

Development of a Japanese AGE model for Analysis of Regulatory Reform

*by AGE Modeling Unit, ERI/EPA**

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Chapter 1 Development of the Japanese AGE Model

1. Research Using Applied General Equilibrium Models

The goal of our research into the applied general equilibrium (AGE) models was to measure the economic effects on trade and investment liberalization based on the "Manila Action Plan (MAPA)," which was agreed upon during the APEC Ministerial Meeting in November 1996 with the aim of contributing to the promotion of trade and investment liberalization among APEC member economies. Along with the globalization of the world economy, policy-making objectives are undergoing radical changes. The globalization of the economy means an increase in dependence; thus, when economic policies in one or several countries are changed, it is necessary to take the effect of the changes on other countries into account. The purpose of our research is to evaluate how the liberalization of trade and investment will affect the Japanese economy as well as the world economy, not only from a macroeconomic point of view, but also an industrial one. Therefore, to ensure transparency in the analysis and to make it acceptable for each member, we have adopted the Global Trade Analysis Project (GTAP) model in this research, which is the same model the WTO has used in the evaluation of trade liberalization.

The GTAP model is an applied general equilibrium (AGE) model, and is useful in the analysis of households, which perform an important role in the real economy, in market transactions carried out based on the maximization of efficiency and profits (cost minimization) of an economic unit (i.e., corporations), and in transactions between markets. At the same time, macroeconometric models are used under stable economic conditions, based on past economic variables, to conduct economic forecasts or to analyze the macroeconomic effects on economic policies; for example, the impact on production and employment. In comparison, AGE models allow us to quantify how changes in policy may affect industrial structure and the allocation of resources and income distribution, along with relevant changes in prices and the activities of the economic unit. In addition, the latter can be applied not only to the analysis of the economic effects of trade liberalization, including the reform of tariffs, but also to the analysis of the effects of economic structural reform, which aims at correcting disparities arising from regulations. It can even be applied to analyze how the taxation of specific goods, for example tax on CO₂ emissions, will influence a specific country as well as the global economy. Thus, AGE models are expected to cover a wide range

of issues. In fact, for the purpose of discovering applicable cases, we have used them to analyze several cases and published the results in *Keizai Bunseki* (Economic analysis) No. 156 (Ban, Otsubo et al., 1998) in March 1998.

2. The Necessity of a New General Equilibrium Model

With the GTAP model, it is possible to measure the economic effects of regulatory reform to a certain extent. Because the GTAP model is a general equilibrium model for the analysis of several sectors or regions, it is particularly useful in that it makes it possible to estimate how changes in policy in our country may affect other countries. In the database of the GTAP model, industry is mainly classified by sectors of tradable goods, while the sectors of services, in which we intend to focus on the aspect of regulatory reform, are roughly categorized. Thus, the classification of the service sector needs more detail. However, because the database for the GTAP model is too large, it is probably not possible to revise the whole database. We decided therefore to develop a single-region model for Japan with detailed industrial classification.

In the process of developing a new Japanese model, we took the following three points into consideration: (1) encompassing the industries targeted for regulatory reform in Japan that the GTAP model does not sufficiently take into account; (2) corresponding to the analysis with the GATP model, which is used as a global model to examine the ripple effects in other regions; and (3) simulating the phenomena resulting from regulatory reform as much as possible. As a result of these considerations, we decided to develop a new model for Japan based on Australia's ORANI-G model.

Australia's Impact Project for the development of the ORANI model is jointly promoted by the government, Monash University, La Trobe University and Australia National University, in which studies are conducted into industrial policy using AGE models. The ORANI model is an AGE model, in which the Australian economy is divided into 56 areas and 112 industrial sectors. Since the 1970s, it has been used to evaluate the effects of changes in the taxation system, reductions in tariffs, deregulations, and environmental regulations. The ORANI model was developed to analyze the domestic economy in detail, and the ORANI-G model was established by generalizing the former, so as to correspond with actual conditions in other countries. The SALTER model is another AGE model, which was developed under the SALTER

(Sectoral Analysis of Liberalizing Trade in the East Asian Region) Project of the Australian Industrial Committee, to expand the ORANI model to other countries or regions around the world, mainly those in the Asia-Pacific region.

On the other hand, the GTAP model is an applied general equilibrium model developed under the Global Trade Analysis Project, which was inaugurated in 1992 for the purpose of evaluating the influence of international trade on each country, and led by Prof. Thomas W. Hertel of Purdue University. The GTAP database (currently Version 4) consists of an international input-output table in 45 regions and 50 industrial sectors. The database, model, and software for the GTAP model can be said to be derived from the SALTER model. Moreover, for the software to be used to manage the database, to describe the model, and to solve it, the “GEMPACK” is used for both the GTAP and SALTER model. The GEMPACK was developed by the group led by Prof. Kenneth Pearson of Monash University (Australia), and is useful for solving large-scale linear AGE models.

The GTAP model originally comes from the Australian SALTER model, and it can also be regarded as a development of the ORANI model. In addition, because the GTAP and ORANI models share many similarities in their structure as well as in the structure of database, the same software is used for solutions. Therefore, the ORANI-G model is useful, since it is compatible with the GTAP model.

The ORANI-G model can be characterized in comparison with the GTAP model because it is a single-region model that only needs data from one country in its database, making it easy to make detailed classifications for industries. In this Japanese AGE model, based on the Input-Output Tables for 1990, industries were classified into 91 sectors (actually 89 sectors because two sectors were temporary sectors). In addition, since the margin sector is provided separately, it is possible to make detailed examinations of the ripple effect by regulatory reform in the transport and distribution sectors. Moreover, it is also possible to analyze joint production, although this was not conducted in this research. As to the structure of the model, the ORANI-G is basically similar to the GTAP, except that a simpler consumption function is used for the ORANI-G model.

(Table 1-1) Goods and Service Classifications for the Japanese AGE Model

1 Crop cultivation	crop	47 Household electric equipment	hsee
2 Livestock raising and sericulture	lsrs	48 Telecommunications equipment	tele
3 Agricultural services	agrs	49 Heavy electrical equipment	heav
4 Forestry	for	50 Other electrical equipment	oelm
5 Fisheries	fsh	51 Motor vehicles	mvh
6 Metal ores	mtor	52 Ships and ship repair	srsh
7 Non-metal ores	nmor	53 Other transport equipment and repair	oter
8 Coal and lignite	col	54 Precision instruments	pris
9 Crude petroleum and natural gas	cpga	55 Miscellaneous manufacturing	mmpr
10 Food products	food	56 Construction	cnst
11 Alcoholic and non-alcoholic drinks	drin	57 Construction repair	rcns
12 Feed and organic fertilizers	feed	58 Civil engineering	cien
13 Tobacco	toba	59 Electric power for enterprise use	ely
14 Textile products	txtl	60 Gas and heat supply	gdt
15 Apparel and other ready-made textile products	wap	61 Water supply	wtr
16 Timber and wood products	tiwo	62 Waste disposal services	wsds
17 Furniture and fittings	fufi	63 Commerce	cmrc
18 Pulp and paper	ppps	64 Finance and insurance	fins
19 Paper products	papp	65 Real estate and rental services	rers
20 Publishing and printing	pspr	66 House rental	hore
21 Chemical fertilizers	chfe	67 Railway transport	rwtr
22 Inorganic chemical-base products	iobc	68 Road transport	rotr
23 Petrochemical basic products and intermediate chemical products	pech	(69) Self-transport by private motor cars	strp
24 Synthetic resins	syre	70 Water transport	wtrr
25 Synthetic fibers	syfi	71 Air transport	aitr
26 Final chemical products	fich	72 Storage facility service	sfs
27 Petroleum refinery products	pepr	73 Other transport services	otrs
28 Coal products	copr	74 Communication	cmcn
29 Plastic products	plpr	75 Broadcasting	brca
30 Rubber products	rupr	76 Public administration	pbad
31 Leather, fur products and miscellaneous leather products	lea	77 Education	educ
32 Glass and glass products	glpr	78 Research	resc
33 Cement and cement products	cepr	79 Medical services and health	mdsh
34 Pottery, china and earthenware	pott	80 Social security	scse
35 Ceramic, stone and clay products	cera	81 Other public services	opus
36 Pig iron and crude steel	ircr	82 Advertising agencies, marketing research and information services	adsi
37 Steel products	stpr	83 Goods renting and leasing services	grls
38 Steel castings and other steel products	sosp	84 Car and machine repair	crmr
39 Non-ferrous metals and metal products	nfm	85 Other business services	obus
40 Other non-ferrous metal products	onfm	86 Amusement and recreational services	amre
41 Metal products for construction	mecn	87 Eating and drinking establishments	eadr
42 Other metal products	omps	88 Hotel and other lodging establishments	htlo
43 General industrial machinery	gnim	89 Other personal services	opes
44 Special industrial machinery	spim	(90) Office supplies	offs
45 Other general equipment	ogee	91 Activities not elsewhere classified	anec
46 Machinery for offices and the service industry	mfos		

(Note) No.69 “Self-transport by private motor cars” and No.90 “Office supplies” are temporary sectors.

Chapter 2 Regulatory Reform in Japan

In this chapter, we will summarize the theoretical background of public regulations and introduce the preceding studies on the economic effects of regulatory reform in Japan.

1. Theoretical Background of Public Regulations

1.1 Public Regulations

Public regulations mean that the government or local authorities involve themselves in or interfere with the activities of corporations or people to achieve specific policy goals. In Japan, although economic activities are carried out based on the principles of a market economy, if the economy were based purely on market mechanisms, in which people and corporations were allowed to behave in an unregulated fashion, the stability of lifestyles or the sound development of industries might be undermined. In such a case, public authorities may prohibit certain activities or impose restrictions, for example a ban on certain activities or requirements for approval or permission, so as to achieve certain political goals that contribute to public welfare.

According to economic theories, the allocation of resources through market mechanisms is regarded as efficient, but why do public regulations that place restrictions on the market mechanism exist? According to traditional economic theory, if the efficient allocation of resources through market mechanisms was not effectively realized (market failure), restrictions should be imposed on market entry or prices to efficiently allocate them. Examples of market failure include public goods, natural monopolies, externalities, asymmetry of information, imperfect competition, uncertainty, and risks.

The Management and Coordination Agency (1998) exemplified the purposes of public regulations as follows:

- To avoid situations where public security or environmental conservation cannot be ensured under free competition (avoidance of external diseconomies);

- To eliminate consumers' disadvantages due to the inability to obtain sufficient information on producers or providers of goods or services (elimination of disadvantages from the asymmetry of information) ;
- To avoid situations where, if economies of scale exist, consumers may suffer from disadvantages in terms of price-setting or provision of services as a result of free competition, which may lead to market monopoly (avoidance of disadvantages due to the existence of economies of scale);
- To promote sound industrial development such as the development of infant industries and smooth structural changes of declining industries;
- To secure the stability of individual households and income of producers by adjusting and stabilizing the demand and supply of products.

Of these purposes, the regulations that control corporate activities, including market entry/exit, price-setting, service quality/quantity, investment, finance and accounting, by means of requiring approval or permission mainly for the aims of avoiding inefficiency in the allocation of resources as well as ensuring fair access of users, in areas where a natural monopoly or asymmetry of information exists, are called “economic regulations.” Meanwhile, those which establish certain standards for the activities relating to the quality of goods or services or provision of them, or ban or restrict certain activities for the purposes of ensuring the safety, health, and hygiene of employees and consumers, conserving environments, and preventing disasters, are referred to as “social regulations.” Although a clear distinction between these cannot always be made, they are useful in seeking and reviewing regulations.

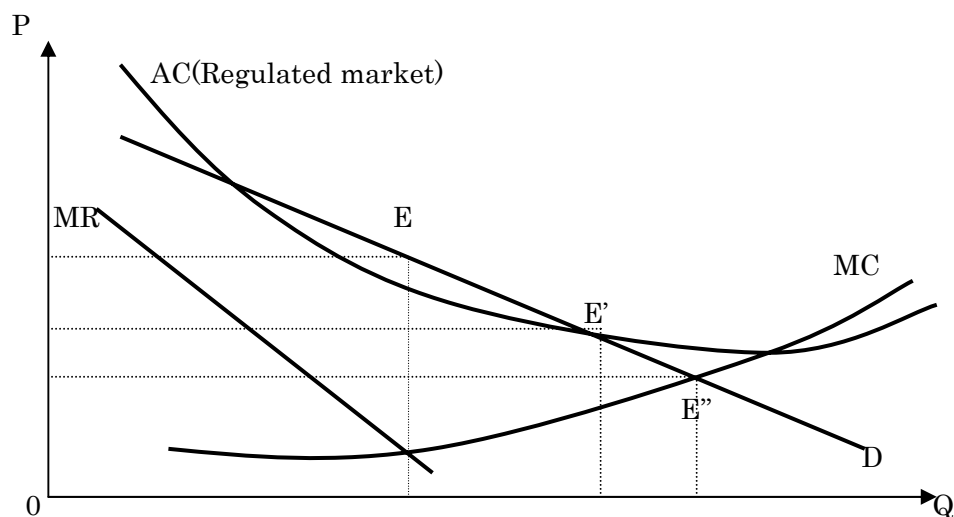
In this research, we will focus on the economic regulations which include those on market entry or price-setting for analysis. The following is a brief summary of theories that give grounds for the major economic regulations on natural monopoly (decreasing cost industries), asymmetry of information, and adjustment of demand and supply (prevention of excessive competition).

1.1.a Natural Monopoly

Natural monopoly refers to situations where, due to the scarcity of resources and the existence of economies of scale or scope, there is a significant possibility in that one

(monopoly) or several companies (oligopoly) provide a single good or service or a set of several goods or services.¹ These types of industries include public utility companies such as electricity, gas and waterworks, and also telecommunications and transport (railroad in particular) industries. They are characterized by the existence of economies of scale, an enormous network of service provisions, and a large amount of sunken costs. Due to the economies of scale, in these industries only large companies will be able to survive competition, while investment on the part of losing companies may prove fruitless. Moreover, because those surviving companies control the market and set advantageous prices for themselves, if this was left to the market, resources would not be effectively allocated. Thus, in the market where goods or services are of a necessary and public nature, and also from the aspect of avoiding destructive competition and waste of costs (in other words, dual investment), it is desirable to preserve such a monopoly by regulating the market entry of other companies. In addition to regulations on market entry, it is also necessary to set other regulations, including price control, so as to prevent monopolistic companies from abusing their power on the market, to realize efficient allocation of resources, to improve the internal efficiency of a company, to secure fair allocation, protect consumers, and to stabilize corporate finance for appropriate investment.

(Figure 2-1) Natural monopoly



At the equilibrium point for efficient resource allocation $\langle E'' \rangle$, a company may suffer from a deficit and will not be able to supply their goods or services without subsidy. A monopolistic company may intend to supply their goods or services at the point of $\langle E \rangle$, however, by setting regulations, and their price should be reduced to the level at $\langle E' \rangle$ so as to realize efficient resource

¹ Uekusa (1991)

allocation.

1.1.b Asymmetry of Information

Economic regulations are also justified where asymmetry of information exists. In a competitive market, it is premised that both buyers and sellers have gained sufficient information about goods and services, but sometimes sellers know better than buyers. In such cases, no matter how good the quality is, buyers cannot judge the appropriate price for it, and thus resources may not be efficiently allocated through the market or price mechanism. Even a standard price is needed for some cases, for example, financing or transport businesses such as taxis, because consumers may suffer a loss as they only have limited information.

