Exchange Rates and Deindustrialization: Japanese Experiences

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Abstract

The strongest yen's appreciation in 2011 made many Japanese companies choose overseas operations. The general public is worrying that this choice may put them out of work. Contrary to this public debate, academic debate argues that deindustrialization is the natural outcome of the successful economic development in advanced economies. However, a regression analysis on the current Japanese economy suggests that the negative deindustrialization associated rising unemployment has started recently. Based on statistical findings, this paper develops a system dynamics model and examines the negative effect of deindustrialization. A shift from domestic production to overseas production reduces economic performance little by little. Although foreign direct investment is preferred to exports under the home currency appreciation, this myopic strategy will hollow out the domestic industry in the long run.

Keyword : deindustrialization, hollowing-out, foreign direct investment, unemployment

1. Introduction

Deindustrialization or hollowing-out of the industry is a controversial phenomenon[1]. Although the manufacturing sector in a number of advanced economies shows the decline in output and employment, it does not mean the decline of the economy as a whole. A shift from the manufacturing sector to the service sector is a typical economic development process, predicted by the Petty-Clark's Law[2].

Rowthorn and Wells (1987) examined the merits and demerits of deindustrialization of the economy; they distinguished between deindustrialization explanations that saw it as a positive process of maturity of the economy and those that associated deindustrialization with negative factors like poor economic performance. Positive deindustrialization is associated with full employment and rising real incomes; whilst negative deindustrialization is associated with rising unemployment and stagnant real incomes. They suggested deindustrialization might be both an effect and a cause of poor economic performance.

In Japan, the issue of deindustrialization was first discussed at the end of the 1980s. Given the

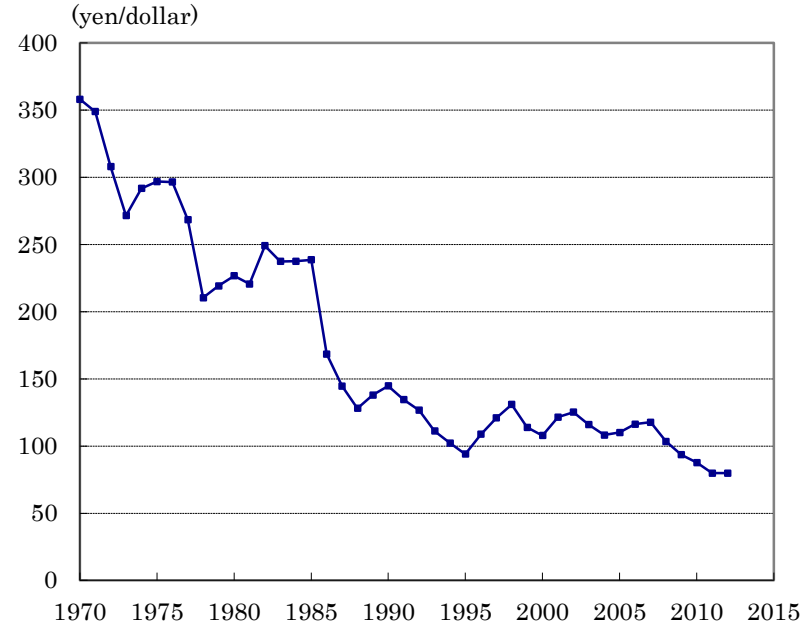
[1] " Hollowing-out" was first used to describe the implications of off-shoring by U.S. manufacturers in 1970s.

[2] Clark (1940) examined the significance of this tendency and called "Petty's Law" after Sir William Petty who first found this type of tendency in *Political Arithmetic* (1690). This theory is now referred to as "Petty-Clark's Law".

rapid appreciation of the yen after the Plaza Accord in 1985, Japanese manufacturing industries' production bases largely transferred overseas seeking cheap labor. Japan-United States trade frictions accelerated Japan's overseas production in the USA. Domestic employment decreased, and there arose concerns that technology levels would grow stagnantly. Although the debate on hollowing-out intensified again in the middle of 1990s under the yen appreciation, it faded away in the late 1990s because domestic investments recovered under the yen depreciation phase. The most persuasive opinion was that deindustrialization or hollowing-out was a sign of maturity because this phenomenon had been recognized in other advanced economies. Among them, the successful transition from the manufacturing sector to service sector of the US economy was one of the good models for Japanese economy.

In 1990s, production bases were largely transferred towards Asia and these bases started to import components and capital goods from Japan. Some regarded it as a new international division of labor which would bring benefit to Japan. Furthermore, others regarded that growing accumulation of net international investment was another sign of maturity based on the development stage theory.

The issue of deindustrialization recurred under the strongest yen appreciation in 2011 (Figure 1). Many manufactures recorded deficits from exports and planned seriously transferring their factories overseas. Among advanced economies, Japan has been the most eager in maintaining the domestic manufacturing industry because of anxiety over quality and seeking flexibility and technological advantage in production. However, manufacturers cannot endure the strong yen any more. Presently, there is a growing concern on moving out of R&D bases, following a transfer of production operations overseas.



