The Lost Decade in the Japanese Labor Market: Labor's share and Okun's Law

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Abstract*

The purpose of this study is to reexamine two empirical regularities in the Japanese labor market: the constant labor share and Okun's law. The former law relates to the price of labor in the labor market while the latter is a quantity law; they represent suitable benchmarks for judging the condition of the labor market. Although there are more elaborate statistical techniques, these laws are frequently used because they can clarify the macroeconomic situation at a glance. First, a constant labor share is implied in theory by the Cobb-Douglas production function. Thus, labor's share should be based on the production function. Labor's share based on income has only been rising because of massive depreciation. Secondly, there have been several structural breaks in Okun's law since the bubble collapsed, and the potential growth rate has fallen.

I. Introduction

The purpose of this study is to reexamine two empirical regularities in the Japanese labor market: the constant labor share and Okun's law. The former law relates to the price of labor in the labor market while the latter is a quantity law; they represent suitable benchmarks for judging the condition of the labor market. Although there are more elaborate statistical techniques, these laws are frequently used because they can clarify the macroeconomic situation at a glance.

The following two hypotheses have been advanced to explain Japan's so-called 'lost decade' of the 1990s:

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- *deficient investment hypothesis*: Labor's share increased to squeeze firm profits and reduce investment.
- *idle resources hypothesis*: If appropriate macroeconomic policies had been pursued, resource allocation would have been more effective.

These hypotheses, however, are doubtful. In recent years, firms have had cash surpluses. Hence, firms could have financed investment. Although there were several cyclical economic recoveries, the unemployment rate has been on an upward trend. This raises questions. Therefore, I reexamined both laws empirically and found the following:

- In recent years, the rising labor share was the subject of much concern, but reflected high depreciation. The labor share, adjusted appropriately for depreciation, was almost constant in the lost decade.
- There were structural breaks in Okun's law following the collapse of the bubble, and the potential growth rate fell to around 2%.

In Section II, I consider movements in labor's share. In Section III, I consider Okun's law.

II. Labor's share and increased depreciation

In recent years, many have argued that labor's share is rising. Among others, Hashimoto (2002) stressed that seniority wage systems squeeze firm profits, which reduces investment.

However, Figure II-1, based on data from the System of National Accounts (93SNA), shows that compensation to employees as a share of GDP is extremely stable

Since this graph does not suggest the problem of a rising labor share, why has there been such confusion over this issue? Problems of defining labor's share have been discussed, but the main problem relates to the issue of dealing with depreciation (Hyuga (2003)). Japan's depreciation rate has risen to 20% of GDP in recent years. Depreciation currently amounts to a substantial 98 trillion yen.

The following two definitions differ according to whether depreciation is included in labor's share.

- labor's share based on value-added (national income) does not include depreciation in the denominator:

$$\frac{\text{compensation of employees}}{\text{national income}(\fallingdotseq \text{gross national product} - \text{depreciation})}$$

- labor's share based on the production function (GDP) includes depreciation in the denominator:

$$\frac{\text{compensation of employees}}{\text{gross domestic products}}$$

Hence, depreciation is included in the definition based on GDP, but not in the definition based on national income. Hence, there is the problem of which definition to use. While the former (labor's share based on income) seems plausible, the latter (labor's share based on the production function) is appropriate for theoretical analysis.

Theoretically, the production function approach should be used. The Cobb-Douglas production function implies a constant labor share, and treats depreciation separately. Hence, I conduct theoretical and empirical analyses.

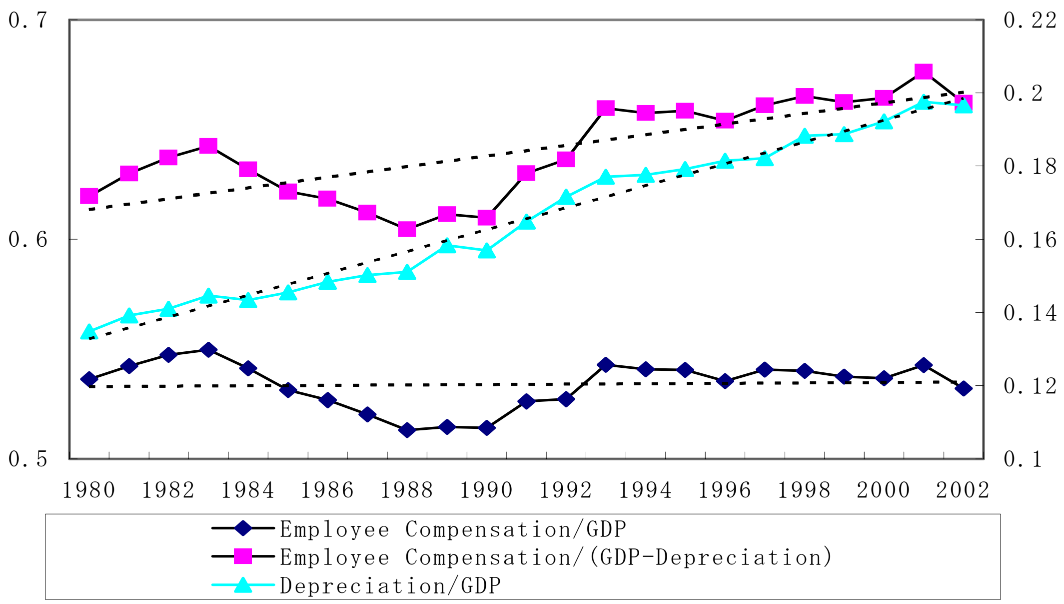


Figure II-1: Labor's share and depreciation in the SNA

The Cobb-Douglas production function and labor's share

A constant labor share is a well-known empirical regularity in the US (Cobb and Douglas (1928)). However, the production function does not incorporate depreciation, since the production function relates total production to productive factors. If a rising labor share is abnormal, there should be solid empirical regularities for a benchmark. Such regularities should be based on the property of Cobb-Douglas production function.