1.1.c Prevention of Excessive Competition

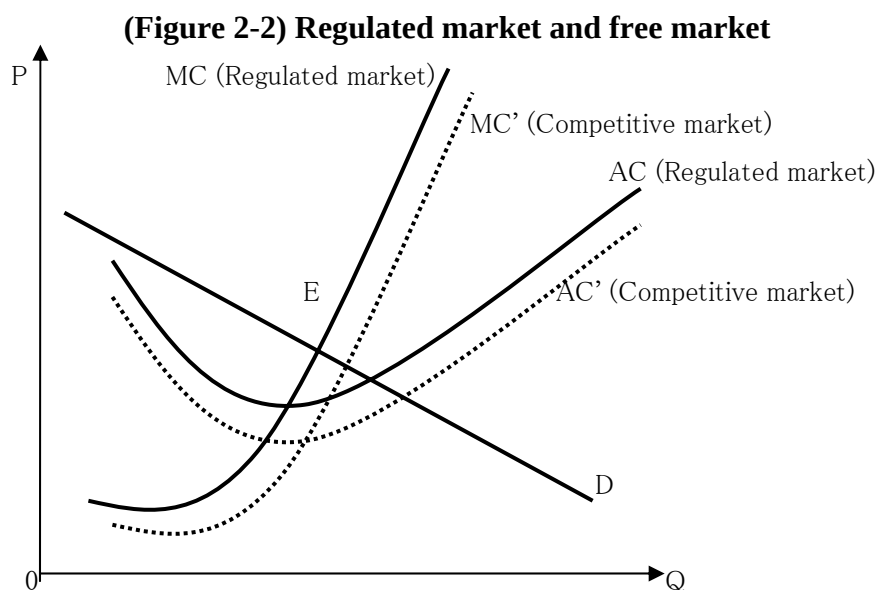
From the aspect of preventing excessive competition, some competitive industries are bound to restrictions of market entry/exit or price according to the provisions of demand-supply adjustment. In the case where an optimal number of companies, which is fewer than those in the free entry/exit market, exist in a market and it is possible to gain higher economic welfare, the entry of more companies than the optimal number is called “excessive competition.” In such an industry, excessive competition may cause a decline in the average profit of the industry to less than the normal level or even below zero, resulting in the bankruptcy of some companies, difficulty in supplying services to meet the demand, and damage to people’s property. These factors may lead to social disorder. It has been said that, in order to prevent these situations, regulations were put in place. On the other hand, it is pointed out that the regulations for demand-supply adjustment are arbitrarily operated, and that although these regulations aim to prevent excessive competition, they, as a consequence, protect the existing companies, particularly small- and medium-sized enterprises.

1.2 Inefficiency in the Regulated Industries

Compared with competitive markets, regulated markets have the following problems, although the regulations are imposed to correct the problems of the market mechanism.

1.2.a Inefficient Corporate Management

Prices in a regulated market are usually decided by the full-cost principle. According to this principle, the price is determined to secure the income to compensate for the cost needed for the provision of goods and services. Cost should be calculated based on the premise of “appropriate costs including appropriate profit under efficient management” aiming at the improvement of efficiency in management. However, when competition is restricted by regulations on market entry, incentives to reduce costs will not be given, efficiency in corporate management will deteriorate, and thus an increase in costs resulting from these tend to be laid on the price. In other words, this is a trade-off between efficient allocation of resources encouraged by the regulations and inefficiency in corporate management.



In a regulated market, the average cost curve is AC and the marginal cost curve is MC, and supply at the point <E> is realized by the regulations on market entry and price. However, AC might include excess profit or costs related to regulations. If competition were allowed, they should be AC' and MC', and it is possible to further improve the efficiency in resource allocation.

1.2.b Related Costs to Regulations

Although regulations are primarily based on the principle of law and orders, details are only outlined in many cases, and their operation is mostly left to the discretion of the authorities concerned. Meanwhile, the regulated industries appeal to

the authorities for advantageous measures to be taken, and seek to ensure excess profits by making use of regulations on market entry and price, so that extra costs for these will accumulate. In addition, the authorities may also have to bear the enormous cost of gathering the necessary information for regulations as well as making adjustments in the administration.

1.2.c Depression on Innovative Action of Corporations

In a regulated market, because market entry and prices are restricted by the regulations, free competition will not take place and any innovative action on the part of companies will be discouraged. In other words, restrictions act as a protection for the regulated companies, and as a result, improvements to the production and technology and incentives to the development of new technology will be lessened in those companies.

Moreover, under regulations, the diversification of services or price system tends to be delayed. Companies strive to develop new services or to set up a wide range of rates under competition. But the diversification of services or price system including the discount system tend to be delayed in regulated companies due to complexity in the procedures under regulations and reductions in technical innovation.

1.2.d Time Lag in Regulations

If it has taken too long from the application stage to approval of the revision of prices along with changes in the market, the response to such a change will be delayed, and thus, corporations and consumers might adversely suffer.

1.3 Background of Regulatory Reform

Regulations may lose their significance or effectiveness due to changes in socioeconomic environment or technological development, although they were established for good reasons, for example, natural monopoly or disparity in the provision of information. If they were left as they were, they might have had a negative impact on the primary goal; they might, for example, hinder the efficient allocation of resources or the private sector's activities and efforts for making improvements, and in addition place a greater burden or restrictions than necessary on

the public. This is the so-called "failure of regulations."

Since the 1970s, problems in regulations have been emphasized in developed nations such as the US and UK, and the relaxation of regulations or deregulation have been called for. The background to this is as follows:

- 1) Due to the oil crisis, developed countries have experienced economic stagnation. To realize a small government, they were forced to downsize government functions on regulations and, in addition, to promote and revitalize the regulated companies and industries under the government regulations.
- 2) As a result of rapid technological innovation, the economic environment surrounding the regulated industries has changed since the introduction of regulations, while the significance of maintaining a natural monopoly has been lost, and regulations have become a barrier to the establishment of new industries.
- 3) Along with the globalization of human resources, goods and money, it has become necessary to relax those regulations that hinder globalization.

1.4 Merits and Demerits of Regulatory Reform

The primary goal of regulatory reform is to introduce competition to the regulated market, so that the level of economic welfare through the incentives created under competition can be enhanced.

If market entry is allowed and price competition does happen, corporations will think it necessary to improve the level of efficiency in their management and seek to increase productivity. Also, regulatory reform may reduce the costs which are incurred by the regulations. Thus, prices will be lowered and push demand.

Regulatory reform will not only create price competition but also quality competition. Under the regulated market, differentiation in price in accordance with quality is unlikely to happen, while prices can be set according to quality in the competitive market, so that goods and services as well as price will be diversified. In addition, as improvements in quality are sought, technological innovation will also be promoted.

On the other hand, there are some demerits pointed out on regulatory reform. The

major points in such opinions are as follows:

- 1) From the viewpoint of the existing businesses, their vested interests or excess profits that have been protected by regulations may be lost.
- 2) As corporations intend to improve efficiency, inefficient divisions will be eliminated, or the ailing companies may have to file for bankruptcy. As a result, job opportunities will be reduced or costs for getting out of the market, including sunken costs, will turn out to be wasteful.
- 3) Subsidized goods and services under regulations may not be supplied under the market mechanism, and will bring about disadvantages to consumers.
- 4) Companies can coexist regardless of the differences in their competitiveness in the regulated market. However, only strong companies will be able to survive under competition and may encourage monopoly or oligopoly.

2. Evaluation of the Regulatory Reform in the Preceding Studies

There have been many studies carried out in Japan as to how regulatory reform will affect the economy. Various evaluation methods are adopted for these studies, including an integration of the figures of effects for each division using simple models, and calculation with the macroeconomic models. The effects of regulatory reform on the economy include the following:

- 1) Regulatory reform will be followed by the introduction of the principles of competition. Accordingly, improvements will be made to the efficiency of corporate management and technology, which will lead to an increase in productivity.
- 2) Stiffer competition will bring prices down and at the same time increase real income, which may lead to an increase in demand.
- 3) Regulatory reform will create new markets and eventually provide an overall boost for the Japanese economy.
- 4) With regard to producers, because investment and job opportunities will be adjusted in accordance with the increase in productivity and changes in demand, investment will be newly made, and migration of employment among businesses and industries will take place. (Alternatively, this may create unemployment.)

As we regard the preceding studies, particularly those using econometric models as informative for our research, we will introduce them in the next section.

2.1 The Preceding Study on “The Effects of Economic Structural Reform including Relaxation of Regulations” (Economic Planning Agency (EPA), June 1997)

This study estimated the macroeconomic effects of economic reform for 1998 to 2003, based on the proposals of economic structural reform in the “Economic Structural Reform in 6 Sectors” by the Economic Council in December 1996, “Revised Deregulation Action Plan” in March 1997, and “Action Plan for Reform and Reconstruction of Economic Structure” in May 1997.

The econometric model used in the above-mentioned study was the Medium-Term Multi-Sectoral model of the EPA, which is often used for calculation of the macro-frame of government economic plans. By using this model, it is intended to estimate in an objective and consistent manner how improvements to one sector will affect the whole economy through the lowering of prices and increase in demand.

Eight sectors, including finance, information and communications, transport, distribution, energy, land and housing, medicine and welfare, and employment and labor, were analyzed in this research. It was carried out by estimating the effects on the total factor productivity, final consumption, and plant and equipment investment of each sector, and also the economic effects on the whole economy, for example, external economies of the investment in information and communications sector, so that the impact on the economy was numerically gauged.

In calculating the effects on each sector, it was hypothesized that along with the increase in competition, the level of productivity of the whole industry will catch up with that of leading companies (financial and transport sectors), and that the level of industry will by no means be inferior to the international level (distribution). Also, by applying the fruits of the relaxation of regulations in the past (information and communications), are applied, and the productivity of the business plan of companies (transport) is estimated.(See Table 2-1)

Based on such conditions, the following estimates were obtained:

- 1) The average annual GDP growth would be approximately 0.9% for 1998 to 2003.

- 2) Consumer prices would fall by approximately 1.2% per year on average.
- 3) Surplus in the current account in 2003 against the GDP ratio would fall by approximately 0.9%, compared with that in the case where structural reform is not carried out.
- 4) If structural reform was not conducted in the labor sector, the unemployment rate would increase by approximately 0.3% for 2003 along with a further relaxation of regulations. However, deregulation would be able to prevent a worsening of the unemployment rate; thus, effects on the unemployment rate would be offset.

(Table 2-1) Effects of Relaxation of Regulations

Effects on Each Sector		(1998~2003)	
Sector	Objectives and effects	Indicator	Size of effects ²
Financial services	Productivity will increase along with competition	TFP	27.90%
	Demand will increase as a result of diversification and consolidation of personal financial asset management	Final consumption	¥295.9 bn.
	Import of financial services will increase by the revision of the Foreign Exchange and Foreign Trade Control Law	Imports	¥570.4 bn.
	Export of financial services will increase along with the globalization of international finance	Exports	¥988.5 bn.
Information and communications	Demand will be newly created in the mobile communications market	Final consumption	¥ 338.5 bn.
	Productivity will increase as a result of deregulation	TFP	20.90%
	Demand for telecommunications devices and computers will be newly created	Final consumption	¥ 166.7bn.
	New radio services will be developed and investment by TT-NET and KDD will increase	Investment	¥ 280.8 bn.
Transport	Productivity will enhance as a result of deregulation	TFP	8.70%
Distribution	The gap in productivity with the manufacturing sector will become equivalent to international levels	TFP	20.60%
Energy	Electricity costs will be reduced to international levels	Electricity cost	-12.7%
Land / housing	Demand for apartments will be newly created as a result of the easing of regulations (e.g. floor area ratio)	Housing investment	¥ 327.3 bn.
	House prices will remain at the same level as a result of the standardization of construction specifications and international harmonization of construction standards	House prices	Same level
Medicine / welfare	The gap in pharmaceutical prices will be reduced by the fundamental review of the pharmaceutical price standards.	Medical cost	¥ - 1350 bn.
Employment / labor	New businesses will be created along with the expansion of the outsourcing business	Investment	¥30 bn.

² Effects to be obtained from 1998 through 2003

Effects on the Whole Economy

	Objectives and effects	Indicator	Size of effects
External effect of investment in telecommunications	Productivity of the whole industry will enhance along with the increase of property of the information and communications sector	TFP	0.40%
Improvement of labor productivity	Productivity will enhance along with the increase in mobility in the labor market and flexibility in working style	TFP	0.28%
Promotion of investment in human resources	As an indirect result of wage increase, investment in human resources will be promoted	TFP	0.27%
Decrease of unemployment rate	Along with greater labor mobility, structural and frictional unemployment will decrease	Unemployment rate	-0.25%
Development of venture business	Investment in potential growth areas will increase	Investment	¥ 668.2 bn.

2.2 Estimation of Economic Effects of Deregulation --- Report of the Study Group on the Economic Effects of Deregulation --- (Ministry of International Trade and Industry, 1997)

This report estimated the economic effects of comprehensive reforms in the five sectors including physical distribution, energy, information and communications, finance and distribution. It also presented several hypotheses on the improvement of productivity in each sector, especially where efforts for relaxing regulations were being made according to the “Program for Reform and Reconstruction of Economic Structure” in December 1996, the “Revised Deregulation Action Plan” in March 1997, and the “Action Plan for Reform and Reconstruction of Economic Structure” in May 1997.

The assumption about the effects of deregulation in this report is that deregulation will contribute to improving efficiency in corporate management through competition and enhancing productivity along with technological innovation; as a result, prices will be lowered and demand will increase. In addition, it will also affect the whole Japanese economy, resulting in, for example, an increase in GDP or plant and

equipment investment. Meanwhile, deregulation will make it possible to supply new goods and services and to create new markets.

Based on the above assumption, with regard to each industry in which regulations are to be eased, changes in the total factor productivity (TFP) were estimated, on the hypothesis that labor productivity and capital productivity will be changed. Also, for the areas where a market is expected to be newly created, demand and investment were estimated. These were calculated with an AGE model so as to estimate the effects not only on the industries in which regulations were eased, but also on the whole economy, including other industries.

In the process of the above-mentioned assumptions, it was also hypothesized that: the level of the whole industry will catch up with that of leading companies; productive companies will secure a larger market share; productivity and cost structures of the Japanese economy will by no means be inferior to international levels; business plans of companies will be realized as expected; fruits of the relaxation of regulations brought about in the past will be applicable to future results; and increase in the productivity of industries will be represented through the changes in the surrogate variables. (See Table 2-2.)

The results of this research were as follows:

1) Effects on GDP

- The relaxation of regulations would encourage economic growth through price reductions as well as create demand for new goods and services thanks to improved productivity; GDP would increase by 6% from 1995.
- According to industry, the expansion of communications services will be extremely large, followed by retail, energy, transport, and financial sectors. A reduction is expected, however, for the retail sector.

2) Effects on plant and equipment investment

- The relaxation of regulations would increase plant and equipment investment, and the accumulated amount of such increase would amount to approximately ¥39 trillion.
- According to industry, productivity would improve the most in the financial sector, followed by distribution, information and communications, energy, and physical distribution.

3) Effects on consumer price and consumer surplus

- Improved productivity thanks to the relaxation of regulations together with the reform of the high-cost structure of industries would reduce consumer prices by 3.4% from 1995. This would be particularly visible in the transport industry. A significant price reduction is expected for clothing and shoes, housing rent, and energy.
- Consumer surplus would be approximately ¥16.9 trillion in total of return to the income, much of which will be brought about in the information and communications industry.

4) Effects on producer prices

- Producer prices would be reduced the most in the financial and energy sectors, and also in the transport, retail and wholesale sectors, where productivity is improved.

5) Effects on employment

- Creation of job opportunities would vary depending on sectors; that in the communications and service sectors would increase, while there would be a decrease in the retail, financial, and transport sectors.
- Provided that the number of employees remains the same, real wages would increase by approximately 6%.