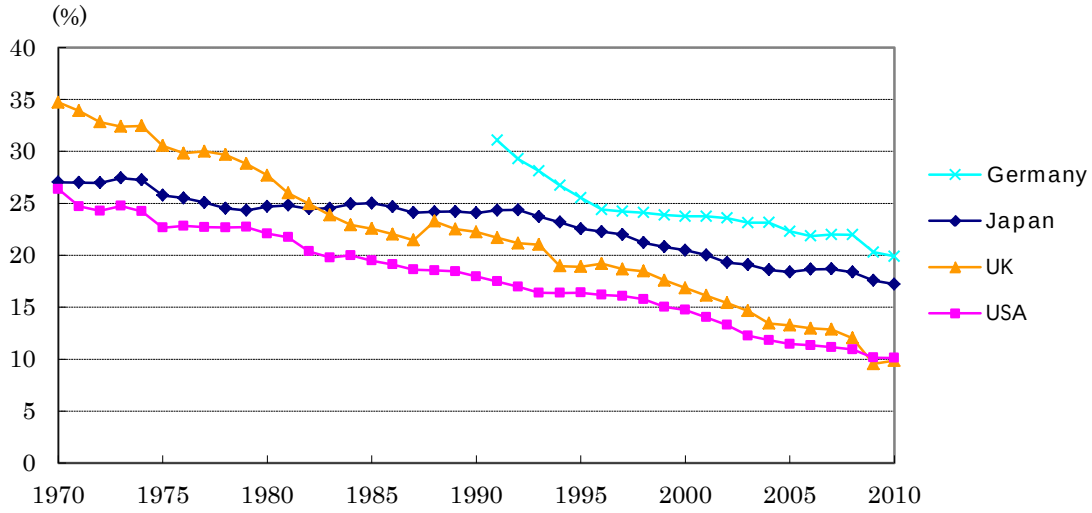
Source:: OECD, *Economic Outlook.*

Figure 1 Exchange rate of the Yen

This paper examines the conditions of deindustrialization and reveals how the foreign direct investment (FDI) under strong home currency harms the manufacturing sector.

2. Deindustrialization

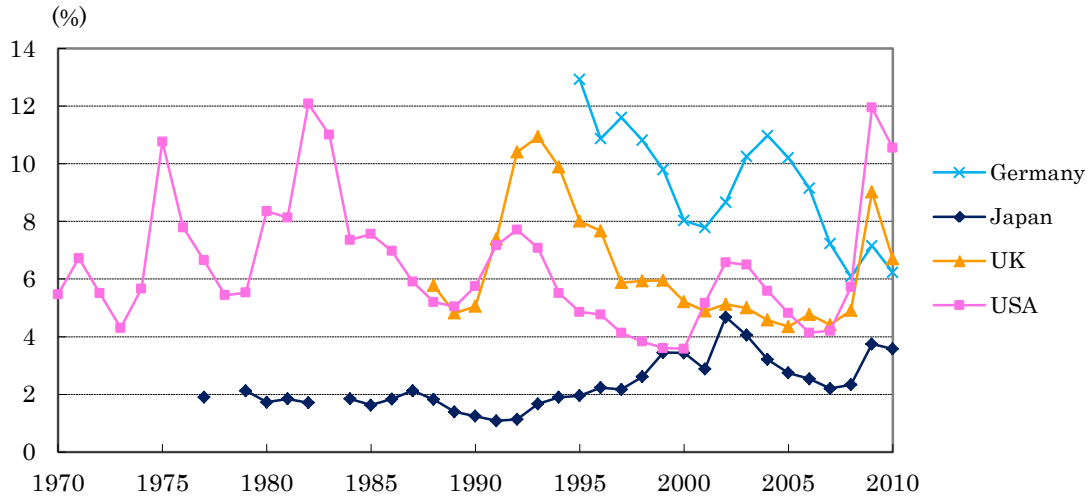
In this section, we present and discuss some trends in advanced economies. Figure 2 shows time series for share in total employment of manufacturing employment level. We see a marginal decline from 1990s in Japan while we see monotonous declines in the UK and the USA.



Source:: ILO, *Labour Statistics*.

Figure 2 Employment share of manufacturing industry

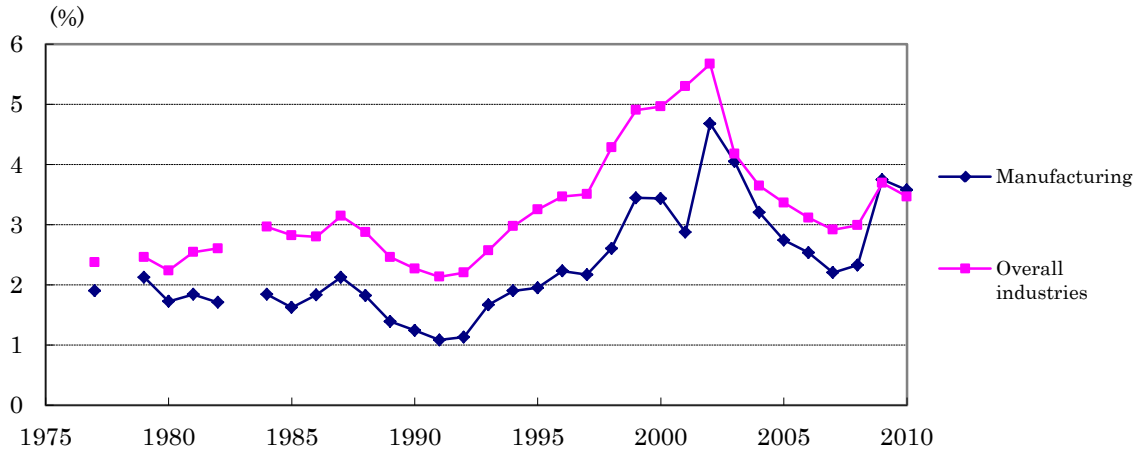
Although Germany and Japan still maintain the manufacturing industry in comparison with the UK and the USA, Figure 3 reveals the difference between two countries. Japan has a low unemployment rate while Germany has a high unemployment rate.