I confirm these points by conducting theoretical analysis. For convenience, I consider capital's share based on the Cobb-Douglas production function, $X_t = N_t^a K_t^{1-a}$. The user cost of capital is the sum of the interest rate, r_t, the depreciation rate, δ_t, and the capital loss rate $\frac{\dot{q}_t}{q_t}$ multiplied by the capital goods price, q_t. The first-order condition for capital K for a competitive firm is

$$(1-a)P_t N_t^{a} K_t^{-a} - (r_t + \delta_t + \frac{\dot{q}_t}{q_t})q_t = 0 \qquad (1)$$

The reciprocal of capital's share using labor's share based on the production function is

$$\frac{P_t X_t}{(r_t + \delta_t + \frac{\dot{q}_t}{q_t})q_t K_t} = \frac{1}{1-a}$$

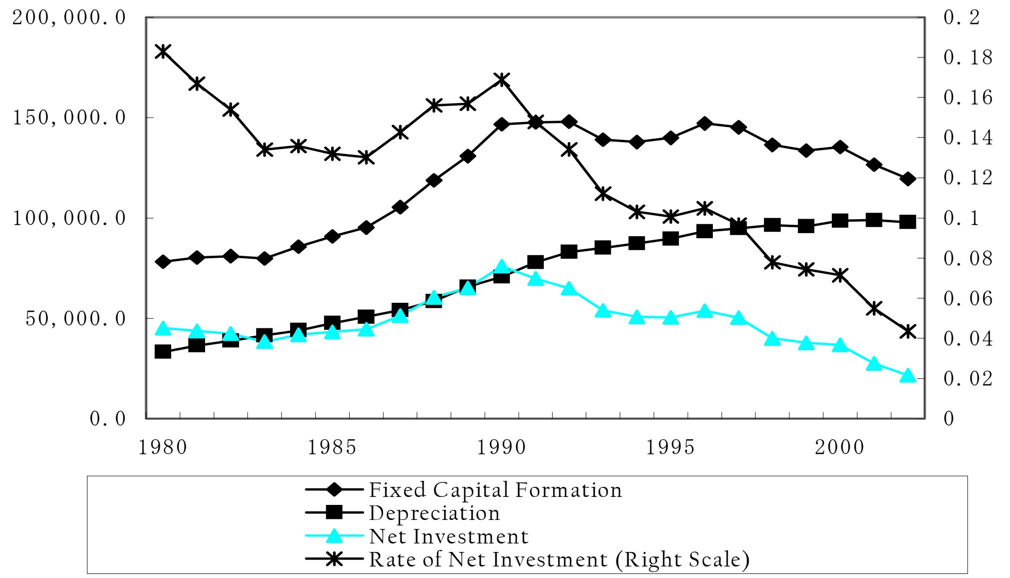


Figure II-2: Investment and Labor's share

The reciprocal of capital's share when labor's share is based on income is

$$\frac{P_t X_t - \delta_t q_t K_t}{(r_t + \delta_t + \frac{\dot{q}_t}{q_t})q_t K_t} = \frac{1}{1-a} - \frac{\delta_t}{(r_t + \delta_t + \frac{\dot{q}_t}{q_t})} \qquad (2)$$

Thus, the depreciation rate for the user cost of capital is constant if labor's share based on income is constant. This property is independent of the properties of the Cobb-Douglas production function.

If one considers a transition process to the steady-state equilibrium in the context of optimal growth theory, net investments decrease along the path; declining net investment is an unavoidable feature of a mature economy.

Depreciation in the SNA

Depreciation in the SNA reflects accounting costs. Figures show that:

- depreciation (D) moves together with tangible fixed assets (K) in the SNA (Figure II-3);
- the ratios, D_t/K_t and D_t/K_{t-1}, are roughly constant over time at 8%.

This reflects the accounting cost of depreciation applied in the tax system (Figure II-4).

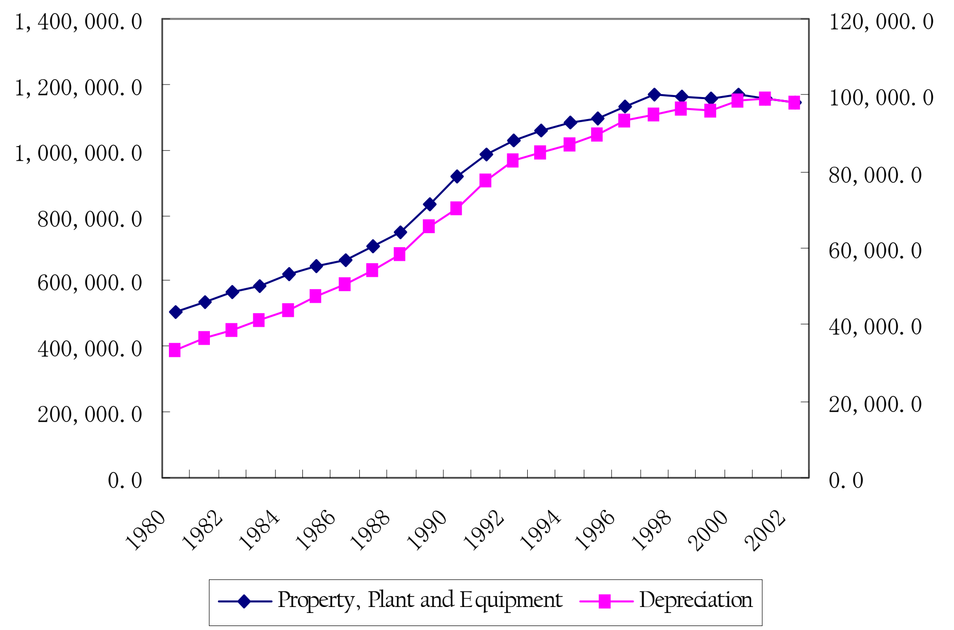


Figure II-3

Thus, increased depreciation, as recorded in the SNA, is primarily due to the increase in the capital stock. (See Masuda (2000) for details of capital-stock statistics in Japan). Depreciation rates are also constant according to data from the Financial Statements Statistics of corporations, which are used to measure labor's share.