(Table 2-2) Effects of Relaxation of Regulations on Each Sector

(1990~2001)

Sector	Objectives and effects	Item	Size ³
Physical distribution (trucks)	Productivity will increase	TFP	14.10%
	Share of transport services will increase	New demand	¥ 676.2 bn.
	Share of carriage of goods for personal use will decrease	Demand reduction	¥-587.8 bn.
Physical distribution (freight trains)	Productivity in the operation of JR freight trains will improve	TFP	0.30%
	Plant and equipment investment in JR freight services will increase	Plant and equipment investment	¥ 104 bn.
Physical distribution (Shipping and port services)	Productivity will increase as a result of abolishment of the ship tonnage adjustment rules and containerization	TFP	9.10%
	New demand for ocean transport will increase	New demand	¥ 124 bn.
Electricity	Cost structure will be internationally competitive	TFP	32.10%
Oil	Productivity will increase as a result of liberalization of imports	TFP	5.90%
Information and communications (Broadcast)	Demand will increase along with the creation of new services	New demand	¥ 672.7 bn.
	Facility and equipment investment will increase along with the creation of new services	Facility and equipment investment	¥ 1,279 bn.
Information and communications (communications)	Productivity will increase	TFP	9.40%
	New demand will be created in the mobile communications sector	New demand	¥ 8,107 bn.
	New investment in mobile communications will be made	Facility and equipment investment	¥ 8,771 bn.
Financial services	Productivity of financial industries will increase	TFP	22.90%
Distribution	Productivity will increase as a result of the easing of regulations on the retail industry	TFP	11.30%
	Demand for wholesale business will decrease as a result of the streamlining of the distribution system	Demand reduction	¥-3,457 bn.

³ Effects to be obtained from 1990 through 2001

Chapter 3 The Structure of the Japanese AGE Model¹

1. Database

(Figure 3-1) Structure of the Database

		Absorption Matrix					
		1	2	3	4	5	6
		Producers	Investors	Households	Export	Government	Change in Inventories
		← I →	← I →	← 1 →	← 1 →	← 1 →	← 1 →
Basic Flow	Size ↑ C×S ↓	V1BAS	V2BAS	V3BAS	V4BAS	V5BAS	V6BAS
Margins	↑ C×S×M ↓	V1MAR	V2MAR	V3MAR	V4MAR	V5MAR	n/a
Taxes	↑ C×S ↓	V1TAX	V2TAX	V3TAX	V4TAX	V5TAX	n/a
Labor	↑ O ↓	V1LAB	C = Number of Commodities I = Number of Industries S = 2: Domestic Products, Imports O = Number of Occupation Types M = Number of Margins				
Capital	↑ 1 ↓	V1CAP					
Land	↑ 1 ↓	V1LND					
Other Costs	↑ 1 ↓	V1OCT					

Joint Production Matrix	
	← I →
↑ C ↓	MAKE

Import Duties	
	← 1 →
↑ C ↓	V0TAR

Commodity flows

Commodity flows are threefold: basic flows, margins, and taxes. The database in the Japanese model was created based on the 1990 Input-Output Tables. Data for the supply of goods are divided into domestically produced goods and imported goods (non-competitive import method). Domestically produced goods and imported goods are

¹ This chapter is based on Horridge, Parmenter, and Pearson (1998).

demanding by imperfect substitution (the Armington structure). Two kinds of margins - commercial and fare margins - are imposed on both domestic and imported goods. Regarding taxes, because they have not been specified in the 1990 Input-Output Tables, they have been estimated on the basis of tax statistics and other sources. Commodity flows at the purchaser's price are the sum of these three values.

The basic commodity flow is the product of the producer price and the quantity. The increase in inventory is the sum of the price change and the change in inventory volume. The margin is the product of the margin price and the margin quantity. Taxes are indicated according to changes in quantity, price, and the tax rate.

Value-added section

The value-added section is classified into four categories: labor, capital, land, and other (such as non-household consumption, indirect taxes, subsidy (exemptions), etc.). Among these, the labor section can be subdivided into a number of occupation types. In the original ORANI-G model, the section is divided into skilled and non-skilled labor. In the Japanese AGE model, labor is classified into those with a college degree or above, and those with a high school diploma or below. Values in the Input-Output Tables were divided using such sources as the "Basic Survey on Wage Structure." Due to restrictions on data, data on land has been deleted from the database.

Each primary factor is the product of the price and quantity.

Joint production

In this model, it is assumed that an industry produces more than one product (Joint Production). The joint production matrix (MAKE) is the transformation matrix from the industry section to commodities. In the Japanese AGE model, joint production is not assumed; rather, it supposes that one industry produces one product. In this situation, the joint production matrix is a diagonal matrix.

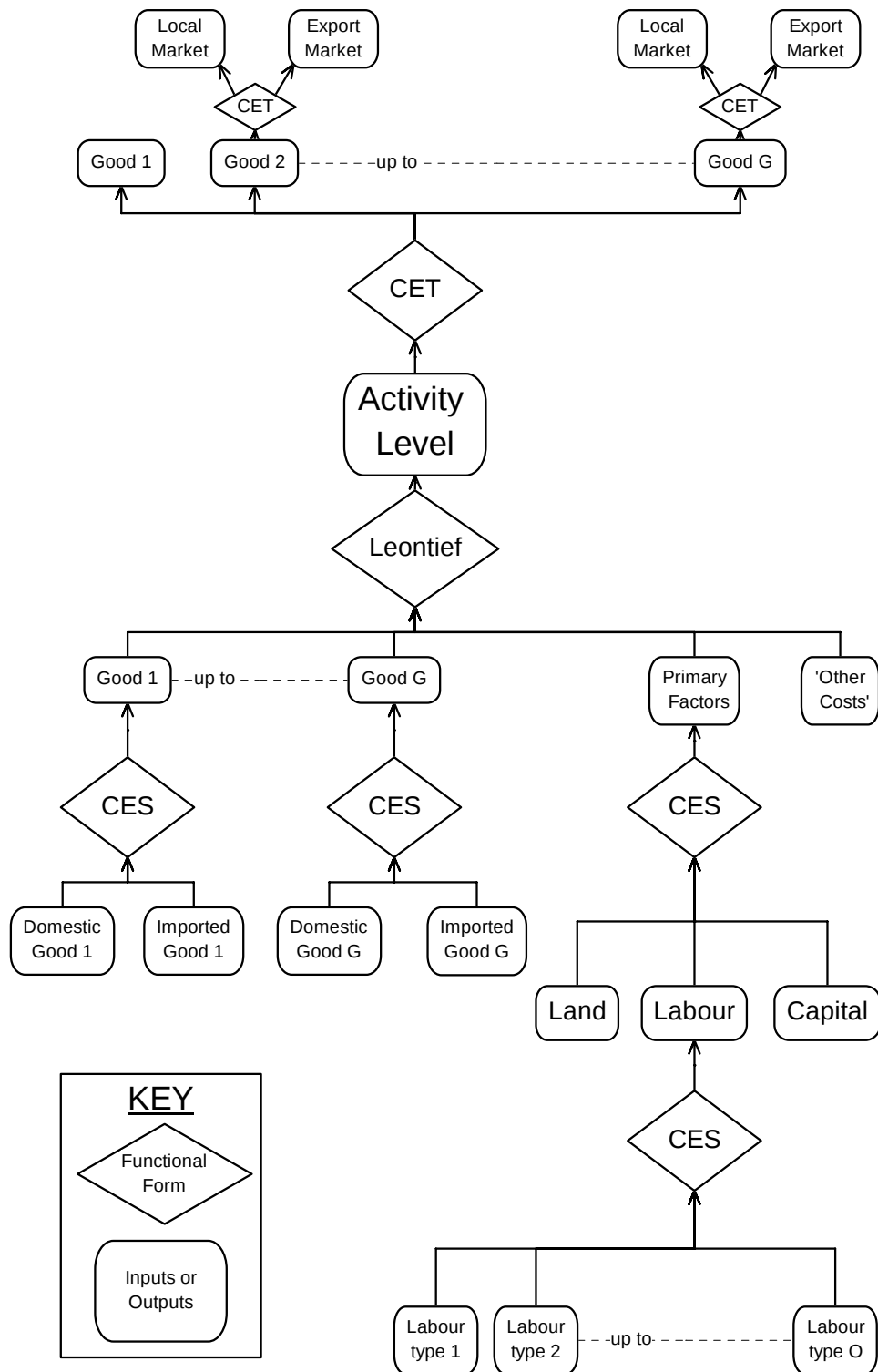
Import duties

The revenues from tariffs (V0TAR(c)) are classified according to each commodity.

2. Structure of the model

2.1 Production structure

(Figure 3-2) Production structure



In the ORANI-G model, it is assumed that each industry produces more than one product, that it inputs in domestic and import intermediate goods, various labor, land, capital and other resources, and that input and output are equal. Production is performed on the basis of these assumptions, and the products are classified into those for domestic use and those for export overseas. As a rule, the ORANI-G model uses capital letters to indicate variables that are quantities and values (monetary amounts), while it uses lower-case letters to denote the corresponding rates of change. Most relations among variables in various model equations are non-linear. However, they can be converted to linear relations by using rates of change. The rates of change are obtained by solving CES functions and Leontief functions using elasticity coefficients.

Demand for labor by occupation types

The labor section consists of a number of types; the input of each type is determined by CES functions so as to minimize costs.

Let SIGMA1LAB(i) be the CES substitute elasticity coefficient among occupational types. Then, the demand for labor “x1lab” and wages “p1lab_o” of the i-th industry according to occupation type are shown as follows. In the Japanese AGE model, SIGMA1LAB(i) is set to 0.5 in all industries.

$$(1) \quad x1lab(i,o) = x1lab_o(i) \cdot SIGMA1LAB(i) \cdot [p1lab(i,o) \cdot p1lab_o(i)]$$

$$(2) \quad V1LAB_O(i) \cdot p1lab_o(i) = \sum\{o,OCC, V1LAB(i,o) \cdot p1lab(i,o) \}$$

Wages by industry and by occupation “p1lab(i,o)” are obtained using shift parameters as follows:

$$(3) \quad p1lab(i,o) = p3tot + f1lab_io + f1lab_o(i) + f1lab_i(o) + f1lab(i,o)$$

Composition of demand for primary factors

The primary factors consist of labor, capital and land. The demands for these primary factors are determined by CES functions as to minimize costs.

Let SIGMA1PRIM(i) be the CES substitute elasticity coefficient among the factors. Then, the demand for labor “x1lab_o”, capital “x1cap”, land “x1land” and the primary price “p1prim” of the i-th industry are shown as follows. In the Japanese model, the values for SIGMA1PRIM(i) are based on the GTAP model values and are listed in Table 3-1.

$$(4) \quad x1lab_o(i) \cdot a1lab_o(i) = x1prim(i) \cdot SIGMA1PRIM(i) \cdot [p1lab_o(i) + a1lab_o(i) \cdot p1prim(i)]$$

$$(5) \quad x1cap(i) \cdot a1cap(i) = x1prim(i) \cdot SIGMA1PRIM(i) \cdot [p1cap(i) + a1cap(i) \cdot p1prim(i)]$$

$$(6) \quad x1lnd(i) \cdot a1lnd(i) = x1prim(i) \cdot SIGMA1PRIM(i) \cdot [p1lnd(i) + a1lnd(i) \cdot p1prim(i)]$$

$$(7) \quad V1PRIM(i) \cdot p1prim(i) = V1LAB_O(i) \cdot [p1lab_o(i) + a1lab_o(i)]$$

$$+V1CAP(i)*[p1cap(i) + a1cap(i)] + V1LND(i)*[p1lnd(i) + a1lnd(i)]$$

Domestic/Imported Composition of Products for Intermediate Input

Intermediate input consists of domestic goods and imported goods. With the Armington assumption of imperfect substitution, the composition of intermediate input is determined by CES functions.

Let SIGMA1(c) be the Armington elasticity coefficient between domestic and imported goods. Then, the demand for each “x1(c,s,i)” and the composite price “p1_s(c,i)” are determined as given below. In the Japanese AGE model, the values for SIGMA1(i) are based on the GTAP model values and are listed in Table 3-1.

$$(8) \quad x1(c,s,i) \cdot a1(c,s,i) = x1_s(c,i) \cdot SIGMA1(c) * [p1(c,s,i) + a1(c,s,i) \cdot p1_s(c,i)]$$

$$(9) \quad p1_s(c,i) = \text{sum}\{s, SRC, S1(c,s,i) * [p1(c,s,i) + a1(c,s,i)] \}$$

Primary factors and intermediate input

The composition of intermediate goods necessary for production and that for the primary factors is determined by Leontief functions. The demands of intermediate goods “x1_s(c,i)”, primary factors “x1prim(i)” and other costs “x1oct(i)” are determined as follows:

$$(10) \quad x1_s(c,i) \cdot [a1_s(c,i) + a1tot(i)] = x1tot(i)$$

$$(11) \quad x1prim(i) \cdot [a1prim(i) + a1tot(i)] = x1tot(i)$$

$$(12) \quad x1oct(i) \cdot [a1oct(i) + a1tot(i)] = x1tot(i)$$

The producer price “p1tot(i)” under the zero-profit condition is determined as follows:

$$(13) \quad \begin{aligned} V1TOT(i) * [p1tot(i) - a1tot(i)] \\ = \text{sum}\{c, COM, V1PUR_S(c,i) * [p1_s(c,i) + a1_s(c,i)] \} \\ + V1PRIM(i) * [p1prim(i) + a1prim(i)] \\ + V1OCT(i) * [p1oct(i) + a1oct(i)] \end{aligned}$$

The price of other cost “p1oct(i)” is determined as follows:

$$(14) \quad p1oct(i) = p3tot + f1oct(i)$$

Joint production

The composition of the production of commodities in joint production is determined by the CET (Constant Elasticity of Transformation) function. The CET function is basically the same as the CES function; the difference is that the parameter in the CES function is negative while that in the CET function is positive. In other words, if

the relative price of a commodity rises, its production increases. Let $SIGMA1OUT(i)$ be the CET elasticity coefficient. Then, the production of the commodity c in the i -th industry “ $q1(c,i)$ ” is described as given below. In the Japanese AGE model, it is assumed that each industry produces one product, and joint production is not assumed. Furthermore, for every industry, the value of $SIGMA1OUT(i)$ is set at 0.4.

$$(15) \quad q1(c,i) = x1tot(i) + SIGMA1OUT(i) * [p0com(c) - p1tot(i)]$$

The total production in the i -th industry “ $MAKE_C(i)$ ” and the total production of the commodity c “ $MAKE_I(c)$ ” are as follows:

$$(16) \quad MAKE_C(i) = \sum\{c, COM, MAKE(c,i)\}$$

$$(17) \quad MAKE_I(c) = \sum\{i, IND, MAKE(c,i)\}$$

The price of the product in the i -th industry “ $p1tot(i)$ ” and the quantity of production of the commodity c “ $x0com(c)$ ” are as follows:

$$(18) \quad MAKE_C(i) * p1tot(i) = \sum\{c, COM, MAKE(c,i) * p0com(c)\}$$

$$(19) \quad MAKE_I(c) * x0com(c) = \sum\{i, IND, MAKE(c,i) * q1(c,i)\}$$

Product Exports (CET function)

Products are classified into domestic supplies and exports. Let $EXPSHR(c)$ be the export share of the commodity c and $TAU(c)$ be the inverse of the elasticity coefficient between domestic and export products. Then, the domestic supply “ $x0dom(c)$ ” and the total supply “ $x0com(c)$ ” can be shown as given below. If TAU were zero, then $p0com$, $p0dom$ and pe are all equal.

$$(20) \quad EXPSHR(c) = V4BAS(c) / SALES(c)$$

$$(21) \quad TAU(c) * [x0dom(c) - x4(c)] = p0dom(c) - pe(c)$$

$$(22) \quad x0com(c) = [1.0 - EXPSHR(c)] * x0dom(c) + EXPSHR(c) * x4(c)$$

$$(23) \quad p0com(c) = [1.0 - EXPSHR(c)] * p0dom(c) + EXPSHR(c) * pe(c)$$

The domestic supply price “ $p0dom(c)$ ” and import price “ $p0imp(c)$ ” are defined as follows:

$$(24) \quad p0dom(c) = p0(c, "dom")$$

$$(25) \quad p0imp(c) = p0(c, "imp")$$

2.2 Investment behavior

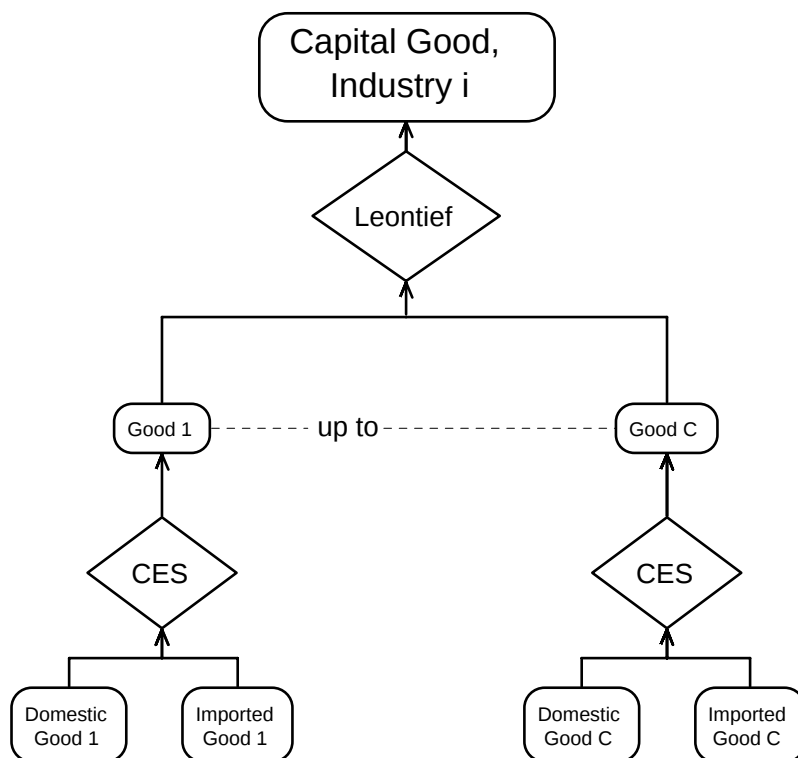
Figure 3-3 is a flowchart of demand for investment; each investment consists of domestic goods and imported goods and is determined by CES functions.

