large negative shocks are inevitable. Thus, the combination of policy measures to establish a safety net as well as boost effective demand is of great importance to support economic distress in the short-term. Even in such a case, however, the sequencing of policy measure implementation is also important from the standpoint of making use of limited effective policy tools, while not hindering incentives for structural reform.

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on real resources used in capital movement, it is necessary to reduce adjustment costs in order to accelerate structural reforms and realize the economy's prompt return to its long run equilibrium.

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Table 1. Break Down of Labor Productivity Growth (All Industries)

(%)

	1980-90	1991-99
Labor Productivity Growth	3.69	2.11
Capital Accumulation	1.72	1.21
TFP	1.63	0.84
Labor Movement	0.38	0.06

Source: Miyagawa (2003)

Table 2. Effect of Factor Market Distortions on GDP Growth Rate

(%)

	1980-85	1986-91 (Bubble Period) (a)	1992-98 (Post-Bubble Period) (b)	(b)−(a)
GDP Growth	3.96	4.82	1.24	−3.58
TFP	1.39	2.18	0.61	−1.58
Capital accumulation	1.51	2.77	1.45	−1.32
Number of workers	0.79	1.29	0.34	−0.94
Work hours	0.04	−1.85	−1.12	0.73
Distortions	0.23	0.44	−0.03	−0.47
Relative MP	0.18	0.11	−0.15	−0.26
Labor input share	0.06	0.32	0.12	−0.21

Table 3. Contribution of Manufacturing and Non-manufacturing Industries

(%)

		Decline in GDP growth rate due to structural problems	
		Relative marginal productivity	Labor input share
Total		–0.26	–0.21
	Manufacturing	–0.05	–0.38
	Non-manufacturing	–0.21	0.07

Table 4. Factor Price Changes from Short-Run to Long-Run Due to Change in Goods Prices

$< \hat{P}_M > \hat{P}_N$ Case>

	M Goods as Capital-Intensive Goods	*M* Goods as Labor-Intensive Goods
K_M	Better off	Worse off
K_N	Better off	Worse off
L	Worse off	Better off

Note: The shaded areas indicate productive factors whose prices fall due to capital movement.

Figure 1. Changes in the Production Possibility Frontier
Due to Factor Immobility