The reciprocal of capital's share based on income is

$$\frac{1}{1-a}-\frac{\delta}{(r_t+\delta+\frac{\dot{q}_t}{q_t})}$$

This is primarily determined by r_t and $\frac{\dot{q}_t}{q_t}$, both of which declined during the 1990s. These declines caused labor's share based on income to increase. Other factors that influence labor's share are discussed in the appendix.

An empirical analysis of labor's share

It is well known that labor's share in Japan moves countercyclically in relation to business conditions (Ono (1973), Nishimura and Inoue (1994), and Yoshikawa (1994)). In addition, changes in labor's share have been analyzed in many countries, especially European countries such as France.

Blanchard (1997) pointed out that labor's share is fairly constant in Anglo-Saxon countries, while labor's share has decreased in European countries. In particular, in France, labor's share rose in the 1970s, and fell in the 1980s.

Blanchard and others have classified movements in labor's share according to:

[1] short-term adjustment (Kessing (2003));

[2] the rents received by workers (Caballero and Hammour (1998), Cadiou et al. (2003)); and

[3] biased technical progress (Young (2004)).

Boldrin and Horvath (1995) and Gomme and Greenwood (1995) examined labor's share within a real business-cycle framework, while Yoshikawa (1994) offered a theoretical explanation based on the utilization rate.

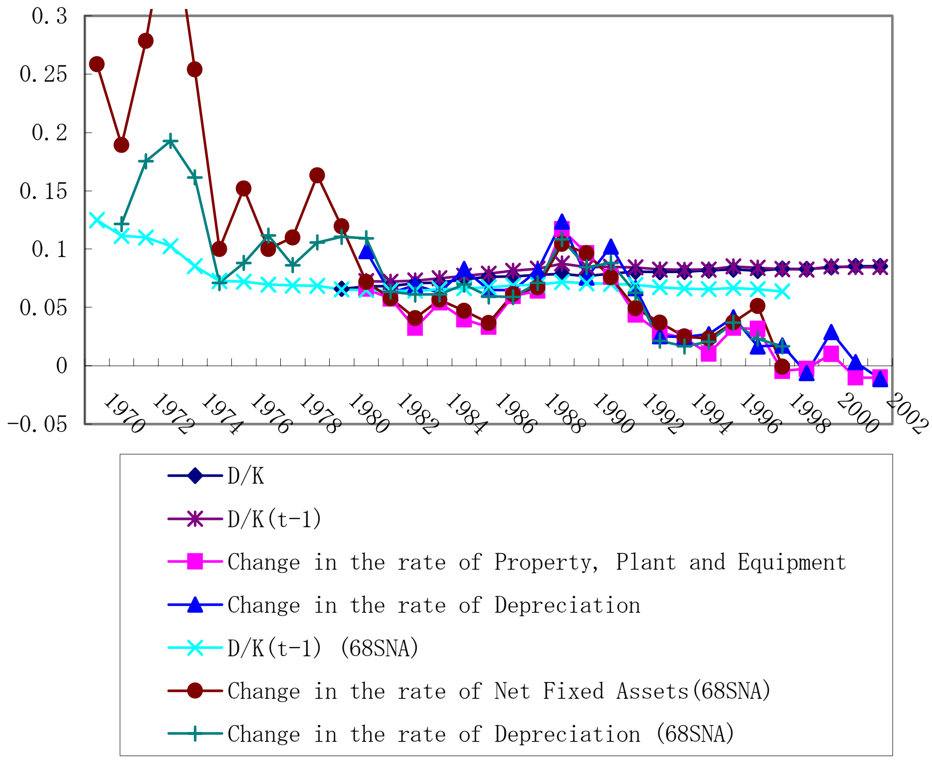


Figure II-4

Therefore, I empirically analyze movements in labor's share and business cycles. I employ two definitions of labor's share as dependent variables: *NShare* measures labor's share by using the natural logarithm of income after taking logarithm and *GShare* measures labor's share by using a production function, as follows:

$$Share_t = constant + seasonal\ dummies + \alpha\Delta_4 Inv_{t-1} + time\ trend + dummy\ 92$$

where $\Delta_4 Inv_t$ is seasonally differenced total fixed capital formation in the SNA.

Table 1 Labor Share

	log(Gshare)				log(Nshare)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CONST	−.526 ***	−.538 ***	−.542 ***	−.529 ***	−.401 ***	−.394 ***	−.372 ***	−.405 ***
	(.007)	(.006)	(.004)	(.007)	(.008)	(.006)	(.006)	(.008)
S1	−.221 ***	−.221 ***	−.221 ***	−.221 ***	−.186 ***	−.187 ***	−.186 ***	−.186 ***
	(.006)	(.006)	(.006)	(.006)	(.007)	(.007)	(.008)	(.007)
S2	−.037 ***	−.036 ***	−.036 ***	−.037 ***	−.020 ***	−.020 ***	−.019 **	−.019 **
	(.006)	(.006)	(.006)	(.006)	(.007)	(.007)	(.008)	(.007)
S3	−.094 ***	−.094 ***	−.094 ***	−.094 ***	−.073 ***	−.073 ***	−.073 ***	−.073 ***
	(.006)	(.006)	(.006)	(.006)	(.007)	(.007)	(.008)	(.007)
Δ_4INV (−1)	−.222 ***	−.249 ***	−.216 ***	−.267 ***	−.249 ***	−.234 ***	−.443 ***	−.312 ***
	(.047)	(.048)	(.036)	(.041)	(.053)	(.052)	(.046)	(.046)
Dummy 92	.017 *	−.006			.024 **	.037 ***		
	(.010)	(.006)			(.011)	(.006)		
TREND	−.0005 ***			−.0002 **	.0003			.0006 ***
	(.000)			(.000)	(.000)			(.000)
Adjusted R2	.950	.946	.946	.949	.927	.926	.895	.924
S.E.	.019	.020	.020	.020	.022	.022	.026	.022
LL	225.644	221.340	220.777	223.988	215.635	214.483	198.658	213.066
DW	1.639	1.442	1.404	1.572	1.809	1.800	1.372	1.704

Note: OLS, T=1981Q2−2003Q1, N=88. Δ_4INV is seasonally adjusted fixed capital formation, S.E. the standard error of regression, DW the Durbin Watson Statistics, LL the maximized value of the log-likelihood function. *** (**) (*) respectively indicate significance levels at 1 (5) (10) %.