Let SIGMA2(c) be the Armington elasticity coefficient between domestic and imported goods for investment. Then, the demand for each investment goods “x2(c,s,i)” and its composite price “p2_s(c,i)” are as given below. In the Japanese AGE model, the values of SIGMA2(c) are based on the GTAP model values and are listed in Table 3-1.

$$(26) \quad x2(c,s,i) \cdot a2(c,s,i) \cdot x2_s(c,i) = - \text{SIGMA2}(c) * [p2(c,s,i) + a2(c,s,i) \cdot p2_s(c,i)]$$

$$(27) \quad p2_s(c,i) = \text{sum}\{s, \text{SRC}, S2(c,s,i) * [p2(c,s,i) + a2(c,s,i)] \}$$

(Figure 3-3) Investment Behavior



The composition of the demand for each investment goods is determined by a Leontief function. The demand for investment goods c “x2_s(c,i)” is as follows. The value x2tot(i) is determined by the rate of return on the investment.

$$(28) \quad x2_s(c,i) \cdot [a2_s(c,i) + a2tot(i)] = x2tot(i)$$

$$(29) \quad V2TOT(i) * (p2tot(i) - a2tot(i)) \\ = \text{Sum}\{c, \text{COM}, V2PUR_S(c,i) * [p2_s(c,i) + a2_s(c,i)] \}$$

Let finv(i) be the investment shifter and omega be the global rate of capital return.

Then, the current rate of return on capital “r1cap(i) is given as the following equation:

$$(30) \quad r1cap(i) = 2.0 * (p1cap(i) - p2tot(i)).$$

$$(31) \quad x2tot(i) - x1cap(i) = finv(i) + 0.33 * [r1cap(i) - \omega]$$

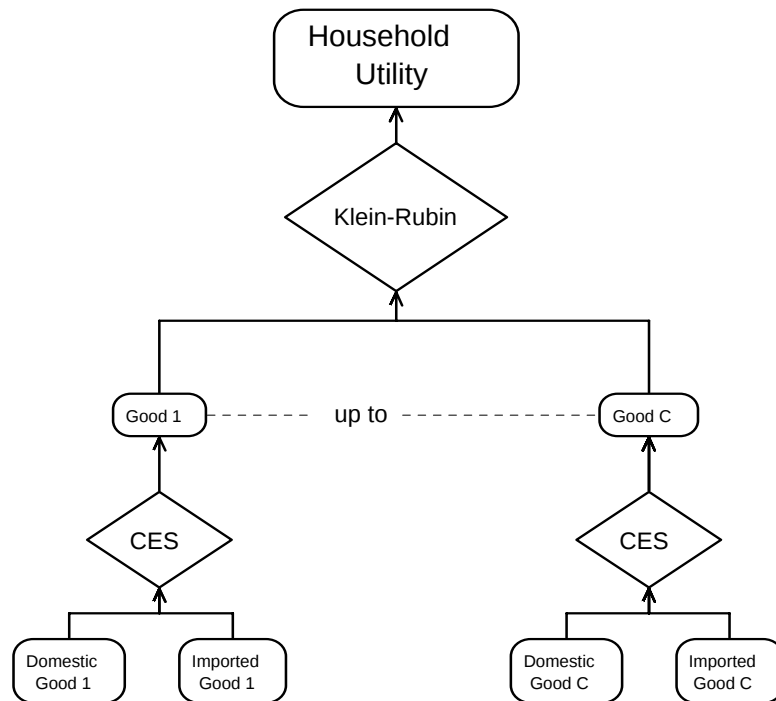
2.3 Household behavior

Figure 3-4 is a flowchart of household demands. Household consumption goods consist of domestic and imported goods, and its composition is determined by CES functions. Let SIGMA3(c) be the Armington elasticity coefficient between domestic and imported goods for consumption. Then, the demand “x3(c,s)” and the composite price “p3_s(c)” are as given below. In the Japanese AGE model, the values of SIGMA3(c) are based on the GTAP model values and are listed in Table 3-1.

$$(32) \quad x3(c,s) - a3(c,s) = x3_s(c) - SIGMA3(c) * [p3(c,s) + a3(c,s) - p3_s(c)]$$

$$(33) \quad p3_s(c) = \sum\{s, SRC, S3(c,s) * [p3(c,s) + a3(c,s)] \}$$

(Figure 3-4) Flowchart of household behavior



The composition of each consumption good is derived from a Klein-Rubin utility function. Consumption goods are divided into subsistence consumption goods, which are

not influenced by price or income changes, and supernumerary consumption goods, which are influenced by price or income changes. The household demand function is a LES (Linear Expenditure System). Let FRISCH be the ratio of the total consumption to luxury consumption multiplied by minus one, and let EPS be the household expenditure elasticity coefficient. In the Japanese AGE model, FRISCH is set to -1.2 (i.e., the percentage of consumption effected by price changes is 83%). The values of $ESP(c)$ are based on the GTAP model values and are listed in Table 3-1. $S3_S(c)$, $B3LUX(c)$, and $S3LUX(c)$ are determined as follows:

$$(34) \quad S3_S(c) = V3PUR_S(c) / V3TOT$$

$$(35) \quad B3LUX(c) = -EPS(c) / FRISCH$$

$$(36) \quad S3LUX(c) = EPS(c) * S3_S(c)$$

Let “ $x3sub(c)$ ” represent the subsistence consumption demand, “ $x3lux(c)$ ” the supernumerary consumption demand, “ $x3_s(c)$ ” the total consumption demand and “utility” the change in utility. They can then be expressed as follows, considering the changes in taste with regard to the consumption of supernumerary goods “ $a3lux(c)$ ” and the changes in taste with regard to the consumption of subsistence goods “ $a3sub(c)$ ”:

$$(37) \quad x3sub(c) = q + a3sub(c)$$

$$(38) \quad x3lux(c) + p3_s(c) = w3lux + a3lux(c)$$

$$(39) \quad x3_s(c) = B3LUX(c) * x3lux(c) + [1 - B3LUX(c)] * x3sub(c)$$

$$(40) \quad utility + q = \sum\{c, COM, S3LUX(c) * x3lux(c)\}$$

$$(41) \quad a3lux(c) = a3sub(c) - \sum\{k, COM, S3LUX(k) * a3sub(k)\}$$

$$(42) \quad a3sub(c) = a3_s(c) - \sum\{k, COM, S3_S(k) * a3_s(k)\}$$

Total of nominal consumption demand “ $w3tot$ ” is expressed as follows:

$$(43) \quad w3tot = w0gdpexp + f3tot$$

2.4 Export demand

The ORANI-G model classifies export demand into traditional export commodities (the demand for each of these commodities changes with changes in their relative prices) and non-traditional export commodities (the demand for each of these changes at a common rate). In the Japanese AGE model, all goods are treated as traditional export commodities; i.e., demand varies for each item.

Let $V4NTRADEXP$ be the income from non-traditional export commodities. In other words,

$$(44) \quad V4NTRADEXP = \sum\{c, NTRADEXP, V4PUR(c)\}$$

EXP_ELAST(c) is the export demand elasticity coefficient; the traditional export commodity demand function and the non-traditional export commodity demand function are as given below. In the Japanese AGE model, the values of EXP_ELAST(c) are based on the GTAP model values and are listed in Table 3-1.

$$(45) \quad x4(c) - f4q(c) = EXP_ELAST(c) * [p4(c) - \phi - f4p(c)] \quad (TRAD)$$

$$(46) \quad x4(c) = x4_ntrad \quad (NONTRAD)$$

The non-traditional export price “p4_ntrad” is obtained as follows:

$$(47) \quad V4NTRADEXP * p4_ntrad = \sum\{c, NTRADEXP, V4PUR(c) * p4(c)\}$$

Let EXP_ELAST_NT be the non-traditional export demand elasticity coefficient; the non-traditional export demand (x4_ntrad) is then as given below. In the Japanese AGE model, EXP_ELAST_NT is set to -2.0.

$$(48) \quad x4_ntrad - f4q_ntrad = EXP_ELAST_NT * [p4_ntrad - \phi - f4p_ntrad]$$

2.5 Government demand

Government demand “x5(c,s)” and the government demand shift parameter “f5tot” are as given below. The parameter “f5” is an exogenous variable. If, in addition, “f5tot” is also an exogenous variable, then “x5” is determined exogenously. In this case, “f5tot2” is an endogenous variable. By making “f5tot” endogenous and “f5tot2” exogenous, one can interlink these with the rate of change in household consumption.

$$(49) \quad x5(c,s) = f5(c,s) + f5tot$$

$$(50) \quad f5tot = x3tot + f5tot2$$

2.6 Margin demand

Changes in each margin demand are expressed as the sum of changes in technology and commodity demand.

$$(51) \quad x1mar(c,s,i,m) = x1(c,s,i) + a1mar(c,s,i,m)$$

$$(52) \quad x2mar(c,s,i,m) = x2(c,s,i) + a2mar(c,s,i,m)$$

$$(53) \quad x3mar(c,s,m) = x3(c,s) + a3mar(c,s,m)$$

$$(54) \quad x4mar(c,m) = x4(c) + a4mar(c,m)$$

$$(55) \quad x5mar(c,s,m) = x5(c,s) + a5mar(c,s,m)$$

(Table 3-1) Elasticity coefficients in the Japanese model

	SIGMA1	SIGMA1	SIGMA2	SIGMA3	EPS	EXP_LAST
PRIM						
Crop cultivation	0.24	2.20	2.20	2.20	0.34	-2.20
Livestock raising, sericulture	0.24	2.80	2.80	2.80	0.73	-2.80
Agriculture services	0.24	2.20	2.20	2.20	0.34	-2.20
Forestry	0.20	2.80	2.80	2.80	1.15	-2.80
Fisheries	0.20	2.80	2.80	2.80	0.42	-2.80
Metal ores	0.20	2.80	2.80	2.80	1.10	-2.80
Non-metal ores	0.20	2.80	2.80	2.80	1.10	-2.80
Coal and lignite	0.20	2.80	2.80	2.80	1.05	-2.80
Petroleum and natural gas	0.20	2.80	2.80	2.80	1.05	-2.80
Food products	1.12	2.20	2.20	2.20	0.51	-2.20
Beverages	1.12	3.10	3.10	3.10	0.94	-3.10
Feed and organic fertilizers	1.12	2.20	2.20	2.20	0.51	-2.20
Tobacco	1.12	3.10	3.10	3.10	0.94	-3.10
Textile products	1.26	2.20	2.20	2.20	0.84	-2.20
Apparel, other textile products	1.26	4.40	4.40	4.40	0.84	-4.40
Timber and wooden products	1.26	2.80	2.80	2.80	0.84	-2.80
Furniture and fittings	1.26	2.80	2.80	2.80	1.15	-2.80
Pulp and paper	1.26	1.80	1.80	1.80	1.15	-1.80
Paper products	1.26	1.80	1.80	1.80	1.15	-1.80
Publishing and printing	1.26	1.80	1.80	1.80	1.15	-1.80
Chemical fertilizers	1.26	1.90	1.90	1.90	1.15	-1.90
Inorganic chemical products	1.26	1.90	1.90	1.90	1.10	-1.90
Petrochemical basic products	1.26	1.90	1.90	1.90	1.15	-1.90
Synthetic resins	1.26	1.90	1.90	1.90	1.10	-1.90
Synthetic fibers	1.26	2.20	2.20	2.20	0.84	-2.20
Final chemical products	1.26	1.90	1.90	1.90	1.15	-1.90
Petroleum refinery products	1.26	1.90	1.90	1.90	1.15	-1.90
Coal products	1.26	1.90	1.90	1.90	1.15	-1.90
Plastic products	1.26	1.90	1.90	1.90	1.15	-1.90
Rubber products	1.26	1.90	1.90	1.90	1.15	-1.90
Leather, fur products	1.26	4.40	4.40	4.40	1.15	-4.40
Glass and glass products	1.26	2.80	2.80	2.80	1.15	-2.80
Cement and cement products	1.26	2.80	2.80	2.80	1.15	-2.80
Pottery, china, earthenware	1.26	2.80	2.80	2.80	1.15	-2.80
Ceramic, stone, clay products	1.26	2.80	2.80	2.80	1.15	-2.80
Pig iron and crude steel	1.26	2.80	2.80	2.80	1.15	-2.80
Steel products	1.26	2.80	2.80	2.80	1.10	-2.80
Steel castings, steel products	1.26	2.80	2.80	2.80	1.15	-2.80
Non-ferrous metals	1.26	2.80	2.80	2.80	1.15	-2.80
Non-ferrous metal products	1.26	2.80	2.80	2.80	1.15	-2.80
Metal products for construction	1.26	2.80	2.80	2.80	1.15	-2.80
Other metal products	1.26	2.80	2.80	2.80	1.15	-2.80
General industrial machinery	1.26	2.80	2.80	2.80	1.05	-2.80
Special industrial machinery	1.26	2.80	2.80	2.80	1.00	-2.80
Other general equipment	1.26	2.80	2.80	2.80	1.05	-2.80
Machinery for office, services	1.26	2.80	2.80	2.80	1.05	-2.80
Household electrical equipment	1.26	2.80	2.80	2.80	1.05	-2.80