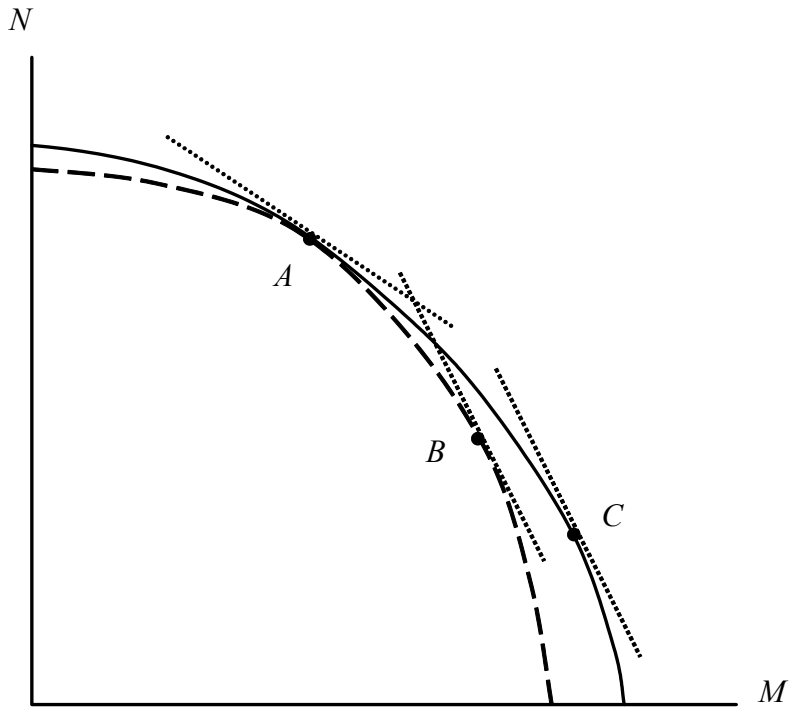


Figure 2. Edgeworth Box with Intersectoral Factor Price Differentials

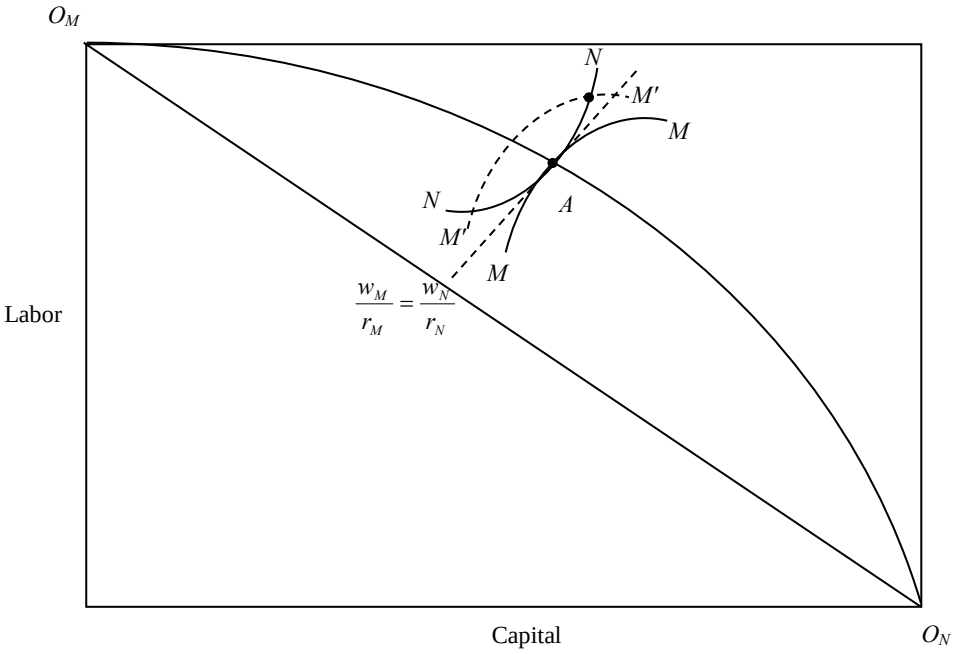
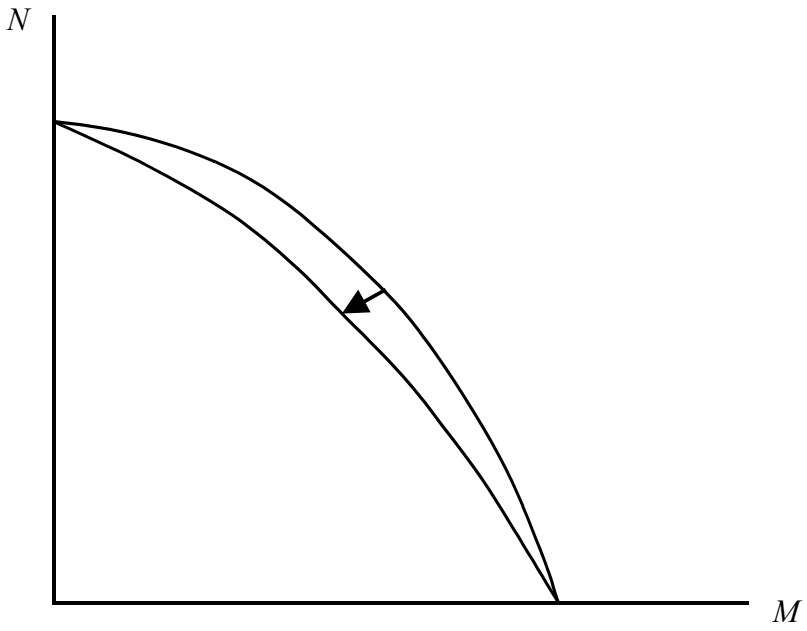