Source:: ILO, *Labour Statistics*.

Figure 3 Unemployment rate in the manufacturing industry

Japan had a low unemployment rate in the manufacturing industry comparing other industries for a long time (Figure 4). In terms of employment, the manufacturing sector remains a base industry of Japan.



Source:: ILO, *Labour Statistics* and *ILOSTAT Database*.

Figure 4　Unemployment rate in Japan

One of the central issues in the debate of deindustrialization is what factors are responsible for the observed decline in manufacturing employment. Several explanations are available.

The first explanation rests on a strong link between the degree of economic maturity and the structure of employment. Clark (1940) suggested that, in the initial phase of development, as per capita income rises the pattern of demand shifts away from food towards industrial products. In the later stages of development, the pattern of demand shifts away from industrial products towards services. This development process changes economic structure and the pattern of employment.

The second explanation relies on the difference of productivity growth among sectors. Clark (1940) argued that productivity gains in the manufacturing sector exceed those in the service sector. Rowthorn and Ramaswamy (1997) confirmed this argument and argued that productivity in the manufacturing sector grows faster than in the service sector. Productivity growth in the manufacturing sector has been exceeding those in other sectors, and this phenomenon will shift employment away from the manufacturing sector into the service sector. Table 1 shows annual growth rates of labor productivity over the period 1997-2010. Productivity is defined as value added at constant 2005 market prices divided by total employment.

Table 1　Average labor productivity growth, 1997-2010 (%)

	Primary	Secondary	Tertiary
Germany	2.096	2.086	0.427
Japan	2.073	2.872	-0.367
UK	0.657	2.714	1.697
USA (since 2000)	3.352	3.815	0.917

Source:: OECD, *Economic Outlook*.

The pattern that emerges is that the growth rates of labor productivity are highest in the secondary industry and lowest in the tertiary industry. High productivity in the manufacturing sector leads to labor saving production, and the excess labor is consumed in the tertiary industry. The exception is productivity growth in Japan in the tertiary industry, which shows minus growth rates. There is less

space for the excess labor in Japan than in other advanced economies. The manufacturing sector has long promised the stable employment and relatively high wages in Japan. Therefore, people are worrying about a recent rise of the unemployment rate.

The third explanation focuses on globalization. There are several factors that we must consider. In North-South trade, South is specializing in labor-intensive manufacturing goods. Facing these cheap imports, North needs to change the industrial structure. Outsourcing of labor-intensive activities previously carried out within the manufacturing sector to countries with cheaper labor is another explanation. In 1970s, under the pressure of dollar depreciation, off-shoring was adopted among US manufacturers. This tendency hollowed out the manufacturing sector by closing home factories and removing employees from the job. Scaling down of the manufacturing sector was compensated by the expansion of the service sectors. Off-shoring production was put into practice with large outward foreign direct investment. Bluestone and Harrison (1982) offered the influential account. Foreign direct investment was once a complement of domestic investment. However, it is now a substitute of domestic investment.

Outcomes of FDI depend on types of investment, product, and host country. Horizontal FDI substitutes export, and hence reduces domestic production. Vertical FDI induces capital goods export and intermediate goods export while introduces reimport.

Figure 5 summarizes these arguments. Domestic factors, such as expand of the tertiary sector and growth of productivity, reduce employment in the manufacturing sector. External factors, North-South trade and outsourcing, accelerate import which reduces home production. Foreign direct investment accelerates overseas production which substitutes home production.

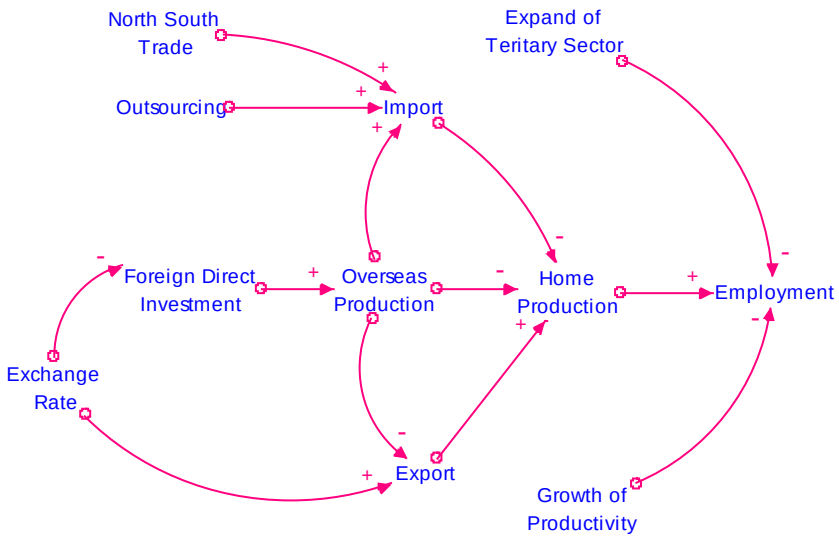
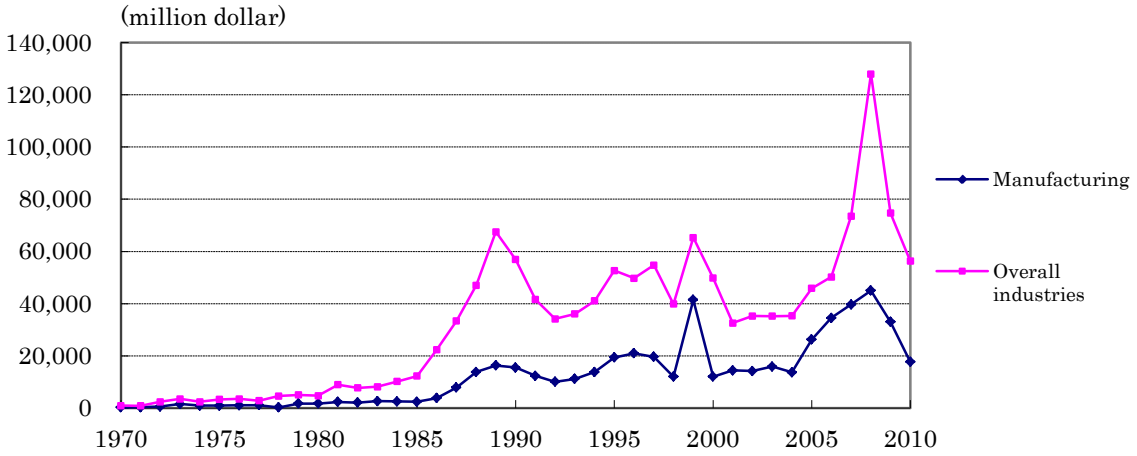