	SIGMA1 PRIM	SIGMA1	SIGMA2	SIGMA3	EPS	EXP_LAST
Telecommunications equipment	1.26	2.80	2.80	2.80	1.05	-2.80
Heavy electrical equipment	1.26	2.80	2.80	2.80	1.05	-2.80
Other electrical equipment	1.26	2.80	2.80	2.80	1.05	-2.80
Motor vehicles	1.26	5.20	5.20	5.20	1.15	-5.20
Ships and ship repair	1.26	5.20	5.20	5.20	1.15	-5.20
Other transport equip., repair	1.26	5.20	5.20	5.20	1.15	-5.20
Precision instruments	1.26	2.80	2.80	2.80	1.05	-2.80
Other manufacturing products	1.26	2.80	2.80	2.80	1.05	-2.80
Constructions	1.40	1.90	1.90	1.90	1.00	-1.90
Repair of construction	1.40	1.90	1.90	1.90	1.00	-1.90
Civil engineering	1.40	1.90	1.90	1.90	1.05	-1.90
Electric power for enterprise use	1.26	2.80	2.80	2.80	1.05	-2.80
Gas and heat supply	1.26	2.80	2.80	2.80	1.05	-2.80
Water supply	1.26	2.80	2.80	2.80	1.05	-2.80
Waste disposal services	1.68	1.90	1.90	1.90	1.15	-1.90
Commerce	1.68	1.90	1.90	1.90	1.15	-1.90
Finance and insurance	1.26	1.90	1.90	1.90	1.15	-1.90
Real estate, rental services	1.26	1.90	1.90	1.90	1.15	-1.90
House rental	1.26	1.90	1.90	1.90	1.05	-1.90
Railway transport	1.26	1.90	1.90	1.90	1.15	-1.90
Road transport	1.68	1.90	1.90	1.90	1.15	-1.90
Self-transport by private cars	1.68	1.90	1.90	1.90	1.15	-1.90
Water transport	1.68	1.90	1.90	1.90	1.15	-1.90
Air transport	1.68	1.90	1.90	1.90	1.15	-1.90
Storage facility services	1.68	1.90	1.90	1.90	1.15	-1.90
Other transport services	1.68	1.90	1.90	1.90	1.15	-1.90
Communications	1.68	1.90	1.90	1.90	1.15	-1.90
Broadcasting	1.26	1.90	1.90	1.90	1.15	-1.90
Public administration	1.26	1.90	1.90	1.90	1.15	-1.90
Education	1.26	1.90	1.90	1.90	1.15	-1.90
Research	1.26	1.90	1.90	1.90	1.15	-1.90
Medical services and health	1.26	1.90	1.90	1.90	1.15	-1.90
Social security	1.26	1.90	1.90	1.90	1.15	-1.90
Other public services	1.26	1.90	1.90	1.90	1.15	-1.90
Advertising, market research, information	1.26	1.90	1.90	1.90	1.15	-1.90
Rental and lease of goods	1.26	1.90	1.90	1.90	1.15	-1.90
Car and machine repair	1.68	1.90	1.90	1.90	1.15	-1.90
Other business services	1.26	1.90	1.90	1.90	1.15	-1.90
Amusement and recreation	1.26	1.90	1.90	1.90	1.15	-1.90
Eating and drinking establishments	1.68	1.90	1.90	1.90	1.15	-1.90
Hotels and other lodging	1.68	1.90	1.90	1.90	1.15	-1.90
Other personal services	1.26	1.90	1.90	1.90	1.15	-1.90
Office supplies	1.26	1.90	1.90	1.90	1.15	-1.90
Not elsewhere classified	1.26	1.90	1.90	1.90	1.15	-1.90

3. Closing the Model

(Table 3-2) Standard Closures of the ORANI-G Model

1 Dimension	2 Variable Count	3 Equation Count	4 Exogenous Count	5 Unexplained Variables
MACRO	61	48	13	f0tax_s f1lab_io f4_ntrad f4tax_ntrad f5tot2 phi q <i>omega</i> w3lux f1tax_csi f2tax_csi f3tax_cs f5tax_cs
COM	18	11	7	t0imp a3_s f4p f4q pf0cif f4tax_trad delx6
COM*IND	7	5	2	a1_s a2_s
COM*MAR	2	1	1	a4mar
COM*SRC	9	7	2	f5 a3
COM*SRC*IND	8	6	2	a1 a2
COM*SRC*IND*MAR	4	2	2	a1mar a2mar
COM*SRC*MAR	4	2	2	a3mar a5mar
IND	27	15	12	a1cap a1lab_o a1lnd a1oct a1prim a1tot f1lab_o f1oct finv x1lnd a2tot x1cap
IND*OCC	3	2	1	f1lab
OCC	2	1	1	f1lab_i
TOTAL	145	100	45	

Standard closures

Table 3-2 shows the number of variables and equations, along with the exogenous variables derived from the equations by each dimension. The variables shown in the right-hand column of the table are the exogenous variables of a standard closure of the ORANI-G model. The variables in italics are changed to other variables in actual closures mentioned later.

Technical progress: a1tot, a2tot, a1, a2, a1mar, a2mar, a3mar, a5mar, a1cap,

a1lab_o, a1lnd, a1prim, a1_s, a2_s

Tax rate: t0imp

Shift parameters: f0tax_s, f1tax_csi, f2tax_csi, f3tax_cs, f4tax_trad, f4tax_ntrad, f5tax_cs,
f4_ntrad, f1lab_io, f5tot2, f4p, f4q, f1lab_o, f1oct, finv, f1lab, f1lab_i

Capital stock: x1cap

Price of foreign goods: pf0cif

Global mean return: *omega*

Inventory change: delx6

Exchange rate (this variable is numeraire in the ORANI-G model): phi

Expenditures “above subsistence level” in households: w3lux

Number of households: q

An actual closure (1) – short-term closure-

In the short-term closure, adjustment mechanism by wage does not work in the labor market. It is assumed that real wage is fixed and total investment, total consumption and total government demand are also assumed to be fixed.

Compared to the standard closure, real household consumption “ x_{3tot} ” is exogenous instead of total nominal supernumerary household expenditure “ w_{3lux} ”. This means level of consumption is fixed. Aggregate real investment expenditure “ x_{2tot_i} ” is exogenous instead of global rate of return “ ω ”. This means that the level of investment is fixed. Aggregate real government demands “ x_{5tot} ” is exogenous instead of shift parameter “ f_{5tot2} ”. Consequently, net export is the only demand changing endogenously.

An actual closure (2) - long term closure-

In the long-term closure, wage rate is adjusted according to the change of labor supply and investment demand is changeable as far as the relative rate of return of each industry per global rate of return converge toward a certain level.

Compared to the standard closure, the current rate of return on capital “ r_{1cap} ” is exogenous instead of current capital stock “ x_{1cap} ”. Aggregate employment “ $employ_i$ ” is exogenous instead of Average real wage “ $realwage$ ”. This means wage is determined according to labor supply. Balance of trade pre GDP “ $delB$ ” is exogenous instead of total nominal supernumerary household expenditure “ w_{3lux} ”. This means level of consumption “ x_{3tot} ” is changing, too.

Chapter 4 Simulation 1 – Change of Activity of Industries

1. Introduction

Economic structural reform such as deregulation is one important policy for the Japanese economy. In the 1990s, when economic growth had slowed down, various industries are beginning to look for ways to correct the expensive nature of Japan's cost structure and to seek new business opportunities in the domestic market. The government is also encouraging regulatory reform by such means as Deregulation Action Program. For these government policies, it is essential to grasp quantitatively the effects of various measures on the economy and to present them clearly to the public to deepen the awareness and understanding of the people. However, regulatory reform changes the economic structure qualitatively, unlike most financial and economic policies, which effect the economy quantitatively. Therefore, it is generally difficult to grasp the economic effects of regulatory reform in a quantitative fashion.

Various interesting quantitative studies have been conducted to analyze the economic effects of regulatory reform, including examples overseas. However, most of these studies have been partial equilibrium analyses in the specific industry where deregulation has taken place, answering such questions as how much prices have fallen, how much demand has increased, and how much the productivity has improved. The Economic Research Institute of the EPA conducted research on deregulation and privatization in 1995 (*"KEIZAI BUNSEKI"*, No. 141—144). In that study, the economic effects in the telecommunications, electricity, airlines, and trucking industries were analyzed in Japan, the US, and the UK.

In considering the economic effects of regulatory reform, one must look at the effects in the particular industry. However, it is quite possible that changes in one market influence other markets through changes in relative prices and in the distribution of the primary factors. Hence, to understand the effects on the entire economy, one must also look at the influence on other markets as well. Our research has begun with this concept—an attempt to measure the economic effects of regulatory reform by using some kind of AGE models capable of reflecting these phenomena. As mentioned before, there are examples in which the effects of deregulation on an entire economy have been quantitatively analyzed, such as a study by the Economic Planning Agency (1997a) and another by the Ministry of International Trade and Industry (1997).

In our study, the main purpose is to provide an analytical tool that can be used to analyze regulatory reform; that is, to construct such an AGE model and to show its usability. This is not to say that partial equilibrium analyses are meaningless. These are

extremely important since the results of partial equilibrium analyses, which show us how much costs have been reduced and how much productivity has increased, become input information for AGE models. Without such information, AGE models cannot calculate anything. Our study also refers to the results of these earlier analyses in individual industries.

2. Regulatory Reform and Changes in Corporate Behavior

2.1 Problems with regulations

Regulations are put in place to compensate for problems caused by the market mechanism. However, as pointed out in the previous chapter, the regulated market has the following problems in contrast to the competitive market:

- 1) Entry regulations limit competition and restrain incentives toward cost-reduction. In the end, an increase in costs in regulated industries often results in a higher price of their products, and makes their management inefficient.
- 2) Regulations are largely executed and carried out at the discretion of the authorities. Thus, corporations in regulated markets tend to set their objectives to secure excess profits through such means as entry regulations and price regulations. This results in extra costs, i.e., rent-seeking costs. Further, the administrative costs incurred by the governing authority are enormous.
- 3) In regulated markets, innovative behavior on the parts of corporations tends to slow or stop entirely. Diversification in services and price system is not developed quickly.
- 4) Even though market environment changes rapidly, however, responses to changing to prices and other areas to meet the changing needs takes a long time from the application stage to approval. This process is time-consuming and sometimes hurts both corporations and consumers.

2.2 Effects of regulatory reform

The primary objective of regulatory reform is to introduce competition in a regulated industry. The result should be an increase in economic welfare through the incentive effect made possible by competition.

Free entry to markets brings in price competition. This creates a need in the corporations involved to seek efficiency in management and to increase their level of productivity. Furthermore, regulatory reform eliminates the costs associated with the previously enforced regulations. This leads to a reduction in cost levels and eventually to an increased level of demand because of the price reduction.

Regulatory reform not only creates price competition but also quality competition. In regulated markets, the prices do not often reflect the quality of the products. In contrast,

in competitive markets, prices can be set according to the quality, making goods and services more versatile and creating a variety of price systems. Corporations place an emphasis on quality improvement of goods and services and try to promote technological innovations and other advancement.

3. Simulations

The purpose of our research is to develop a model that measures the effects of regulatory reform. To this end, various types of simulation using AGE models are attempted here. Among the various phenomena accompanying regulatory reform, this chapter focuses on the effects that the supply side-- i.e., changes in corporate behavior-- have on the Japanese economy.

3.1 Meaning of price reduction due to competition

As described above, an expected result of regulatory reform is the introduction of the competition principle; the first thing most people think of is reduction of prices through increased efficiency within corporations. Here, let us consider some meanings of price reduction.

First, suppose that a competitive condition forces the reduction of producer prices. The model indicates the producer price as the variable “ $p1tot(i)$ ”.¹ For the shock of simulation, suppose that the producer price falls by 1% ($p1tot(i) = -1\%$) in the industry involved in the regulatory reform. In an ordinary model closure, the producers’ price “ $p1tot(i)$ ” is an endogenous variable. To make it an exogenous one, we need to make an appropriate variable endogenous. In the analysis below, one of the following three exogenous variables is made endogenous: one concerning profits “ $profitslack(i)$ ”, one concerning wages “ $f1lab_o(i)$ ”, and one concerning productivity “ $a1tot(i)$ ”. By making these variables endogenous, we will be able to see the extent of expected losses, how much wages must be lowered, and how much productivity must be improved, respectively, when producer prices fall by 1%.

3.1.a When price reduction is temporarily covered by deficit or by cutting profits

First, let us consider touching neither the production structure inside the industry under consideration nor its cost structure. Rather, suppose that the industry facing the price reduction handles the change by a loss in profits.

In the ORANI-G model, it is assumed that corporate profits are zero. Since no variable corresponds to profits in this model, it is necessary to add a new variable to

¹ For the basic framework and variables of the model, see the previous chapter “The Japanese AGE Model.”

represent profits. Following the GTAP model, we will add a new variable “profitslack(i)” and use it as given below and make the variable “f1oct(i)” endogenous. Here, profitslack(i) indicates the rate of returns (losses) to sales revenue.

$$\begin{aligned} V1TOT(i) * [p1tot(i) - a1tot(i)] = \\ \text{sum}\{c, COM, V1PUR_S(c,i) * [p1_s(c,i) + a1_s(c,i)] \} \\ + V1PRIM(i) * [p1prim(i) + a1prim(i)] \\ + V1OCT(i) * [p1oct(i) + a1oct(i)] \end{aligned}$$

$$p1oct(i) = p3tot + f1oct(i)$$

$$\text{profitslack}(i) = V1OCT(i) * f1oct(i) / V1TOT(i)$$

The industrial sectors involved in the regulatory reform in our simulation are as follows: energy (2 industries; electricity and gas and heat suppliers), commerce, financial and insurance, transportation (4 industries; railways, road transport, water transport, air transport), and communications. The simulation assumes that the producer prices in these five sectors (including nine industries) fall by 1% simultaneously. The closure is assumed long-term, which is to be discussed later.

Table 4-1 shows the changes in the macroeconomic variables in Japan. The industries involved in the regulatory reform would be in loss in profit. But the loss would be externally compensated for. In this case, nominal wages would not decrease even though consumer prices fall. Since real income would rise and consumption would also go up, real GDP increases as well.

(Table 4-1) Effects on the Japanese Economy

(%)

	Real GDP	Consumption	Investment	Consumer Prices	Employment	Real wage	Capital stock	Capital prices
Japan	0.276	0.064	0.704	-0.265	0.000	0.870	0.665	-0.067

(Note) Producer price (= sales price) is forced to reduce by 1% while the nine industries involved the regulatory reform suffer a loss in profits.

Table 4-2 shows the effects on those industries to be involved in the regulatory reform. The 1% fall in producer prices would cause almost a 1% fall in consumer prices as well and an increase in both consumption and production. However, since the reformed industries do not take any special measures for output and cost structures, their losses to the total sales revenues would be 0.9 to 1.3%. This loss is to be compensated by issues such as stock of retained earnings and borrowing, bringing in the capital accumulation effect and resulting in an economy-enlarging effect. Employment would also increase,

except in electricity.² However, this can only be considered a temporary measure from the standpoint of corporate management because the profits are lost.

(Table 4-2) Effects on the Reformed Industries

(%)

	Profit or loss	Output	Consumption	Consumer price	Employment	Capital stock	Primary factor price
Electricity	-0.968	0.423	0.734	-0.999	-0.202	0.586	0.107
Gas and heat	-1.007	0.521	0.734	-0.999	0.003	0.856	0.192
Commerce	-1.193	0.329	0.805	-0.997	0.070	1.161	0.449
Finance	-1.116	0.518	0.791	-0.983	0.219	1.071	0.365
Railways	-0.884	0.628	0.786	-0.978	0.144	0.913	0.219
Road Transport	-1.264	0.479	0.785	-0.976	0.310	1.560	0.502
Water transport	-0.973	1.362	0.760	-0.952	1.024	2.160	0.404
Air Transport	-1.079	1.097	0.341	-0.522	0.817	1.995	0.438
Communications	-1.168	0.499	0.807	-1.000	0.056	1.133	0.339

(Note) Only the nine industries affected by the shock are listed. It is assumed that the profit structures of the other industries do not change.

3.1.b When producer price reduction causes change to their cost structure, especially wage structure

As we saw in the previous simulation, the “reformed industries” need to change their production or cost structures to reduce their output price. The following simulation is the case in which industries reduce primary factor costs, especially wages, for reducing their output prices. Wages by industry and occupation, “p1lab(i,o)”, is shown as the following equation in the ORANI-G model³:

$$p1lab(i,o) = p3tot + f1lab_io + f1lab_o(i) + f1lab_i(o) + f1lab(i,o)$$

Changes in wages are uniformly determined among all industries in the ORANI-G model, since the variables “f1lab_o(i)”, “f1lab_i(o)” and “f1lab(i,o)” are exogenous and set at zero. In this simulation, the wage-shift variable “f1lab_o(i)” is endogenous instead of “p1tot(i)”. By doing so, wages can be different among industries, and we can calculate how much these industries must reduce wages to reduce output price.