In columns (1) to (4) of Table 1, the dependent variables, $Share_t$, are labor shares based on the production function (log(*GShare*)). In columns (5) to (8), labor's share is based on income (log(*NShare*)).

[a] Goodness of fit is higher when estimation is based on *Gshare*.

[b] A change in the rate of fixed capital formation causes labor's share to move

countercyclically, as has been found in many previous studies. In addition, the J-test shows that estimation based on fixed capital formation, $\Delta_4 Inv_{t-1}$, is better than estimation based on GDP, which is consistent with the importance of investment-adjustment costs.

[c] The coefficient of the time trend is slightly negative when *Gshare* is used but is positive when *NShare* is used. The dummy variable for the period following the collapse of the bubble (1992) has a small positive coefficient.

In summary, a comparison of the estimates suggests that the rise in labor's share was due to massive depreciation.

Empirical analysis of labor's share and investment

Table 2 reports results from an estimated investment equation based on the simple acceleration principle for both labor shares. Because firms must replace depreciating assets, labor's share based on income may affect investment, unlike in previous analyses.

$$\Delta_4 Inv_t = constant + seasonal\ dummies + \alpha \Delta_4 GDP_{t-1} + \beta\ Share_{t-1} + time\ trend + dummy\ 92$$

where $\Delta_4 GDP_{t-1}$ is seasonally differenced GDP in $t-1$.

Table 2 Investment Function and Labor Share

	(1)	(2)	(3)	(4)	(5)	(6)
CONST	−. 301 **	−. 387 ***	−. 400 ***	−. 220 **	−. 286 ***	−. 237 ***
	(. 138)	(. 138)	(. 125)	(. 093)	(. 092)	(. 090)
S1	. 050 **	. 063 **	. 065 ***	. 038 **	. 048 **	. 045 **
	(. 024)	(. 025)	(. 022)	(. 019)	(. 019)	(. 019)
S2	−. 051	−. 071 **	−. 075 ***	−. 041	−. 059 **	−. 055 **
	(. 032)	(. 032)	(. 028)	(. 026)	(. 026)	(. 026)
S3	. 024	. 031 *	. 032 **	. 020	. 027	. 025
	(. 018)	(. 018)	(. 016)	(. 016)	(. 016)	(. 017)
Δ4GDP(−1)	1. 080 ***	1. 237 ***	1. 184 ***	1. 066 ***	1. 196 ***	. 928 ***
	(. 260)	(. 261)	(. 141)	(. 263)	(. 265)	(. 231)
log(Gshare) log(Nshare)	−. 421 *	−. 562 **	−. 591 ***	−. 383 *	−. 524 **	−. 490 **
	(. 233)	(. 234)	(. 199)	(. 209)	(. 207)	(. 210)
TREND	. 001 *	. 000		. 001 ***	. 001 *	
	(. 000)	(. 000)		(. 000)	(. 000)	
DUM92	−. 047 **			−. 046 **		
	(. 019)			(. 019)		
Adjusted R2	. 613	. 587	. 592	. 614	. 590	. 576
S.E.	. 038	. 039	. 039	. 038	. 039	. 039
LL	168. 042	164. 616	164. 585	168. 080	164. 931	162. 913
DW	1. 164	1. 268	1. 252	1. 185	1. 305	1. 073

Note: OLS, T=1981Q2−2003Q1, N=88.

In columns (1) to (3) of Table 2, the explanatory variables, $Share_{t-1}$, are labor's share based on the production function (log(*GShare*)). In columns (4) to (6), labor's share is based on income (log(*NShare*)).

[a] Goodness of fit is higher when estimation is based on *Nshare*.
[b] Both labor shares negatively affect fixed capital formation.

Thus, labor's share explains the change in the rate of investment.

In summary, this empirical analysis shows:
[A: Trend] the rising labor share reflects a large amount of depreciation;
[B: Cycle] labor's share remains countercyclical.

III. Okun's law

Okun's law predicts an empirical negative relationship between movements in the unemployment rate and real GDP. The law is important for understanding the macroeconomy. It is represented by the following equation.

Real GDP growth rate = 2.4% – 2× (the unemployment rate – unemployment rate of last year)

This law indicates that the real GDP growth rate is about 2.4% if the unemployment rate does not change. In other words, 2.4% is the normal growth rate. This relationship has been considered very stable over time, not only in the US but also in other countries (Sogner and Stiassny (2002)), in contrast to the Phillips curve, which has been unstable. Hence, Okun's law plays a significant role in separating cyclical components from 'normal' levels of economic activity, such as the natural unemployment rate and the potential growth rate.