Figure 3. Changes in the Production Possibility Frontier
Due to Intersectoral Factor Price Differentials



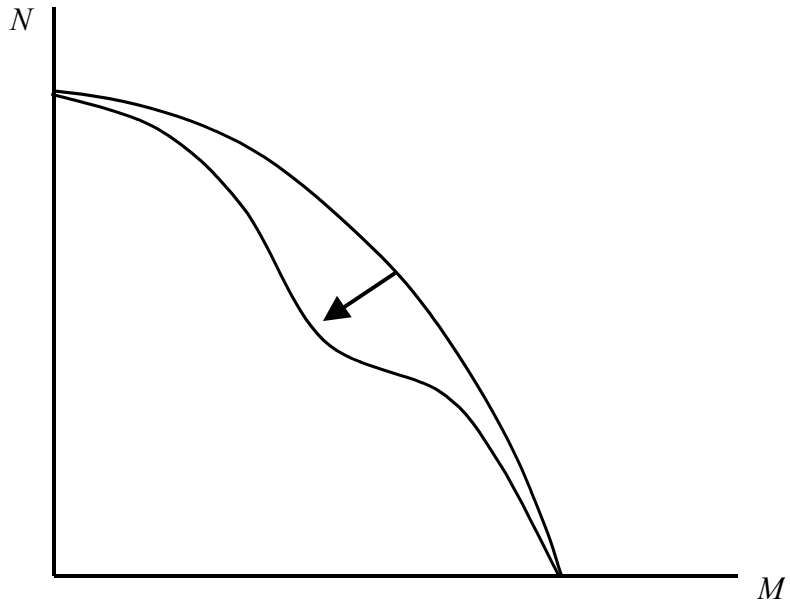
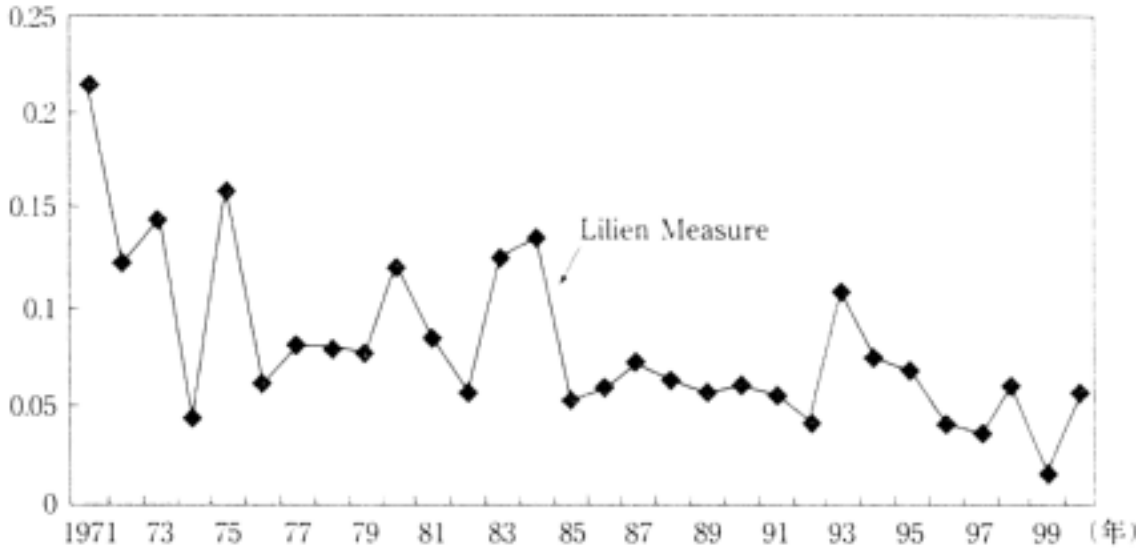
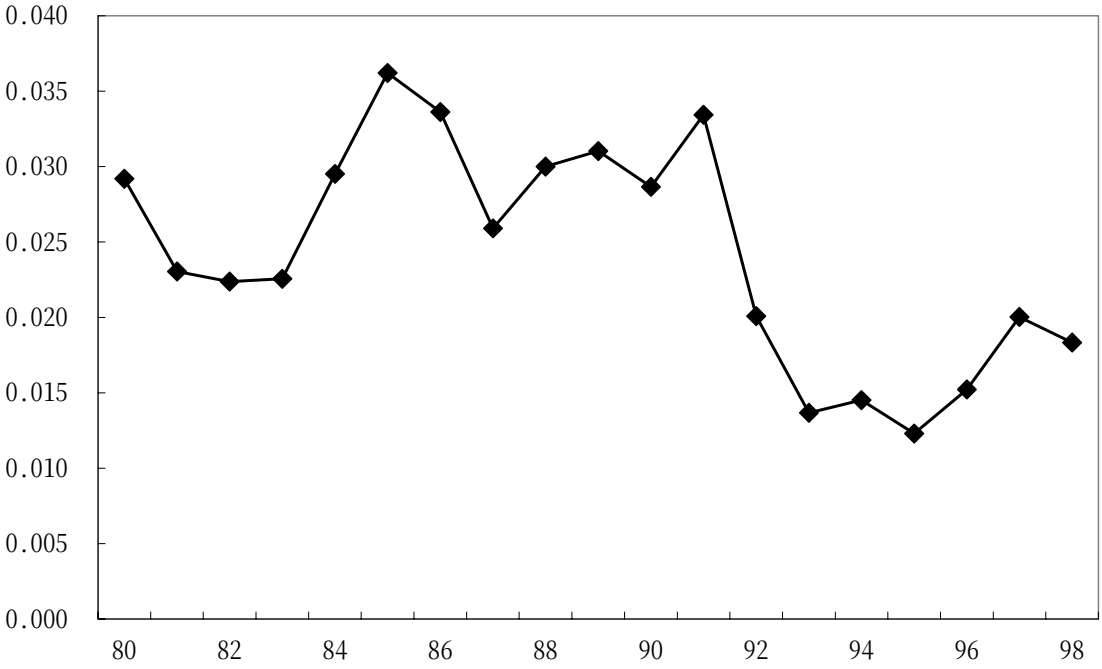