² Because of real wages increase, the primary factors shift from labor to capital. Hence, this simulation shows that employment will drop in this industry.

³ See equation (3) in the previous chapter.

Table 4-3 below shows the changes in the macroeconomic variables in Japan. Because consumer prices would drop, consumption would increase. Further, while wages would decrease and the labor demand would increase, investment would fall because relative capital demand is weakened. In a long-term closure, real GDP would fall because of the capital accumulation effect.

(Table 4-3) Effects on the Japanese Economy

(%)

	Real GDP	Consumption	Investment	Consumer Prices	Employment	Real wages	Capital stock	Capital prices
Japan	-0.079	0.029	-0.334	-0.188	0.000	0.101	-0.195	0.034

(Note) Producer price (=sales price) is reduced by 1% through reduction of wages in the nine reformed industries.

Table 4-4 below shows the effects on those industries involved in the regulatory reform. When producer prices fall by 1%, consumer prices would also fall by about 1%, and increase both consumption and production. The wages do fall in these industries, but employment would increase, because the cost would be reduced only by decreasing the wages in the reformed industries in this simulation. On the other hand, the demand for capital stocks would weaken. Looking at individual industries, the higher the ratio of capital / labor is, the more pressure the industry faces to lower wages.

(Table 4-4) Effect on the Reformed Industries

(%)

	Output	Consumption	Consumer prices	Employment	Capital stock	Primary factor prices	Nominal wages
Electricity	0.134	0.768	-0.999	10.380	-2.416	-1.942	-9.238
Gas and heat	0.430	0.768	-0.999	4.468	-2.112	-1.983	-5.003
Commerce	0.028	0.842	-0.997	0.799	-2.419	-1.401	-1.851
Finance/Insurance	0.294	0.828	-0.983	1.279	-1.494	-1.386	-2.148
Railways	0.496	0.824	-0.978	3.523	-1.247	-1.274	-3.571
Road Transport	0.182	0.822	-0.976	0.541	-2.076	-1.387	-1.597
Water transport	1.181	0.798	-0.952	2.981	-2.983	-2.443	-3.449
Air Transport	0.947	0.378	-0.522	2.621	-4.293	-3.118	-4.061
Communications	0.284	0.845	-1.000	1.871	-1.957	-1.264	-2.183

(Note) Only the nine industries involved in the regulation reform are listed here. The nominal wages of the other industries would be determined uniformly, increasing 0.82%.

Hence, when an industry is to compensate for the reduction in producer prices only by means of reducing wages, then wages must be considerably reduced. Corporations

could not depend only on this measure. They would need to make a larger-scale change in their expenditure structure (not only in wages) and in their production structure.

3.1.c When industry increases its efficiency through better productivity

In the simulation described above, no change in the production structure was assumed; only a reduction in labor unit cost was simply assumed. However, when a corporation attempts to lower its producer price, it almost always tries to increase its production efficiency. The next simulation assumes a change in the production structure. We suppose that an increase of productivity reduce the producer price.

In the ORANI-G model, there are several variables to represent productivity increases and technological changes. Among such variables in the production section are total factor productivity “a1tot(i)”, productivity of the intermediate input “a1_s(c,i)”, productivity of the value-add use “a1prim(i)”, and productivity of other cost sections “a1oct(i)”. These are related to quantity (x) and price (p) by the following equations: ⁴

Equations on quantity

$$\begin{aligned} x1_s(c,i) \cdot [a1_s(c,i) + a1tot(i)] &= x1tot(i) && \text{(Intermediate input)} \\ x1prim(i) \cdot [a1prim(i) + a1tot(i)] &= x1tot(i) && \text{(Primary factors)} \\ x1oct(i) \cdot [a1oct(i) + a1tot(i)] &= x1tot(i) && \text{(Other cost section)} \end{aligned}$$

Equation on the price

$$\begin{aligned} V1TOT(i) \cdot [p1tot(i) \cdot a1tot(i)] &= \\ &\text{sum}\{c, COM, V1PUR_S(c,i) \cdot [p1_s(c,i) + a1_s(c,i)] \} \\ &+ V1PRIM(i) \cdot [p1prim(i) + a1prim(i)] \\ &+ V1OCT(i) \cdot [p1oct(i) + a1oct(i)] \end{aligned}$$

In this simulation, among the variables of technological changes, total factor productivity (TFP), i.e., a1tot(i) is made endogenous instead of producer prices “p1tot(i)”. Our assumption is that due to the TFP increase, the producer price in the reformed industries would go down by 1%. In other words, this answers the following question: How many percent would the TFP have to increase to reduce the producer price by 1%?

Table 4-5 shows the effects on the macroeconomic variables in Japan. The increase in productivity would cause consumption, investment, and real GDP to rise through the accompanied decrease in prices and increase in real wages. For the effects on the macroeconomy, it seems better to handle the situation by increasing productivity rather than by cutting the profits or changing the cost structure.

⁴ See equations (10) through (13) of the previous chapter.

(Table 4-5) Effect on the Japanese Economy

(%)

	Real GDP	Consumption	Investment	Consumer Prices	Employment	Real wage	Capital stock	Capital prices
Japan	0.704	0.724	0.702	-0.315	0.000	0.788	0.737	-0.133

(Note) The nine industries reduce their producer prices (=sales prices) by 1% through an increase in their TFP.

Table 4-6 shows the effects on the industries involved in the regulation reform. As with the two previous simulation cases, the 1% reduction in the producer price would cause consumer prices to fall by about 1% and consumption and production to increase. The difference is that employment would fall slightly, and that capital stock would not rise as much as the production because we assume that productivity would increase. It appears that each industry needs to raise its TFP by 0.9 to 1.2% to reduce their producer price by 1%.

(Table 4-6) Effect on the Industries Involved

(%)

	Output	Consumption	Consumer prices	Employment	Capital stock	Primary factor prices	TFP increase
Electricity	0.696	1.385	-0.999	-0.776	-0.069	0.022	-0.906
Gas and heat	1.006	1.385	-0.999	-0.410	0.359	0.099	-0.940
Commerce	0.671	1.521	-0.997	-0.666	0.313	0.331	-1.097
Finance/insurance	0.634	1.507	-0.983	-0.668	0.096	0.255	-1.027
Railways	0.962	1.502	-0.978	-0.299	0.394	0.124	-0.816
Road Transport	0.794	1.501	-0.976	-0.531	0.593	0.379	-1.163
Water transport	1.367	1.476	-0.952	0.135	1.153	0.290	-0.916
Air Transport	1.329	1.054	-0.522	0.062	1.113	0.321	-1.004
Communications	0.566	1.524	-1.000	-0.911	0.053	0.232	-1.074

(Note) Only the nine industries involved in the regulation reform are listed here. The TFPs of other industries are assumed unchanged.

3.1.d Conclusion

We have thus far presented three different scenarios, conducting simulations on possible measures that corporations can take when the producer prices fall. Because of the restrictions of the model, a simulation was performed individually for each case, thus occasionally producing extreme results. However, different corporate strategies clearly result in different effects in real GDP, employment, and other factors of the economy. Not

all measures produce desirable effects. In reality, corporations are likely to combine such methods as temporary loss profits, cost-cutting measures, and increasing productivity. To reproduce these scenarios on the model, we can place appropriate values for those variables not chosen to be endogenous variables.

3.2 Simulation of Productivity Increase

3.2.a Introduction

One effect of regulatory reform is the rise of efficiency through increases in productivity. As seen in the results of the previous simulations, the most desirable measure corporations could take is to increase their productivity. Even previous search examples such as The Economic Planning Agency (1997a) and the MITI (1997) supposed that the total factor productivity (TFP) would increase in the industries involved in the regulation reform, and that the annual average increase would be between 0.5 % and 4%.

We thus consider in more detail those cases involving a productivity increase, particularly from the viewpoint of verifying the performance of the Japanese model. The shock in the simulation is the assumption that the TFP of the industries involved in regulatory reform should rise by 1%.⁵ The sectors involved in this regulatory reform are the same as in the simulation in (1) above: energy (2 industries: electricity, gas and heat suppliers), commerce, financial and insurance, transportation (4 industries: railways, road transport, water transport, air transport), and communications. The simulation assumes that a 1% increase in TFP takes place in all five sectors (including nine industries) simultaneously. Simulation is performed for each of the two closures—long-term and short-term.

3.2.b Simulation in a short-term closure

In a short-term closure, the adjustment mechanism by means of wages does not work in the labor market.⁶ It is assumed that real wages are fixed, and that total investment, total consumption, and total government demand are also fixed. Compared to a standard closure, real household consumption, “x3tot” is exogenous instead of total nominal supernumerary household expenditure, “w3lux”. This means the level of

⁵ In the ORANI-G model, the TFP is denoted with $a1tot(i)$, and a 1% increase in the TFP is expressed by $a1tot(i) = -1$.

⁶ Because of the nature of the model, the equilibrium of the labor market requires that, as a rule, quantity and price be exogenous variables and the other be an endogenous one. In a short-term closure, the total employment is endogenous because real wages are exogenous,.

consumption is fixed. Aggregate real investment expenditure, “x2tot_i” is exogenous instead of the global rate of return, “omega”. This means the level of investment is fixed. Aggregate real government demands “x5tot” is exogenous instead of shift parameter “f5tot2”. Consequently, net exports are the only demand that could change endogenously.

Table 4-7 shows the effects on the macroeconomic variables in Japan when the TFPs increase in each of the sectors. In a short-term closure, because real wages are assumed to be unchanged, the increase in productivity would have a more significant impact on a resultant price decrease than in a long-term closure. Further, since both consumption and investment are assumed to be fixed at the macroeconomic level, the effect on the real GDP would be less than in a long-term closure. With the total employment being endogenous, it would go up by 0.2% when the TFP increases by 1% in all five sectors. This might cause upward pressure on real GDP. Breaking down the effects on the Japanese economy by sectors, we see that increases in productivity in the wholesale and retail industries (given a large weighting) would have the biggest impact on increasing the real GDP, followed by finance/insurance and transportation sectors’ regulation reform.

(Table 4-7) Effect on the Japanese Economy (Short-term Closure)

(%)

	Real GDP	Consumption	Investment	Exports	Imports	Consumer Prices	Employment	Capital Price
All Sectors	0.497	0.000	0.000	3.286	-1.474	-1.514	0.204	-0.601
Energy	0.028	0.000	0.000	0.363	0.099	-0.172	-0.011	-0.220
Commerce	0.297	0.000	0.000	1.933	-0.909	-0.949	0.181	-0.673
Finance	0.084	0.000	0.000	0.721	-0.076	-0.309	0.021	-0.081
Transportation	0.056	0.000	0.000	0.518	-0.012	-0.193	-0.012	-0.083
Communication	0.021	0.000	0.000	0.039	-0.163	-0.033	0.002	0.087

(Note) The "All Sectors" row shows the effects on the entire economy when all the five sectors are simultaneously affected by the shock. The other rows show the effects on the entire economy when each sector is affected by the shock respectively.

Table 4-8 shows the effects on the industries involved when the TFPs increase by 1% in all five sectors (nine industries). While prices would fall and consumption and productivity rise, employment in those industries would tend to decline.

(Table 4-8) Effects on the Reformed Industries
(when the TFP increases by 1% in all 9 industries simultaneously)

(%)

	Output	Output Prices	Consump- tion	Employ- ment	Real wages	Capital stock	Capital prices
Electricity	0.657	-2.760	1.102	-1.678	0.000	0.000	-2.827
Gas and heat	0.520	-2.275	0.662	-1.232	0.000	0.000	-2.478
Commerce	0.148	-2.449	0.896	-1.119	0.000	0.000	-2.171
Finance	0.409	-2.403	0.816	-0.918	0.000	0.000	-2.232
Railways	0.769	-2.777	1.171	-0.644	0.000	0.000	-2.017
Road Transport	0.528	-2.357	0.757	-0.552	0.000	0.000	-1.838
Water transport	2.434	-1.953	0.319	2.008	0.000	0.000	-0.341
Air Transport	1.571	-2.059	-0.442	0.730	0.000	0.000	-1.086
Communications	0.305	-2.648	1.100	-1.185	0.000	0.000	-2.210

(Note) Effects on the industries involved when the TFP of these nine industries rises simultaneously by 1% while the TFP remains unchanged in all other industries. The effects on other industries are listed in Appendix Table 4-1.

3.2.c Simulation in a long-term closure

In a short-term closure, no labor adjustment mechanism exists with respect to changes in wages. In contrast, with a long-term closure, the labor market can be adjusted through the change of wages according to labor supply. However, the total employment in Japan is treated as an exogenous variable in this case. Namely, the total employment is not simulated to change even with regulatory reforms.⁷ It is important, therefore, to keep in mind that the following simulation does not contain any economic effects caused by a change in total employment due to a productivity increase. As for investment demand, it is determined in such a way that the relative rate of capital returns in each industry “r1cap(i)” with respect to the global rate of capital return “omega” stays fixed, as does the ratio of capital to investment in each industry.

The difference from a standard closure is that the current rate of capital return “r1cap” is exogenous instead of the capital stock volume “x1cap”, the total employment “employ_i” is exogenous instead of the rate of real wage increase “realwage” because labor supply determines wages in a long-term closure, and the balance of trade per GDP “delB” is exogenous instead of the supernumerary consumption “w3lux”, which means the real household consumption “x3tot” also changes in a long-term closure.

⁷ Because of the nature of the model, the equilibrium of the labor market requires that, as a rule, quantity and price be exogenous variables and the other be an endogenous one. In a long-term closure, the total employment is exogenous because real wages are endogenous.

Table 4-9 shows the effects on the macroeconomic variables in Japan when the TFPs increase in each sector. In a long-term closure, capital stock would increase until the current rates of capital return reach zero in each industry. On the other hand, real wages would go up since the total employment in Japan is fixed. Consequently, the rise in productivity would have less impact on a resulting price reduction compared to a short-term closure. However, since the economic growth would increase as the total consumption and total investment in this closure, impacts on the real GDP tend to be larger than in a short-term closure. Breaking down the effects on the Japanese economy of regulatory reform by sectors, the productivity increase in wholesale and retail industries would have the largest impact on the increase in Japan's real GDP.

(Table 4-9) Effect on the Japanese Economy (Long-term closure)

(%)

	Real GDP	Consumption	Investment	Consumer Prices	Employment	Real wages	Capital stock	Capital price
All Sectors	0.662	0.687	0.647	-0.291	0.000	0.746	0.686	-0.116
Energy	0.048	0.073	0.004	-0.003	0.000	0.071	0.036	0.015
Commerce	0.360	0.337	0.425	-0.194	0.000	0.373	0.409	-0.134
Finance	0.117	0.117	0.128	-0.059	0.000	0.146	0.112	-0.005
Transportation	0.106	0.116	0.080	-0.017	0.000	0.116	0.103	0.013
Communication	0.030	0.042	0.009	-0.019	0.000	0.038	0.024	-0.005

(Note) The "All sectors" row shows the effects on the entire economy when all five sectors are affected by the shock at the same time. The rows below that show the effects on the entire economy when each of the sectors is affected by the shock respectively.

Table 4-10 shows the effects on the industries involved in the regulatory reform when the TFPs rise by 1% in all five sectors (nine industries). The effects would be that prices drop, consumption and production increase, and employment in those industries tends to decline.

3.2.d Conclusion

These results can be summarized as follows:

- An increase in TFP leads to price reduction and an increase in both production and consumption in the industries involved in the regulatory reform. The fall in prices also influences other industries, increasing overall production.
- The more industries there are whose productivity is raised by regulatory reform, the bigger its effects are not only on those industries involved but also on the production

increase as a whole. Further, the long-term effects are more considerable than the short-term effects.

- If the TFP of an industry goes up, employment comes down; however, in the whole picture, employment increases (short-term), and essential wages also rise (long-term).
- The more industries there are whose productivity increases, the smaller the reduction in employment is in those particular industries. In general, short-term effects are larger than long-term effects.