Figure 5 Causes of deindustrialization

While public debate about deindustrialization tends to emphasize the rising unemployment and the hollowing-out in the manufacturing sector, academic debate argues that deindustrialization is an evitable feature of the process of economic development and unemployment is temporal. The latter arguments often evaluate the deindustrialization of the USA. as a role model which Japan should follow. Figure 6 shows outward FDI of Japan. In 1980s, automobiles manufacturers and electric-appliance manufacturers promoted the horizontal FDI in the USA and Europe to avoid trade frictions. In 1990s, the light

manufacturing, such as textile makers, promoted the FDI to use the cheap labor. Labor-intensive manufacturing gradually moved abroad, and domestic makers shifted to export capital goods. In 2000's the cost-cutting pressure became severe and more manufacturers considered FDI while preserving research and development centers and components factories in Japan.



Source:: OECD, *International Direct Investment Databases*

Figure 6 Foreign direct investment of Japan

3. Exchange Rates and Deindustrialization

Among causal factors of deindustrialization, overseas transfer of production is a key factor of the deindustrialization in Japan. FDI in the manufacturing sector grows in response to the yen appreciation. We found many empirical studies on deindustrialization in 1990s. However, most of them did not catch the evidence of deindustrialization in Japan[3].

In order to examine the deindustrialization phenomena in Japan, we focus on the unemployment rate in the manufacturing sector because this variable must be raised in the process of deindustrialization.

Our regression analysis reveals the interesting features of deindustrialization (Table 2). The dependent variable in the regressions is the unemployment rate in the manufacturing industry (UEM_t), which is defined as $\frac{\text{unemployment}}{\text{employment} + \text{unemployment}} \times 100$ from *ILO Labour Statistics* database. $FDIM_t$ is the FDI in the manufacturing industry in Figure 6. SR_t is the proportion of services to the gross domestic production from the cabinet office's *Annual Report on National Accounts*.

FDI and trend toward a service economy had little to the unemployment in the period from 1977 to 1997. Both variables became significant in the period from 1990 to 2008. These results indicate that there was no deindustrialization phenomenon in Japan until 1990s. Deindustrialization started behind the UK and the USA. FDI is one of the causes of the current deindustrialization or hollowing-out, but its effect appears with a time lag. The existence of a time lag prevents us to understand the hollowing -out phenomena well.

[3] This is one of the reasons that the arguments on deindustrialization has calmed until 2011.

Table 2 Regression analysis of unemployment rate in manufacturing industry[4]

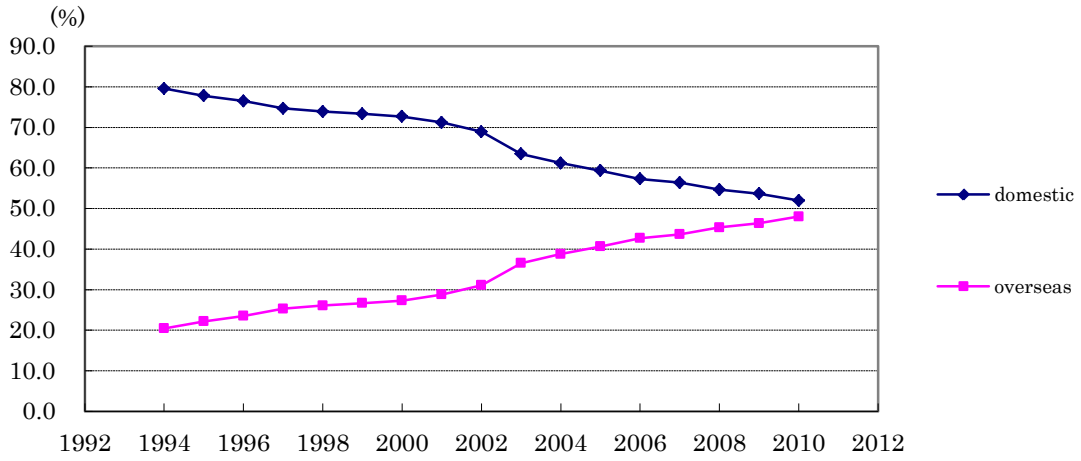
	const.	$FDIM_{t-1}$	$FDIM_{t-2}$	$FDIM_{t-3}$	SR_t	R^2
UEM 1977–97	1.8303 (14.606)	-8.91e-06 (-0.763)				0.0331
	1.8699 (15.899)		-1.56e-05 (-1.273)			0.0870
	1.8576 (16.054)			-1.60e-05 (-1.174)		0.0750
	1.3898 (0.847)				0.5983 (0.223)	0.0029
UEM 1990–08	2.3320 (4.503)	8.84e-06 (0.363)				0.0077
	2.4632 (4.446)		2.12e-06 (0.075)			0.0003
	1.2766 (2.779)			7.50e-05 (2.914)		0.3330
	-22.615 (-6.706)				38.393 (7.451)	0.7656