Figure 4. Labor Mobility



Source: Miyagawa (2003)

Figure 5. Capital Mobility



Note: Compiled on the basis of capital stock by sector using the JIP database.

Figure 6. Changes in Estimates of γ by Sectors

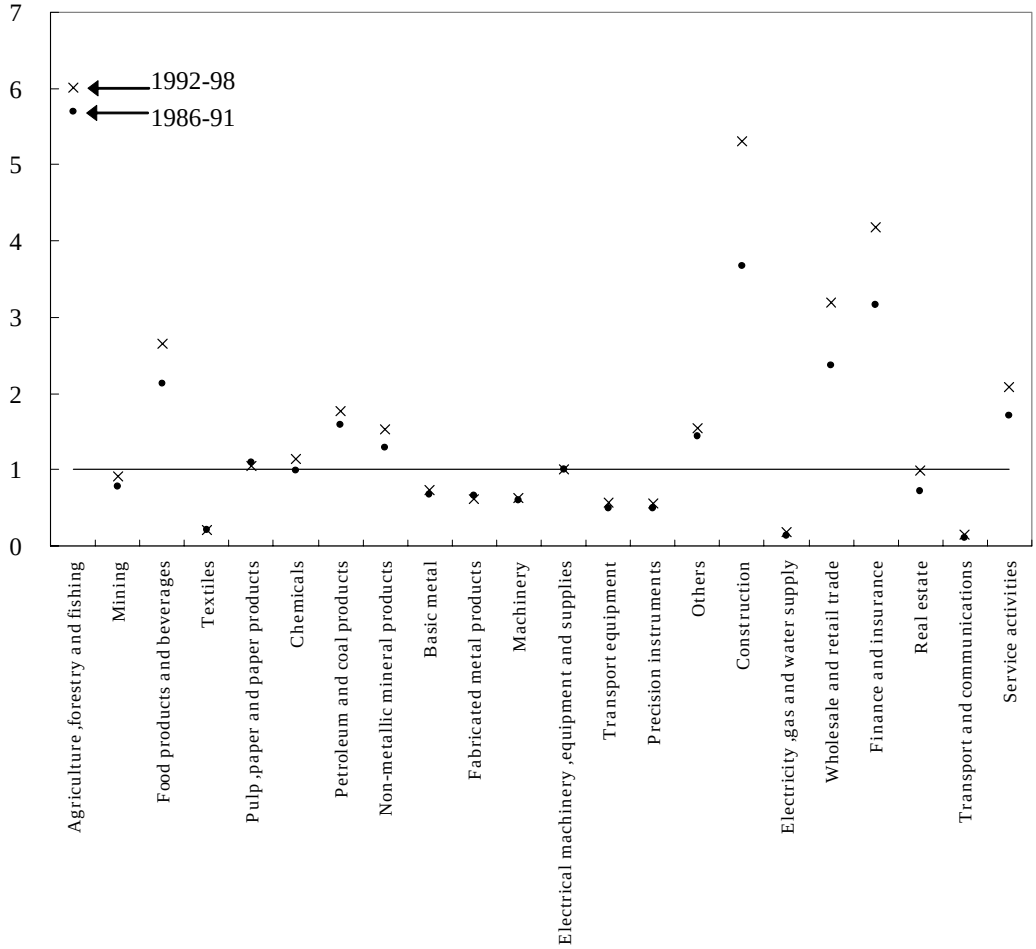
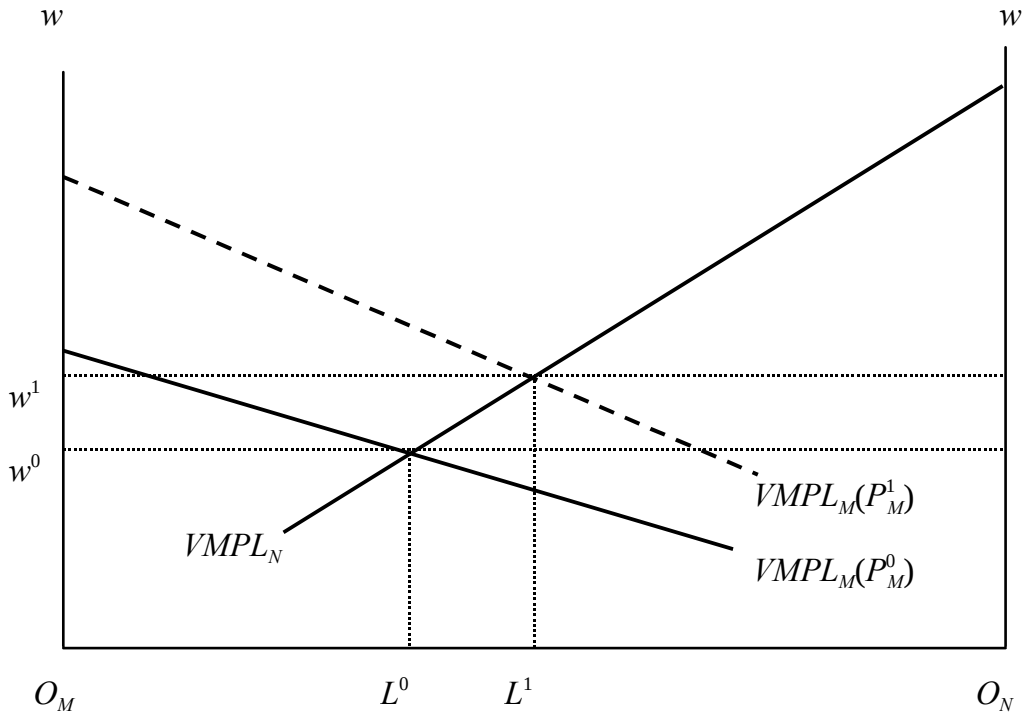