(Table 4-10) Effects on the Reformed Industries

(%)

	Output	Output Prices	Consumption	Employment	Real wages	Capital stock	Capital prices
Electricity	0.686	-1.082	1.439	-0.850	0.746	-0.183	-0.080
Gas and heat	1.012	-1.053	1.412	-0.437	0.746	0.286	-0.122
Commerce	0.624	-0.904	1.405	-0.602	0.746	0.321	-0.098
Finance	0.603	-0.971	1.456	-0.656	0.746	0.063	-0.120
Railways	1.052	-1.181	1.655	-0.369	0.746	0.283	-0.066
Road Transport	0.714	-0.840	1.325	-0.436	0.746	0.620	-0.176
Water transport	1.451	-1.086	1.535	0.151	0.746	1.111	-0.116
Air Transport	1.306	-0.991	1.027	0.057	0.746	1.047	-0.134
Communications	0.531	-0.923	1.426	-0.849	0.746	0.061	-0.092

(Note) Effects on the industries involved in the regulation reform when the TFPs increase by 1% in these nine industries only, with the TFPs in other industries remaining fixed at zero. The effects on other industries are listed in Appendix Table 4-2.

Short-Term Closure

(Appendix Table 4-1) Effect to industries by improving TFP in the “reformed industries”

Total	Output	Output	Consump	Consumer	Employ-	Invest-m	Capital
	prices	prices	-tion	prices	ment	ent	stock
Crop cultivation	0.023	0.053	-0.163	-0.967	0.619	1.352	0
Livestock raising, sericulture	0.184	-0.053	-0.518	-0.694	1.177	2.580	0
Agriculture services	0.059	-1.384	-0.044	-1.380	0.099	-0.170	0
Forestry	0.780	-0.263	-0.479	-1.041	1.215	3.622	0
Fisheries	0.198	-0.526	-0.068	-1.343	0.509	1.252	0
Metal ores	2.025	-0.036	n.a.	n.a.	2.782	9.004	0
Non-metal ores	0.523	-1.680	n.a.	n.a.	1.212	3.664	0
Coal and lignite	1.063	-0.644	-0.422	-1.056	1.420	4.342	0
Petroleum and natural gas	0.179	-0.155	n.a.	n.a.	0.626	1.652	0
Food product	0.122	-0.884	-0.090	-1.326	0.211	-0.269	0
Beverages	0.151	-1.213	-0.008	-1.523	0.345	-0.160	0
Feeds and organic fertilizers	0.218	-0.916	0.095	-1.752	0.410	-0.143	0
Tobacco	0.318	-1.313	-0.017	-1.512	0.589	-0.033	0
Textile products	0.916	-1.094	-0.094	-1.401	1.250	0.276	0
Apparel, other textile products	0.508	-1.101	0.148	-1.741	0.778	0.071	0
Timber and wooden products	0.984	-0.990	-0.132	-1.348	1.434	0.400	0
Furniture and fittings	0.275	-1.204	0.186	-1.724	0.421	-0.199	0
Pulp and paper	0.548	-1.264	0.214	-1.753	1.171	0.247	0
Paper products	0.159	-1.307	0.114	-1.650	0.262	-0.199	0
Publishing and printing	0.159	-1.291	0.245	-1.784	0.233	-0.316	0
Chemical fertilizers	0.385	-1.070	0.128	-1.665	0.983	0.150	0
Inorganic chemical products	1.078	-1.123	n.a.	n.a.	2.444	0.888	0
Petrochemical basic products	1.096	-0.600	-0.040	-1.492	3.460	1.427	0
Synthetic resin	0.979	-0.770	n.a.	n.a.	2.446	0.892	0
Synthetic fibers	1.287	-1.034	n.a.	n.a.	1.986	0.642	0
Final chemical products	0.429	-1.077	0.076	-1.612	1.016	0.175	0
Petroleum refinery products	0.214	-0.762	-0.265	-1.262	0.500	-0.136	0
Coal products	0.807	-0.631	-0.582	-0.935	2.516	1.027	0
Plastic products	0.778	-0.955	0.028	-1.562	1.555	0.375	0
Rubber products	1.172	-0.947	-0.009	-1.525	2.038	0.633	0
Leather, fur products	0.958	-0.936	-0.188	-1.341	1.593	0.395	0
Glass and glass products	1.066	-0.906	0.074	-1.610	2.386	0.850	0
Cement and cement products	0.282	-1.602	0.099	-1.635	0.495	-0.106	0
Pottery, china, earthenware	0.939	-1.040	-0.090	-1.442	1.456	0.375	0
Ceramic, stone, clay products	0.959	-1.168	-0.092	-1.439	1.668	0.521	0
Pig iron and crude steel	1.363	-0.626	n.a.	n.a.	4.200	1.795	0
Steel products	1.236	-0.768	n.a.	n.a.	2.941	1.149	0
Steel castings, steel products	1.144	-1.040	-1.408	-0.071	1.856	0.562	0
Non-ferrous metals	1.945	-0.577	-0.782	-0.726	4.314	1.884	0
Non-ferrous metal products	1.018	-0.676	-0.498	-1.021	2.117	0.770	0
Metal products for construction	0.567	-1.156	0.096	-1.632	0.904	0.059	0
Other metal products	0.797	-1.044	0.014	-1.548	1.221	0.203	0
General industrial machinery	0.973	-1.045	-0.256	-1.244	1.646	0.335	0
Special industrial machinery	1.167	-0.871	n.a.	n.a.	2.278	0.586	0
Other general equipment	1.209	-1.010	0.052	-1.592	1.960	0.579	0

Short-Term Closure

(Appendix Table 4-1) Effect to industries by improving TFP in the “reformed industries”

	Output	Output	Consump	Consumer	Employ-	Invest-m	Capital
	prices	tion	prices	ment	ent	stock	
Machinery for office, services	0.845	-1.083	-0.147	-1.368	1.546	0.262	0
Household electric equipment	1.085	-0.941	-0.084	-1.438	1.996	0.530	0
Telecommunication equipment	1.111	-0.759	-0.232	-1.272	2.516	0.789	0
Heavy electrical equipment	0.798	-1.002	n.a.	n.a.	1.373	0.228	0
Other electrical equipment	1.504	-0.799	-0.236	-1.267	2.642	0.946	0
Motor vehicles	2.162	-0.877	-0.049	-1.484	3.602	1.428	0
Ships and repair of ships	2.993	-0.962	-1.133	-0.360	4.148	1.679	0
Other transport equip., repair	1.161	-0.923	0.117	-1.653	1.779	0.176	0
Precision instruments	1.263	-0.978	-0.130	-1.387	2.011	0.503	0
Other manufacturing products	0.761	-1.185	-0.201	-1.307	1.207	0.186	0
Construction	0.816	-1.308	n.a.	n.a.	1.340	0.263	0
Repair of construction	0.117	-1.504	n.a.	n.a.	0.202	-0.270	0
Civil engineering	-0.122	-1.565	n.a.	n.a.	-0.181	-0.441	0
Electric power for enterprise use	0.657	-2.760	1.102	-2.759	-1.678	-1.182	0
Gas and heat supply	0.520	-2.275	0.662	-2.274	-1.232	-0.988	0
Water supply	0.082	-1.458	-0.068	-1.457	0.222	-0.924	0
Waste disposal services	0.070	-1.495	-0.038	-1.495	0.083	-0.285	0
Commerce	0.148	-2.449	0.896	-2.442	-1.119	-0.790	0
Finance and insurance	0.409	-2.403	0.816	-2.362	-0.918	-0.886	0
Real estate, rental services	-0.136	-1.603	0.068	-1.603	-0.469	-0.582	0
House rent	0.000	-1.533	0.000	-1.533	0.040	-0.353	0
Railway transport	0.769	-2.777	1.171	-2.717	-0.644	-0.617	0
Road transport	0.528	-2.357	0.757	-2.302	-0.552	-0.567	0
Water transport	2.431	-1.953	0.319	-1.859	2.008	0.361	0
Air transport	1.571	-2.059	-0.442	-1.079	0.730	-0.115	0
Storage facility service	0.441	-1.331	-0.287	-1.239	0.659	-0.092	0
Other transport services	0.245	-1.126	-0.440	-1.081	0.472	-0.118	0
Communication	0.305	-2.648	1.100	-2.647	-1.185	-0.791	0
Broadcasting	0.090	-1.297	-0.231	-1.297	0.136	-0.334	0
Public administration	0.005	-1.426	-0.105	-1.426	0.005	-0.983	0
Education	-0.033	-1.409	-0.122	-1.408	-0.037	-0.389	0
Research	0.993	-0.749	-0.761	-0.749	1.213	0.229	0
Medical service and health	-0.156	-1.357	-0.172	-1.357	-0.208	-0.521	0
Social security	-0.134	-1.260	-0.267	-1.260	-0.143	-0.458	0
Other public services	-0.207	-1.125	-0.398	-1.125	-0.243	-0.555	0
Advertising, survey, information	0.185	-1.205	-0.320	-1.205	0.264	-0.298	0
Goods renting and leasing	0.291	-0.718	-0.790	-0.718	2.016	0.584	0
Car and machine repairing	0.134	-1.224	-0.302	-1.224	0.182	-0.493	0
Other business services	0.185	-1.282	-0.258	-1.269	0.256	-0.269	0
Amusement and recreational	0.010	-1.488	-0.058	-1.474	0.026	-0.377	0
Eating and drinking places	-0.077	-1.294	-0.306	-1.219	-0.109	-0.418	0
Hotel and other lodging places	0.154	-1.319	-0.496	-1.023	0.247	-0.283	0
Other personal services	-0.164	-1.348	-0.183	-1.346	-0.289	-0.524	0
Not elsewhere classified	0.523	-0.140	-1.475	0.000	5.190	2.300	0

(Appendix Table 4-2) Effect to industries by improving TFP in the “reformed industries”

	Output	Output	Consump	Consumer	Employ-	Invest-m	Capital
	prices	prices	-tion	prices	ment	ent	stock
Crop cultivation	0.423	-0.179	0.289	-0.467	0.292	0.428	0.428
Livestock raising, sericulture	0.445	-0.234	0.589	-0.412	0.316	0.469	0.469
Agriculture services	0.394	-0.072	0.176	-0.072	0.332	0.488	0.488
Forestry	0.553	0.020	0.832	-0.317	0.508	0.634	0.634
Fisheries	0.414	-0.101	0.350	-0.451	0.338	0.463	0.463
Metal ores	0.840	-0.029	n.a.	n.a.	0.807	0.935	0.935
Non-metal ores	0.517	-0.135	n.a.	n.a.	0.451	0.569	0.569
Coal and lignite	-0.005	-0.021	0.776	-0.338	-0.032	0.077	0.077
Petroleum and natural gas	0.249	-0.097	n.a.	n.a.	0.173	0.280	0.280
Food product	0.415	-0.157	0.395	-0.381	0.122	0.822	0.822
Beverages	0.591	-0.183	0.737	-0.387	0.178	0.916	0.916
Feeds and organic fertilizers	0.454	-0.203	0.494	-0.611	0.118	0.838	0.838
Tobacco	0.720	-0.223	0.739	-0.389	0.385	1.115	1.115
Textile products	0.599	-0.101	0.643	-0.370	0.397	1.159	1.159
Apparel, other textile products	0.655	-0.115	0.754	-0.527	0.402	1.134	1.134
Timber and wooden products	0.567	-0.070	0.657	-0.390	0.330	1.090	1.090
Furniture and fittings	0.572	-0.061	0.947	-0.435	0.309	1.071	1.071
Pulp and paper	0.400	-0.227	1.021	-0.510	0.029	0.729	0.729
Paper products	0.286	-0.108	0.875	-0.360	0.000	0.725	0.725
Publishing and printing	0.317	-0.035	0.924	-0.411	0.054	0.884	0.884
Chemical fertilizers	0.459	-0.149	0.988	-0.477	0.030	0.737	0.737
Inorganic chemical products	0.591	-0.263	n.a.	n.a.	0.187	0.913	0.913
Petrochemical basic products	0.555	-0.155	1.048	-0.538	0.096	0.771	0.771
Synthetic resin	0.529	-0.148	n.a.	n.a.	0.121	0.805	0.805
Synthetic fibers	0.556	-0.131	n.a.	n.a.	0.311	1.013	1.013
Final chemical products	0.568	-0.089	0.943	-0.431	0.168	0.862	0.862
Petroleum refinery products	0.440	-0.147	0.896	-0.382	0.007	0.766	0.766
Coal products	0.479	-0.146	0.793	-0.277	0.037	0.691	0.691
Plastic products	0.530	-0.113	0.953	-0.441	0.141	0.922	0.922
Rubber products	0.589	-0.099	0.965	-0.453	0.256	1.044	1.044
Leather, fur products	0.793	-0.089	0.912	-0.399	0.460	1.300	1.300
Glass and glass products	0.551	-0.106	1.097	-0.588	0.151	0.878	0.878
Cement and cement products	0.515	-0.153	0.904	-0.390	0.200	0.933	0.933
Pottery, china, earthenware	0.453	-0.031	0.896	-0.382	0.181	0.949	0.949
Ceramic, stone, clay products	0.576	-0.106	0.81	-0.294	0.275	0.988	0.988
Pig iron and crude steel	0.623	-0.210	n.a.	n.a.	0.176	0.842	0.842
Steel products	0.597	-0.182	n.a.	n.a.	0.206	0.885	0.885
Steel castings, steel products	0.603	-0.149	0.538	-0.014	0.324	1.056	1.056
Non-ferrous metals	0.754	-0.177	0.780	-0.263	0.355	1.089	1.089
Non-ferrous metal products	0.532	-0.100	0.774	-0.257	0.176	0.866	0.866
Metal products for construction	0.557	-0.078	0.900	-0.386	0.264	1.052	1.052
Other metal products	0.538	-0.050	0.898	-0.385	0.259	1.065	1.065
General industrial machinery	0.558	-0.061	0.737	-0.295	0.232	1.033	1.033
Special industrial machinery	0.659	-0.058	n.a.	n.a.	0.273	1.069	1.069
Other general equipment	0.760	-0.058	0.867	-0.442	0.448	1.268	1.268

(Appendix Table 4-2) Effect to industries by improving TFP in the “reformed industries”