Note: The regressions taker the form, $UEM = a + b \cdot FDIM$, $UEM = a + b \cdot SR$.

[4] Matsushita, Goto and Yamashita (2011), p.22.

How does FDI affect the deindustrialization? The appreciation of the home currency harms the competitiveness of the manufacturing sector in the domestic market as well as in the world market. To maintain the competitiveness, manufacturing companies are obliged to use the cheap labor and consider overseas production. Japanese manufacturers prefer local production supplying the demand for host markets to offshore production. Although offshore production substitutes and decreases the home production, overseas local production, moving out a part of the production process, increases the export of the home production. The recent yen appreciation makes manufacturers to consider moving larger part of production processes and R&D bases to abroad.

Figure 7 shows the percentages of subsidiaries and affiliated companies owned by Japanese manufacturers. The percentage of overseas subsidiaries continues to rise.



Source: Ministry of Economy, Trade and Industry, *Basic Survey of Japanese Business Structure and Activities*

Figure 7 Ownership of subsidiaries and affiliated companies

Consequences of FDI in the home country are not clear comparing those in the host country. In a theoretical sense, vertical direct investment increases export from the home country to the host country, whereas horizontal direct investment decreases export. Actual FDI can substitute for trade or can be complementary trade. In 1980's, FDI in the automobile industry was intended to stop the export from Japan to USA or Europe avoiding trade frictions. However, the current FDI aims to supply the home market and increases the volume of export and import.

4. Structure of the model

The statistical findings in the previous sections tell us that the time-lag plays a crucial role in the deindustrialization phenomena. In modeling a FDI-led deindustrialization, a system dynamics approach is much more useful than other methods because we can handle time-lags in various variables. A system dynamics approach is also useful in building decision making process.

4.1 Macroeconomic sector

The standard Keynesian aggregate demand model can be applied to the national economy. Gross domestic expenditure (GDE_t) consists of private final consumption expenditure (CP_t), private capital formation (I_t), government expenditure (G_t), exports (EX_t), and imports (IM_t).

$$GDE_t = CP_t + I_t + G_t + EX_t - IM_t \tag{3.1}$$

A subscript means time t.

Private final consumption expenditure

Private final consumption expenditure is a large and stable component in GDE. Private final consumption expenditure function is assumed as a Keynesian type function in which the level of consumption depends on the gross domestic product (GDP_t).

$$CP_t = CP_t(GDP_{t-1}) \tag{3.2}$$

Gross private fixed capital formation

The gross private fixed capital formation consists of the private residential investment (IH_t), the private nonresidential investment (IP_t), the private inventories (IV_t).

$$I_t = IH_t + IP_t + IV_t \tag{3.3}$$

The private residential investment is primarily the domestic demand by household. We assume that it is influenced by the previous investment and the previous demand for imports.

$$IH_t = IH_t(IH_{t-1}, IM_{t-1}) \tag{3.4}$$

It is an advantage the model is developed in the system dynamics that control the variable with the delay easily.

The private nonresidential investment and private inventories are actions of the firm. We assume the private nonresidential investment depended on the previous investment and the change of exports demand.

$$IP_t = IP_t(IP_{t-1}, EX_t - EX_{t-1}) \tag{3.5}$$

Private inventories are related to business fluctuations. We assume that the production plan of the firm is influenced by the economic growth.

$$IV_t = IV_t(GDP_{t-1} - GDP_{t-2}) \tag{3.6}$$

Government Expenditure

We assume that the government expenditure grows steadily year by year.

$$G_t = G_t(TIME) \tag{3.7}$$

Exports

The exports to other countries are assumed to depend on the exchange rate (EXR_t) and the world GDP ($WGDP_t$). We use the world GDP measured by US dollars at current prices and current exchange rates in millions (Source: *UnctadStat*).

$$EX_t = EX(EXR_t, WGDP_t) \tag{3.8}$$

Imports

Imports are dependent on the consumption expenditure and the exchange rate; thus we assumed following regional imports function.

$$IM_t = IM_t(CP_t, EXR_t) \tag{3.9}$$

Figure 8 shows the causal relation of the macroeconomic sector.