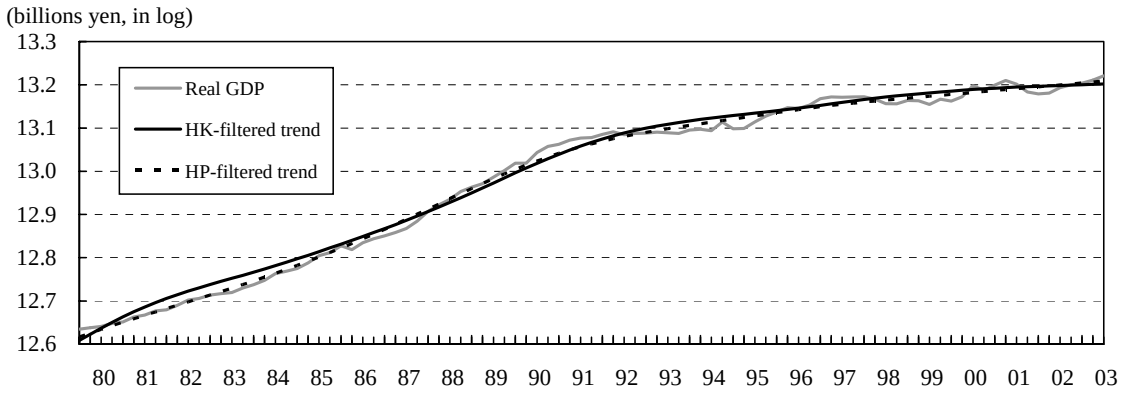
Figure 7. Changes in Factor Prices under the Specific Factor Model



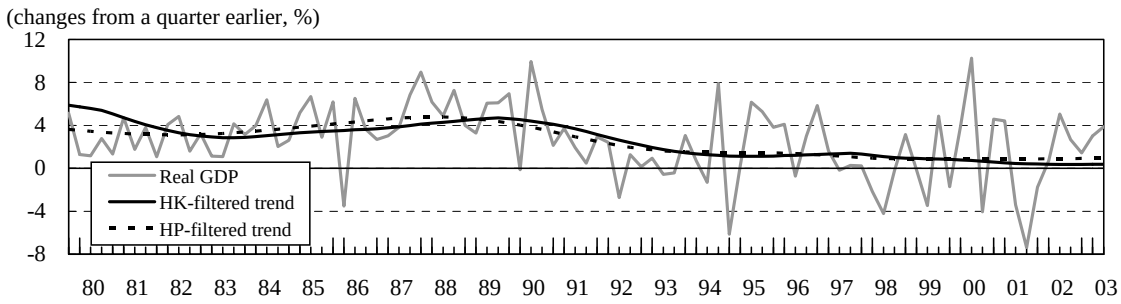
Source: Mussa (1974)