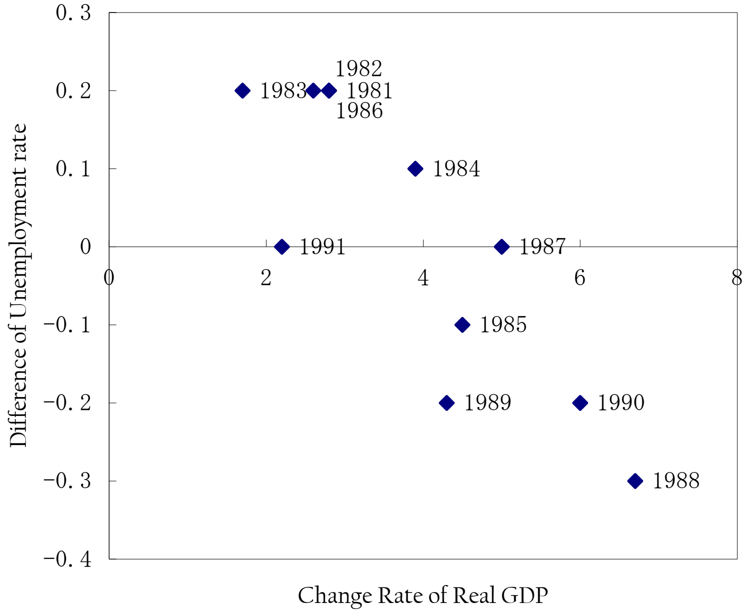
Recently, in Japan, Okun's law has attracted attention. For example, in his paper on the liquidity trap, Krugman (1998) stated that:

> If we were to take the average 2.5 percent unemployment rate in the pre-slump period as an estimate of the natural rate, the 3.4 percent unemployment rate in 1997 would therefore seem to imply an output gap of more than 5 percent last year—and with potential output still presumably growing while output slumps, the gap by the end of 1998 could be as high as 10 percent.

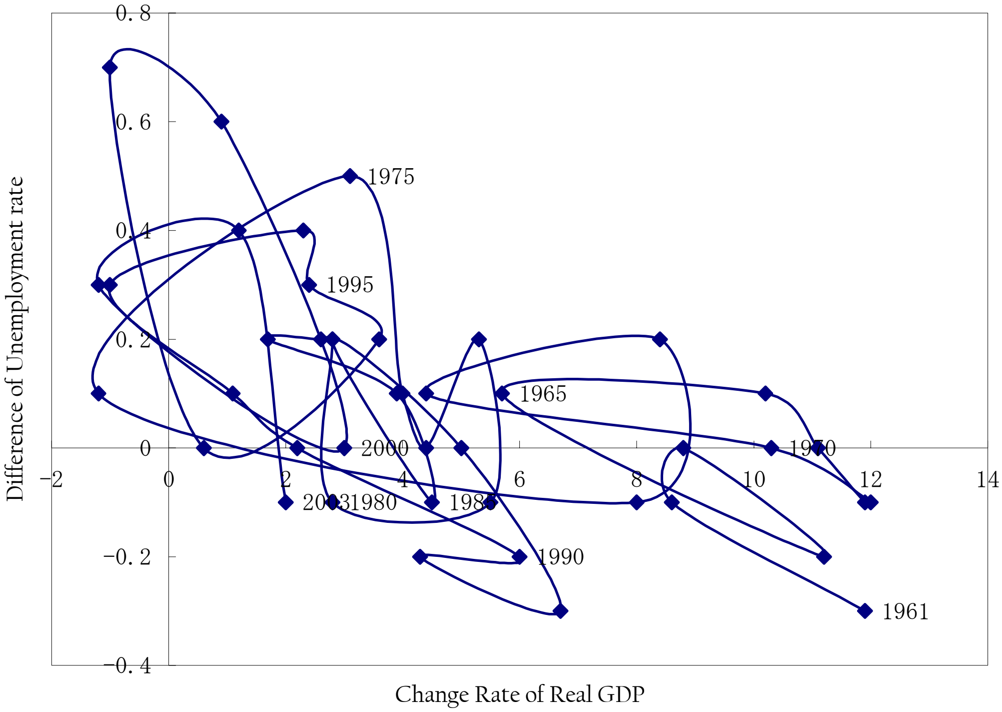
Despite Krugman's argument, estimation of Okun's Law based on Japanese data from the pre-bubble period by Hamada and Kurosaka (1985) suggests that the relationship is unstable. Figure 1 plots Okun's law based on Japanese data from (a) 1981 to 1991; (b) 1961 to 2003; and (c) 1992 to 2003. For (a), the relationship appears stable, as argued by Krugman. For (b), the relationship seems unstable. For (c), the relationship seems to have shifted to the left, which indicates structural breaks.

Figure III-1

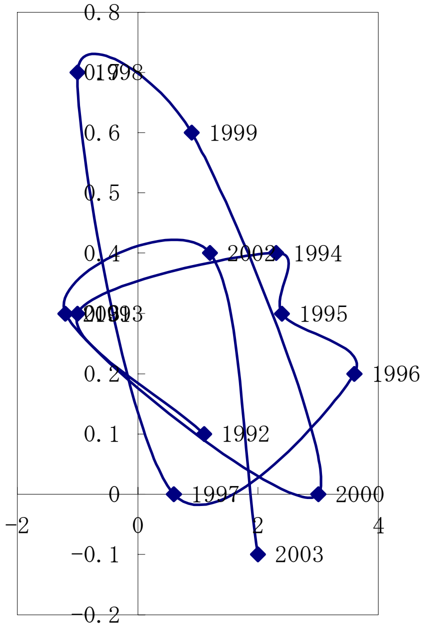
(a) Okun's law poited by Krugman (1998) 1981-1991



(b) 1961-2003



(c) After bubble period (1992–2003)



In collaboration with Hirokuni Uchiyama (Uchiyama and Wakita (2004)), I considered structural breaks in Okun's law by using a recently developed statistical technique. I summarize as follows. First, one encounters the problem of measuring the potential unemployment rate and real GDP. I used the standard estimating equation,

$$u_t - u_t^* = \beta_0 + \beta_1 (y_t - y_t^*) + \varepsilon_t \tag{1}$$

where u_t is the unemployment rate, u_t^* is the potential unemployment rate, y_t is the natural logarithm of GDP, y_t^* is potential GDP. The problem is how to measure u_t^* and y_t^*. Uchiyama and Wakita (2004) used the following methods:

[1] the Hodrick-Prescott (1997) filter;