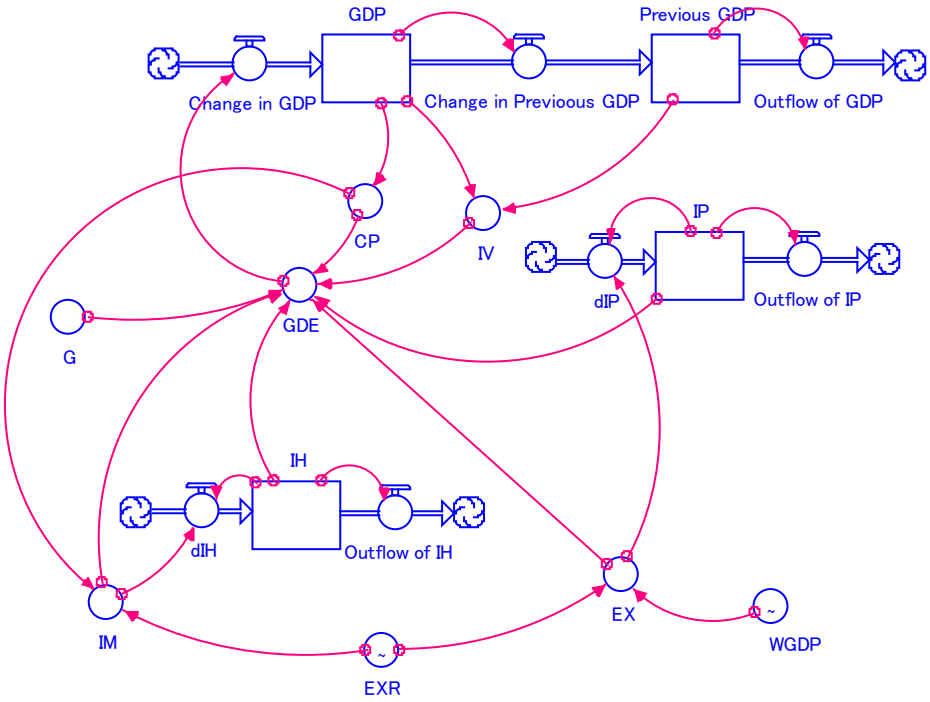


Figure 8　Macroeconomic sector[5]

4.2 Foreign direct investment

We assume that the volume of the foreign direct investment in the manufacturing industry is dependent on the exchange rate.

$$FDIM_t = FDIM_t(EXR_t) \tag{3.10}$$

4.3 Manufacturing sector

In the manufacturing sector, we focus on employment and overseas investment. A significant part of investment in manufacturing companies is for their subsidiaries and affiliated companies. We assume the investment for overseas subsidiaries and affiliated companies ($INVOS_t$) is dependent on investment for all subsidiaries and affiliated companies ($INVS_t$) and the propensity to invest overseas subsidiaries (POS_t) by the parent company.

$$INVOS_t = POS_t \times INVS_t(CP_t) \tag{3.11}$$

The investment for all subsidiaries and affiliated companies ($INVS_t$) is well explained by private final consumption expenditure (CP_t) because the Japanese economy is a domestic consumption-led economy. We use the percentage of the investment for subsidiaries and affiliated companies owned by manufacturers as the propensity to invest overseas subsidiaries. This percentage was gradually rising from 0.527 in 1994 to 0.586 in 2010.

We assume that the demand for labor (LDM_t) is affected by the private nonresidential investment and foreign direct investment from 1975 to 1993.

$$LDM_t = LDM_t(IP_t, EX_t, FDIM_t) \tag{3.12a}$$

Form 1994, we assume that demand for labor is well explained by the private nonresidential investment and investment for overseas subsidiaries and affiliated companies[6].

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[5] The model was developed on STELLA Ver.9.

[6] The investment data for subsidiaries and affiliated companies were available from 1994.

$$LDM_t = LDM_t(IP_t, INVOS_t) \tag{3.12b}$$

Figure 9 shows the causal relation of the manufacturing sector.

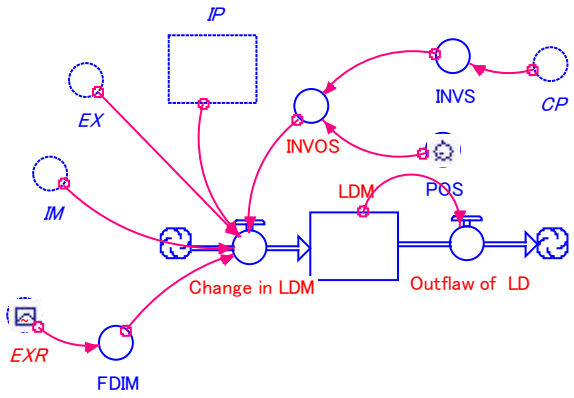

Figure 9 Manufacturing sector

5. Simulation

Let us examine simulations. We have three scenarios: yen appreciation (77.0 yen/dollar)[7], yen depreciation (95.0 yen/dollar), and yen super depreciation (120.0 yen/dollar) from 2012 to 2020[8]. Figure 10 and 11 summarize the results. Along with public belief, GDP will be smaller under yen appreciation scenario than under yen depreciation scenarios for the future.