Figure 8. Potential GDP

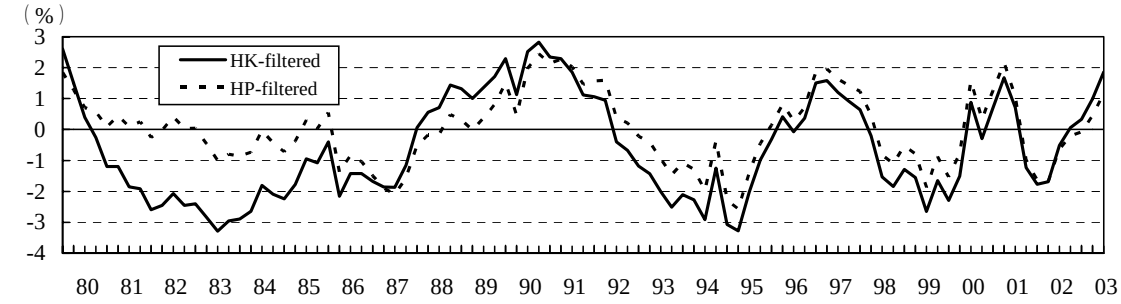
[1] Potential GDP



[2] Potential GDP Growth



[3] GDP Gap

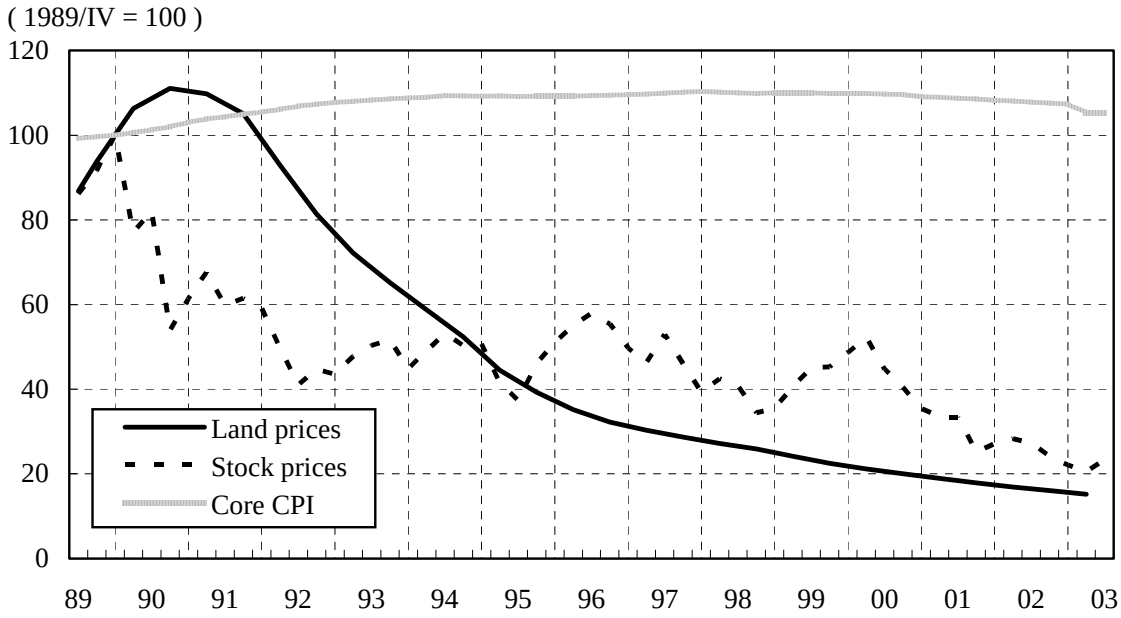


Note: The real GDP and CPI (excluding fresh foods) used for estimation were seasonally adjusted based on the following specifications using X-12-ARIMA.

	Real GDP	Core CPI
Sample period	1977/I–2003/II	1977/I–2003/II
Time series model	(2 1 0) (0 1 1)	(0 1 1) (0 1 1)
Option	The impact of temporary changes in demand at the time of the introduction of the consumption tax and the tax rate increase were adjusted using the dummy variables.	The impact of the introduction of the consumption tax and the tax rate increase were adjusted by the level shifts.

Sources: Cabinet Office, “System of National Accounting,” Ministry of Public Management, Home Affairs, Posts and Telecommunications, “Consumer Price Index”.

Figure 9. Asset Prices and General Prices



Source: Bank of Japan "Financial and Economic Statistics", Ministry of Public Management, Home Affairs, Posts and Telecommunications, "Consumer Price Index", Japan Real Estate Institute "Urban Land Price Index".

Note: Core CPI (CPI Exc. fresh foods) is seasonally adjusted by X-12-ARIMA utilizing ARIMA (0 1 1) and (0 1 1) models, where the impact of introducing the consumption tax (Apr 1989) and the tax rate increase (Apr 1997) were adjusted by level shifts.