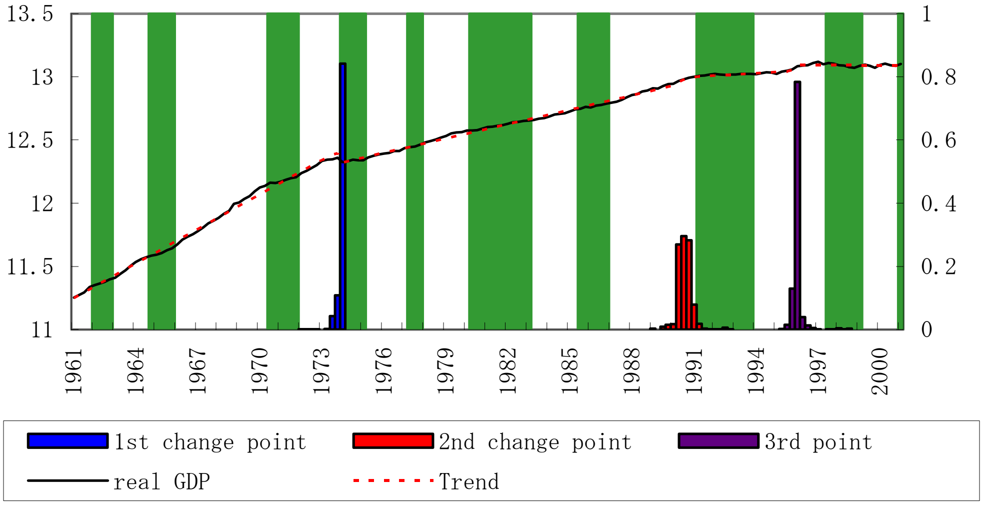
[2] the Baxter-King (1999) filter;

[3] a linear trend and structural breaks;

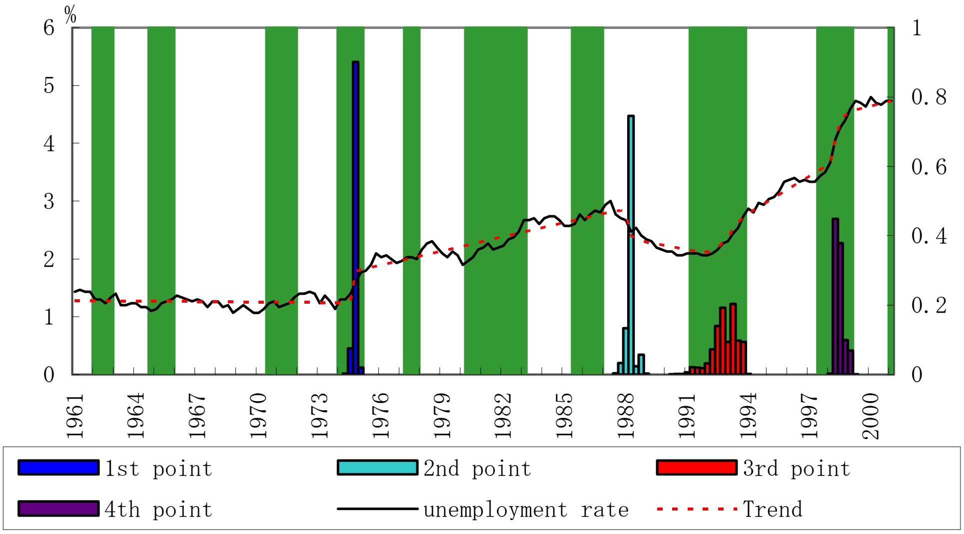
[4] a stochastic trend and structural breaks.

Figure III-2 Structual Breaks

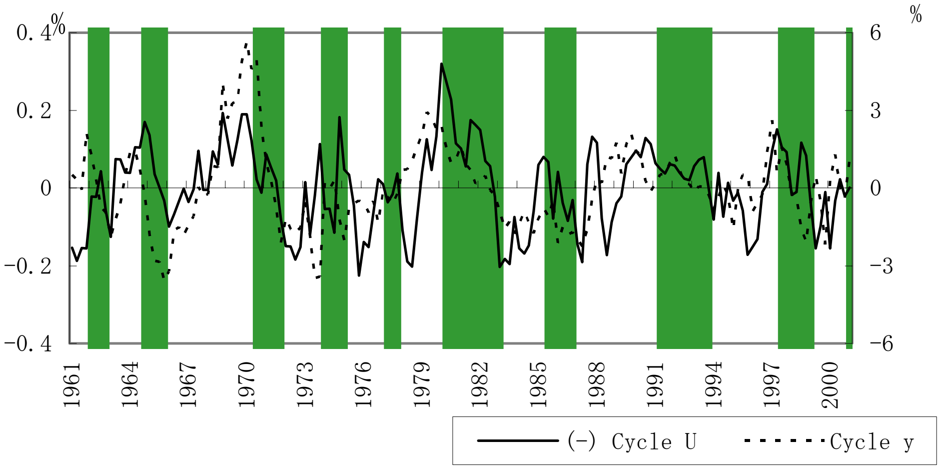
(a) Real GDP and Trend



(b) Unemployment and Trend



(c) Cyclica compnents of Real GDP and Unemployment



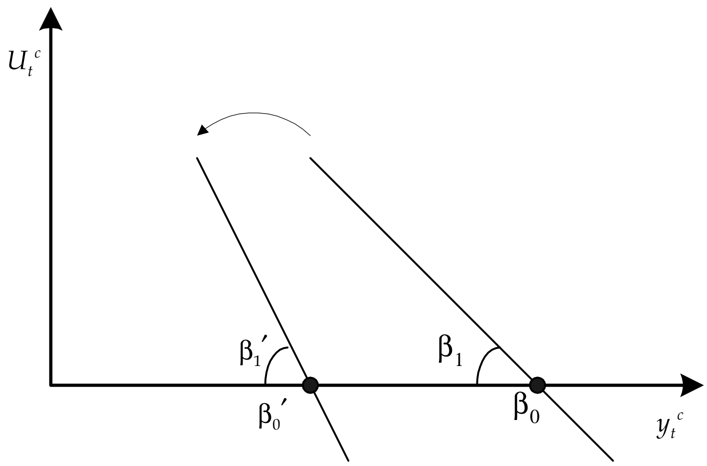


Figure III-3

Here, I explain method [3]. Figure III-2 shows that there were structural breaks in real GDP in 1974, 1990 and 1996. Structural breaks in the unemployment rate occurred later. Only the cyclical factor is plotted in the lower figure. The figure shows that unemployment and GDP followed similar cycles. The extent to which cycles correspond differs between the 1960s and 1990s.