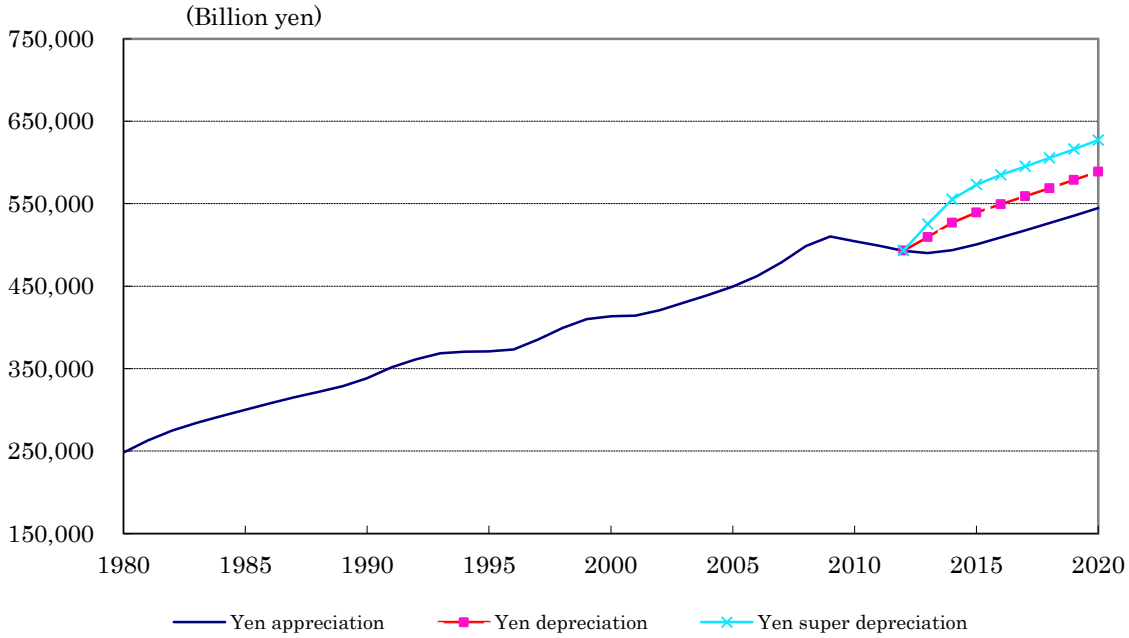

Figure 10 GDP simulation

The labor demand in the manufacturing industry will be smaller under yen depreciation

[7] *OECD Economic Outlook* estimated 77.0 yen/dollar for 2012 and 2013 in November 2011.
[8] 95 yen per dollar are the assumed exchange rate by major companies for the 1st quarter 2014.

scenarios than under yen appreciation scenario after the short recovery. This result implies the importance of manufacturers' decisions. This is dependent on the parent companies decisions (POS_t) in the model.

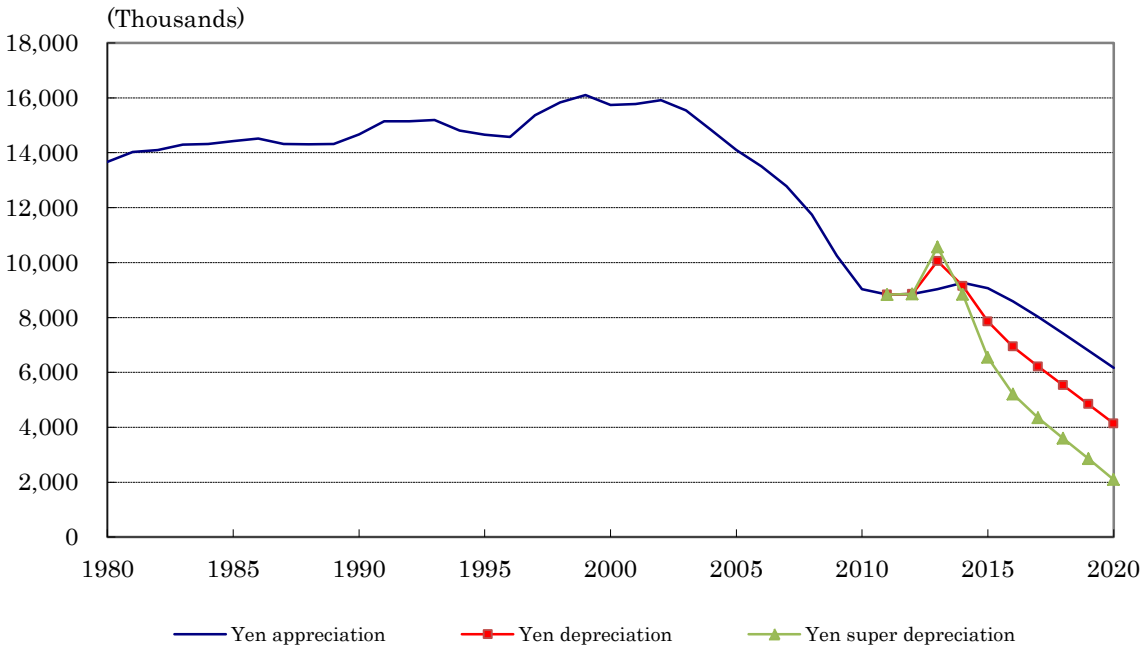

Figure 11 Employment simulation

Figure 12 shows the propensity to invest overseas subsidiaries (POS_t) simulation result under yen depreciation case. Reducing investment towards overseas subsidiaries will increase domestic employment. Industrial policy calling back Japanese manufacturers to home country is more effective than currency policy.

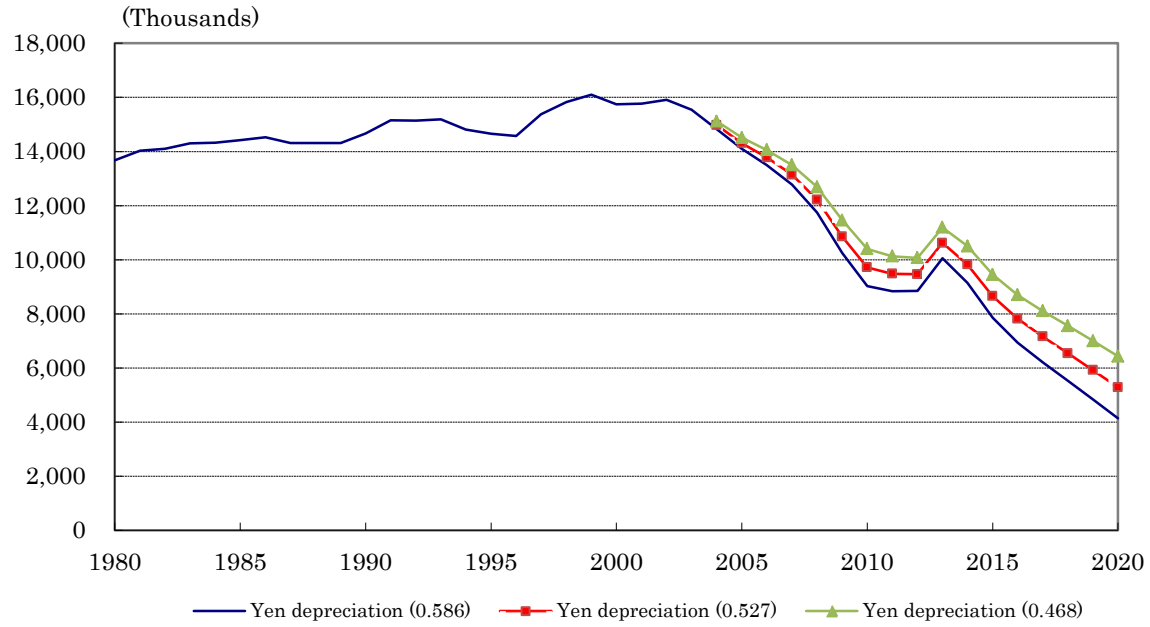

Figure 12 Effect of propensity to invest (POS)

6. Conclusion

The findings of this paper can be summarized as follows.

1) FDI, especially vertical FDI, is a key factor of deindustrialization.

2) Under the home currency appreciation, deindustrialization is a negative phenomenon contrary to many academic debates.

3) The negative effect of FDI appears with delays. System dynamics approach is particularly useful to express these delays.

4) System dynamics model highlights an important result that is unpredictable in other economic forecasting. Yen depreciation will recover the manufacturing employment for a while but will not for a longer term.

5) Industrial policy calling back manufactures to home country is desirable than the currency policy.

Although overseas transfer of production is a formula for deficit-ridden manufacturers, it will hollow out the economy in the long-run. Thousands of manufacturing jobs may be lost in the future.

Appendix: Estimation of functions

A data set was assembled for the years from 1975 to 2010. A value in parentheses under the coefficient is t-distribution, R^2 is a coefficient of determination, $\overline{R}^2$ a coefficient of determination adjusted for the degrees of freedom.

$$CP_t = \underset{(8.101)}{35739.8651} + \underset{(47.868)}{0.5111}\, GDP_{t-1} \quad R^2 = 0.9854$$

$$IH_t = \underset{(1.860)}{2810.6003} + \underset{(13.956)}{0.9635}\, IH_{t-1} - \underset{(-3.075)}{0.04904}\, IM_{t-1} \quad \overline{R}^2 = 0.8495$$

$$IP_t = \underset{(1.841)}{3880.1592} + \underset{(25.572)}{0.9358}\, IP_{t-1} + \underset{(3.257)}{0.3835}(EX_t - EX_{t-1}) \quad \overline{R}^2 = 0.9500$$

$$IV_t = \underset{(0.941)}{345.7746} + \underset{(3.989)}{0.1045}(GDP_{t-1} - GDP_{t-2}) \quad R^2 = 0.3188$$

$$G_t = \underset{(-22.783)}{-4500833.8851} + \underset{(23.109)}{2291.1615}\, TIME \quad R^2 = 0.9401$$

$$\log(EX_t) = \underset{(-5.382)}{-6.5806} + \underset{(5.7427)}{0.4856}\log(EXR_t) + \underset{(18.009)}{0.8740}\log(WGDP_t) \quad \overline{R}^2 = 0.9707$$

$$IM_t = \underset{(-1.021)}{-21050.5388} + \underset{(3.738)}{0.2268}\, CP_t + \underset{0.947)}{42.9251}\, EXR_t + \underset{(3.065)}{0.3863}\, FDIM_t \quad \overline{R}^2 = 0.8443$$

$$\log(FDIM_t) = \underset{(18.157)}{24.6565} - \underset{(-11.579)}{3.1423}\log(EXR_t) \quad R^2 = 0.7977$$

$$INVS_t = \underset{(-11.266)}{-214561250.3684} + \underset{(13.141)}{877.3657}\, CP_t \quad R^2 = 0.9201$$

$$LDM_t = \underset{(34.345)}{10567.1832} + \underset{(2.812)}{0.02523}\, IP_t + \underset{(4.761)}{0.08682}\, EX_t - \underset{(-2.164)}{0.0357}\, FDIM_t \quad \overline{R}^2 = 0.9677$$

$$LDM_t = \underset{(8.056)}{14384.1067} + \underset{(1.895)}{0.1067}\, IP_t - \underset{(-1.638)}{0.097554}\, IM_t - \underset{(-3.694)}{0.0002551}\, INVOS_t \quad \bar{R}^2 = 0.8783$$

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