Thus, different techniques yield the following results, which are graphically summarized in figure III-3, as is standard in the literature on Okun's law. (1) The normal growth rate of GDP has fallen (indicated by a smaller β_0') several times. (2) Okun's coefficient, β_1, has increased following several structural-break points.

IV. Conclusion

I considered the following two characteristics of the labor market.

- A constant labor share is implied in theory by the Cobb–Douglas production function. Thus, labor's share should be based on the production function. Labor's share based on income has only been rising because of massive depreciation.
- There have been several structural breaks in Okun's law since the bubble collapsed, and the potential growth rate has fallen.

Appendix: problems in measuring labor's share

Various problems involved in measuring labor's share have been identified. These problems are in addition to the one I considered in the main text relating to whether depreciation should be included in the denominator of labor's share. I explain these problems below.

There are two ways of measuring GDP or national income. GDP can be measured at factor cost or at market prices by including indirect taxes net of subsidies. In the context of measuring labor's share based on the production function, there is a slight difference between these approaches. Denoting the tax rate by t, the reciprocal of capital's share is $\frac{P_t X_t}{(r_t + \delta_t + \frac{\dot{q}_t}{q_t}) q_t K_t} = \frac{1}{1-a}\frac{1}{1-t}$. Hence, in this case, there is no major problem.

When the share is calculated, there are many circumstances in which it is appropriate to use the Financial Statements Statistics of corporations published by the Ministry of Industry and Finance. However, several issues require attention when these data are used. There is [a] the issue of the expansion of a sample coverage and [b] there are differences between quarterly report and annual reports.

Many researchers use the Financial Statements Statistics of corporations by industry to analyze labor's share. For the SNA, there are many data problems. However, consistent quarterly data from 1960 can be obtained from the Financial Statements Statistics of corporations by industry. Statistics from annual and quarterly reports cover different ranges (see Ministry of Finance (2002) for details). Coverage for small companies in the quarterly report has risen, which produces an apparent increase in labor's share.

Figures A-1 and A-2 show the following.

- Originally, in the annual report, the rising tendency in labor's share is not observed after the mid-1970s (see also Yoshikawa (1994)) and labor's share is high in firms that have capital of more than 10 million yen and is low in firms that have capital of less than 10 million yen (see also Nishimura and Inoue (1994)). (See Figure A-1);
- Originally, in the quarterly report, firms with capital of more than 10 million yen are included in the survey, but firms with less are only included in the annual report.

Many other problems relating to differences between quarterly and annual reports have been identified. However, Figure A-2 shows that these definitional differences do not affect the calculation of labor's share much when the data is adjusted to account for these differences.

In addition, although there is a problem relating to private enterprises, this hardly affects the calculation of factor shares (see Kamata and Masuda (2001) and Wakita (2005) for details).

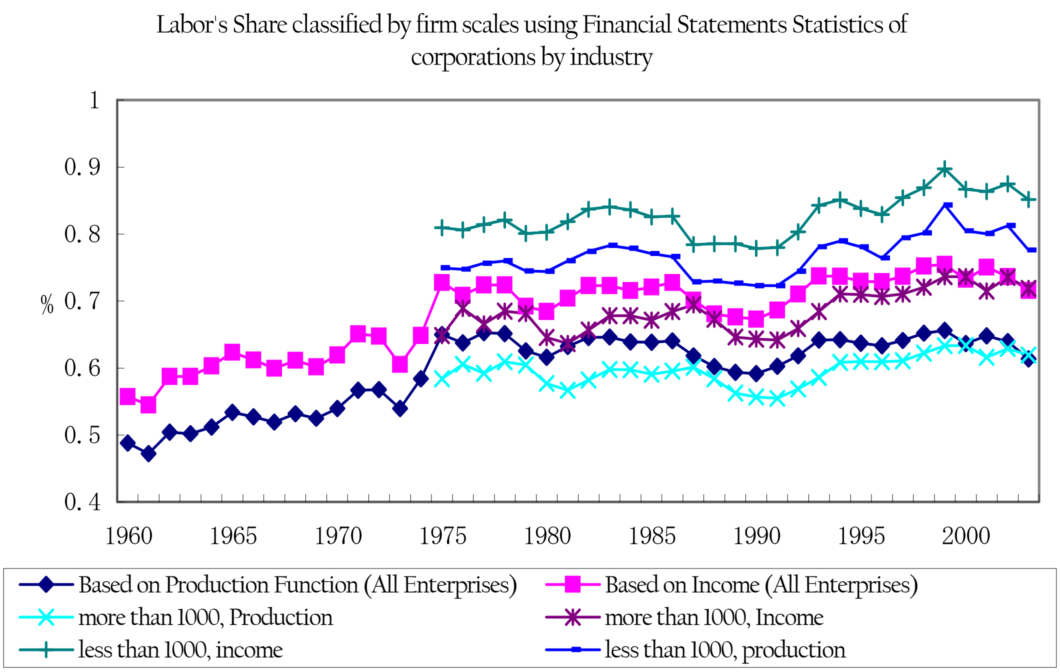


Figure A-1

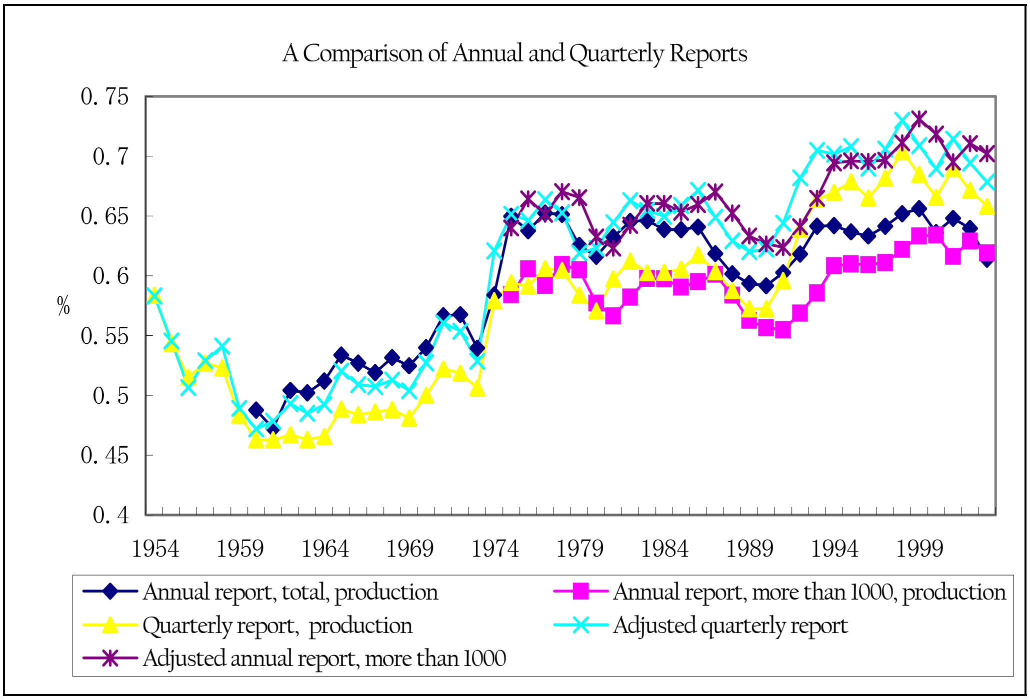


Figure A-2

References

Baxter, M. and R. King (1999) "Measuring Business Cycles: Approximate Band-Pass Filters For Economic Time Series, " *Review of Economics and Economic Statistics* 81, 4, 575-593.

Blanchard, O.J., (1997) "The Medium Run," *Brookings Papers on Economic Activity* 2, 89 - 158.

Boldrin, M., Horvath, M., 1995. Labor Contracts and Business Cycles, *Journal of Political Economy* 103, 972 - 1004.

Caballero, R.J., and Hammour, M.L.,(1998) "Jobless growth: appropriability, factor substitution, and unemployment," *Carnegie-Rochester Conference Series on Public Policy* 48, 51-94.

Cadiou, Loic, Dees, Stephane and Laffargue, Jean Pierre, (2003) "A computational General Equilibrium Model with Vintage Capital," *Journal of Economic Dynamics and Control* 27, 1961-1991.

Clark, P.K. (1989) "Trend Reversion in Real Output and Unemployment," *Journal of Econometrics* 40,15-32.

Cobb, Charles W. and Douglas, Paul H. (1928) "A Theory of Production," *American Economic Review* 18-1, 139-165.

Gomme, P., and Greenwood, J., (1995) "On the Cyclical Allocation of Risk," *Journal of Economic Dynamics and Control* 19, 91 - 124.

Hamada, K. and Kurosaka, Y. (1985) "The Relationship between Production and Unemployment in Japan: Okun' s Law in Comparative Perspective," *European Economic Review* 25, 71-94.

Hashimoto Juro (2002) *How to read progress of deflation*, Iwanami Shoten (in Japanese).

Hodrick, R. and E. Prescott (1997) " Post-War US Business Cycles: an Empirical Investigation, " *Journal of Money, Credit, and Banking*, 29, 1-16.

Hyuga Yuji (2002) "About Measurement Method of Labor Share," Nissei Kisoken Shohou vol.23 (in Japanese).

Kamata Koichiro and Masuda Munehito (2001) "The Influence of measurement error of statistics on GDP in our country" Kinyu Kenkyu Bank of Japan (in Japanese).

Kessing, Sebastian G. (2003) "A Note on the Determinants of Labour Share Movements," *Economics Letters* 81, 9 - 12

Ministry of Finance Policy Research Institute (2002) "The history of Financial Statements Statistics of Corporations by Industry investigation" "Financial Review June (in Japanese).

Masuda Munehito (2000) "Looking at satistics of capital stock" Bank of Japan Research and Statistics Department Working Paper 00-5 (in Japanese).

Nishimura Kiyohiko and Inoue Atsushi (1994) "Labor share of Japanese manufacturing industry after the period of the high growth of economy", in (Tsuneo Ishikawa ed.) Japanese income and wealth distribution, University of Tokyo press (in Japanese).

Ono, Akira (1973) " Japanese wage determination in Japane after war" Toyo Keizai Shinposha (in

Japanese).

Sogner, L. and A. Stiassny (2002) "An Analysis on the Structural Stability of Okun's Law – A Cross-Country Study," *Applied Econometrics*, 14, 1775-1787.

Uchiyama, Hirokuni and Wakita, Shigeru (2004) "Structural Breaks in Okun's Law: Evidence from the Lost Decade in Japan, mimeo.

Wakita, Shigeru (2005) "Rodo Sijo no Usinawareta 10nenn," Financial Review (in Japanese).

Weber, C.E. (1995) "Cyclical Output, Cyclical Unemployment, and Okun's Coefficient: A New Approach," *Journal of Applied Economics*, 10, 4, 433-445.

Yoshikawa, Hiroshi (1994) "Labor share and Growth and cycles of Japanese economy", in (Tsuneo Ishikawa ed.) Japanese income and wealth distribution, University of Tokyo press (in Japanese).

Young, Andrew T. (2004) "Labor' s Share Fluctuations, Biased Technical Change, and the Business Cycle," *Review of Economic Dynamics* 7, 916 - 931.