	Output	Output	Consump	Consumer	Employ-	Invest-m	Capital
	prices	prices	-tion	prices	ment	ent	stock
Machinery for office, services	0.615	-0.107	0.749	-0.308	0.252	1.056	1.056
Household electric equipment	0.625	-0.089	0.802	-0.368	0.263	1.063	1.063
Telecommunication equipment	0.518	-0.075	0.775	-0.337	0.094	0.858	0.858
Heavy electrical equipment	0.483	-0.055	n.a.	n.a.	0.142	0.961	0.961
Other electrical equipment	0.563	-0.057	0.757	-0.318	0.224	1.017	1.017
Motor vehicles	0.713	-0.089	0.928	-0.415	0.421	1.159	1.159
Ships and repair of ships	0.576	-0.082	0.596	-0.073	0.358	1.151	1.151
Other transport equip., repair	0.597	-0.045	0.977	-0.466	0.337	1.091	1.091
Precision instruments	0.602	-0.043	0.789	-0.353	0.290	1.134	1.134
Other manufacturing products	0.600	-0.093	0.797	-0.362	0.305	1.107	1.107
Construction	0.633	-0.029	n.a.	n.a.	0.315	1.132	1.132
Repair of construction	0.378	-0.092	n.a.	n.a.	0.025	0.868	0.868
Civil engineering	0.453	-0.035	n.a.	n.a.	0.183	1.012	1.012
Electric power for enterprise use	0.686	-1.082	1.439	-1.082	-0.850	-0.183	-0.183
Gas and heat supply	1.012	-1.053	1.412	-1.052	-0.437	0.286	0.286
Water supply	0.486	-0.092	0.558	-0.092	0.028	0.753	0.753
Waste disposal services	0.488	0.186	0.346	0.186	0.340	1.285	1.285
Commerce	0.624	-0.904	1.405	-0.902	-0.602	0.321	0.321
Finance and insurance	0.603	-0.971	1.456	-0.954	-0.656	0.063	0.063
Real estate, rental services	0.080	-0.020	0.544	-0.020	-0.379	0.268	0.268
House rent	0.586	-0.123	0.586	-0.123	-0.019	0.593	0.593
Railway transport	1.052	-1.181	1.655	-1.155	-0.369	0.283	0.283
Road transport	0.714	-0.840	1.325	-0.820	-0.436	0.620	0.620
Water transport	1.451	-1.086	1.535	-1.033	0.151	1.111	1.111
Air transport	1.306	-0.991	1.027	-0.517	0.057	1.047	1.047
Storage facility service	0.519	0.029	0.499	0.027	0.187	1.193	1.193
Other transport services	0.167	0.017	0.509	0.016	-0.261	0.631	0.631
Communication	0.531	-0.923	1.426	-0.923	-0.849	0.061	0.061
Broadcasting	0.269	-0.009	0.534	-0.009	-0.001	0.797	0.797
Public administration	0.675	0.223	0.310	0.223	0.659	1.426	1.426
Education	0.552	0.279	0.256	0.279	0.476	1.321	1.321
Research	0.552	0.063	0.464	0.062	0.406	1.219	1.219
Medical service and health	0.513	0.020	0.505	0.020	0.305	1.140	1.140
Social security	0.525	0.167	0.364	0.167	0.475	1.259	1.259
Other public services	0.387	0.114	0.414	0.114	0.262	1.102	1.102
Advertising, survey, information	0.185	0.025	0.501	0.025	-0.070	0.781	0.781
Goods renting and leasing	0.409	-0.212	0.731	-0.212	-0.309	0.531	0.531
Car and machine repairing	0.349	-0.038	0.561	-0.038	0.061	1.170	1.170
Other business services	0.277	0.068	0.460	0.067	0.046	0.886	0.886
Amusement and recreational	0.520	-0.065	0.587	-0.065	0.074	0.811	0.811
Eating and drinking places	0.326	-0.041	0.562	-0.039	0.043	1.005	1.005
Hotel and other lodging places	0.375	-0.067	0.575	-0.052	0.043	0.928	0.928
Other personal services	0.458	0.046	0.480	0.046	0.136	0.881	0.881
Not elsewhere classified	0.509	-0.126	0.525	0.000	-0.037	0.571	0.571

Long-term Closure

Chapter 5 Simulation 2 - Changes in Consumer Behavior

1. Introduction

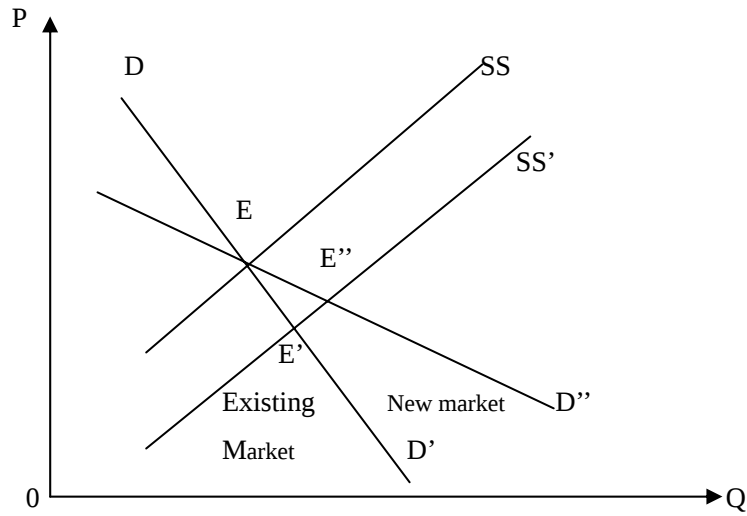
In the simulation described in Chapter 4, we discussed economic effects by changes in behavior on the supply side as to how corporations would respond to a decline in prices due to competition triggered by regulatory reform. But it should be noted that regulatory reform could cause changes not only to industry and the supply side, but also to consumer behavior.

The demand for employment in the "reformed industries" would decrease when the effect of regulatory reform could only bring improvement of productivity in these industries. The effect of regulatory reform may be underestimated for this type of scenario. Although some businesses may go bankrupt due to competition, it is not likely that the sectors facing competition as a result of regulatory reform would collapse. To the contrary, reformed industries tend to become revitalized and grow more than they would otherwise. The purpose of regulatory reform is to revitalize the Japanese economy. This includes not only improvements in management efficiency but also in the entry of new companies into the market, in the provision of new goods and services, and in the diversification of pricing systems, which would cause a significant expansion of demand. Thus, it is necessary to add the viewpoint of the influence of the changes on the demand-side for further analysis. In this chapter, therefore, we will examine simulations in which not only corporate behavior but also consumer behavior would change.

2. How should changes in consumer behavior be analyzed in AGE models?

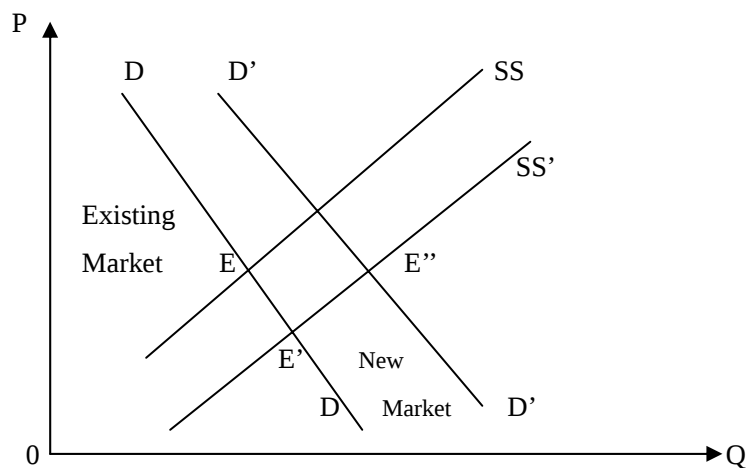
A simulation result is basically shown as a percentage change in the GTAP and ORANI models. However, a percentage change in a brand-new market either cannot be defined or could be close to infinity. Therefore these models should be modified when using them in the analysis. However, it can be clearly and luminously expressed by adding emerging markets to existing ones; for example, the cellular phone market might be added to the telecommunications market.

(Figure 5-1) The Creation of a New Market (1)



Before regulatory reform is put into effect, the demand curve is DD' and the supply curve is SS . When the supply curve shifts downward to SS' because of a productivity increase due to regulatory reform, Point E' becomes the equilibrium point so long as there are only existing markets. On the other hand, intersection E'' of the demand curve DD' and the supply curve SS becomes the new equilibrium point when a new market has been created.

(Figure 5-2) The Creation of a New Market (2)



Before regulatory reform is put into effect, the demand curve is DD' and the supply curve is SS . When the supply curve shifts downward to SS' because of a productivity increase due to regulatory reform and the demand curve shifts to the right to DD' because of creation of a new market, Point E'' becomes the equilibrium.

It is possible to express emerging markets by enlarging the price elasticity of demand, while the supply curve shifts downward due to improvements in the efficiency in industries, i.e., reductions in rent, increases in productivity, etc. (Figure 5-1) The difference between a case in which the price elasticity does not change and another in which it changes shows the effect of emerging markets by changes in consumer behavior.

It is also possible to express emerging markets through a shift to the right in the demand curve by enlargement of income elasticity or by using shift parameters as shown in Figure 5-2. The difference between the curves before and after a change in demand can be understood as various economic effects caused by changes in consumer behavior.

3. Analysis using the ORANI model

1) In the ORANI-G model, the composition of household goods is determined by the Klein-Rubin utility function. The consumption can be divided into two different types: subsistence consumption, which is not influenced by changes in price or income, and supernumerary consumption, which is influenced by these changes. The demand function for households is expressed as a linear expenditure system (LES). FRISCH stands for the ratio of total consumption over the supernumerary consumption multiplied by minus one. EPS stands for the elasticity coefficient for household expenditures. S3_S(c), B3LUX(c) and S3LUX(c) are determined as follows:

$$S3_S(c) = V3PUR_S(c) / V3TOT$$

$$B3LUX(c) = -EPS(c) / FRISCH$$

$$S3LUX(c) = EPS(c) * S3_S(c)$$

Where "a3lux(c)" is a parameter for changes in tastes for supernumerary demand and "a3sub(c)" is a parameter for changes in taste for subsistence demand. Subsistence demand "x3sub(c)," supernumerary demand "x3lux(c)," total composite demand "x3_s(c)," are determined as follows, respectively:

$$x3sub(c) = q + a3sub(c)$$

$$x3lux(c) + p3_s(c) = w3lux + a3lux(c)$$

$$x3_s(c) = B3LUX(c) * x3lux(c) + [1 - B3LUX(c)] * x3sub(c)$$

$$a3lux(c) = a3sub(c) - \sum\{k, COM, S3LUX(k) * a3sub(k) \}$$

$$a3sub(c) = a3_s(c) - \sum\{k, COM, S3_S(k) * a3_s(k) \}$$

2) First of all, we will focus on a change in elasticity as a means of analyzing consumer behavior. In the standard model, the elasticity coefficient for household expenditures "EPS" is used as stated before. This is a mixture of price elasticity and income elasticity. Thus, to distinguish price elasticity, parameter "p3sig(c)" should be added as the following equation:

$$X3lux(c) + p3sig(c) * p3_s(c) = w3lux + a3lux(c)$$

The demand curve can shift in the horizontal direction according to changes in parameters for changes in taste "a3_s(c)".

4. Influence of changes in elasticity coefficients

The simulations in this section estimate the effect by changing such elasticity coefficients as "EPS", "p3sig" and changes in taste "a3_s". The shocks given to the model are, with an assumption of improvement in TFP in "Communications" by regulatory reform being 1%, as follows: (1) The elasticity coefficient for household expenditures "EPS" in "Communications" and "Telecommunications equipment" are doubled. (2) The price elasticity "p3sig" in "Communication" and "Telecommunication equipment" are doubled. (3) The demand curves for "Communication" and "Telecommunications equipment" shift 1% to the right (i.e., "a3_s" is set at 1%). Table 5-1 shows the macroeconomic effect caused by each of the above three shocks. Table 5-2 shows the effect on the "reformed industry", i.e. the Communications industry, and the Telecommunications equipment industry.

(Table 5-1) Effect on the Whole Japanese Economy

(%)

	Real GDP	Consump- tion	Invest- ment	Consumer Prices	Employ- ment	Real wages	Capital stock	Capital Price
(1)Doubled EPS	0.029	0.037	0.016	-0.017	0.000	0.039	0.023	-0.003
(2)Doubled p3sig	0.029	0.037	0.016	-0.017	0.000	0.039	0.023	-0.003
(3)a3_s = 1 %	0.029	0.037	0.016	-0.017	0.000	0.039	0.023	-0.003

(Table 5-2) Effect on the Reformed Industry

(%)

	Output	Output Prices	Consump- tion	Employ-m ent	Real wages	Capital stock	Capital price
(1) "Cmcn"	0.689	-1.036	2.035	-0.337	0.039	-0.292	-0.005
(2) "Cmcn"	0.688	-1.036	2.035	-0.337	0.039	-0.292	-0.005
(3) "Cmcn"	0.686	-1.036	2.028	-0.339	0.039	-0.294	-0.005
(1) "Tele"	0.002	-0.005	0.034	-0.015	0.039	0.017	-0.003
(2) "Tele"	0.002	-0.005	0.023	-0.015	0.039	0.016	-0.003
(3) "Tele"	0.016	-0.005	1.016	-0.001	0.039	0.031	-0.003

The results from the simulations give evidence of the following. First of all, as for the effect on the reformed Communications industry (whose productivity would rise and output price would decline), there would be little difference in results between Case (1), Case (2), and Case (3). As for Case (1) and Case (2), prices would decrease by 1% as productivity would increase by 1%, and thus the increase in consumption would be twice as big (2%). The parameter "p3s1" has only a price elasticity value, while "EPS" is a composite elasticity value derived from the price and income effects. Therefore, there is a difference between the two simulations due to "w3lux". However, there is no difference in the degree of influence on consumption because the change in "w3lux" is extremely small. As for Case (3), a 1% price decrease would cause an increase in consumption and a 1% change in tastes, resulting in a total increase in consumption of 2%.

Secondly, as for the effect on the industry of Telecommunications equipment (whose productivity and output price don't change), there would be a difference. The effect of the consumption increase is small due to the lack of a decrease in price concerning Case (2) when comparing the rates of consumption increase. Case (1) displays a larger effect on consumption increase than Case (2) because its effect on income is positive. Case (3) shows a larger effect on consumption increase than Case (1) and Case (2) because "a3s1" has an additional 1%.

In addition, shocks of this degree cause almost no difference in effect on macroeconomic variables in these three cases.

5. The effect of increase of demand

The simulations in the previous section have shown that the method of changing elasticity coefficients causes large changes only in industries whose prices decrease. So, in the simulation in this section, we tried to analyze emerging markets using the parameter of changes in taste, "a3_s".

According to the Household Survey of the Management and Coordination Agency, household expenditures on communications in 1994, the ebb of a rapid expansion in the cellular phone market, were ¥ 6,442 a month and increased to ¥ 8,841 in 1998; with expenditures increasing 37.2% during those four years. On the other hand, total consumption expenditures were ¥ 353,166 in 1994 and ¥ 353,552 in 1998.

Therefore, we should give a larger value to the shift parameter "a3_s". Here, we made simulations for a case that both the demand curves of "Communications" and "Telecommunications equipment" would shift to the right corresponding to a 10% amount (i.e., a3_s = 10%), while the TFP for "Communications" is improved by 1%. For another case in which both demand curves would change corresponding to a 5% amount (i.e., a3_s = 5%) , while the TFP for "Communications" is improved by 1%. Table 5-3 shows the effect on the whole Japanese economy; Table 5-4 shows the effect on "Communications" and "Telecommunications equipment".

**(Table 5-3) The Effect on the Whole Japanese Economy
(assuming no change in total employment in Japan)**

(%)

	Real GDP	Consump- -tion	Invest-m ent	Consumer Prices	Employ-m ent	Real wages	Capital stock	Capital price
(1) 10% shift	0.020	-0.005	0.078	0.001	0.000	0.043	0.006	0.016
(2) 5% shift	0.025	0.018	0.044	-0.009	0.000	0.041	0.015	0.006
(3) 1% shift	0.029	0.037	0.016	-0.017	0.000	0.039	0.023	-0.003

According to the result of simulations, consumption and output increased significantly in the reformed industries, but the driving effect on the Japanese GDP has become weaker when "a big increase in demand" is seen. In partial equilibrium analyses, a phenomenon of a change in consumer behavior is easy to describe, and the aggregated effect on all markets can usually be measured by accumulating individual effects. However, in AGE models, final consumption and industry investment are decided endogenously. Thus, when new demand or new investment is input in AGE

models, contradictions would cause inefficiency or declines other markets, so that real GDP actually would become smaller. The above simulations are calculated under the long-term closure, in which a balance of current account is fixed at zero, with total employment in Japan also at zero. Thus, an extreme concentration of demand into a certain market would bring about the convergence of resource distribution, so that real wages would be raised under such restrictions. As a result, the whole production becomes inefficient.

(Table 5-4) Effect on the Reformed Industries
(assuming no change in total employment in Japan)

(%)

	Output	Output price	Consumption	Employment	Real wages	Capital stock	Capital price
(1) Effect to Cmcn (10%)	3.714	-1.015	10.928	2.656	0.043	2.708	0.014
(2) Effect to Cmcn (5%)	2.033	-1.027	5.987	0.993	0.041	1.041	0.003
(3) Effect to Cmcn (1%)	0.686	-1.036	2.028	-0.339	0.039	-0.294	-0.005
(1) Effect to Tele equip(10%)	0.294	0.012	9.835	0.272	0.043	0.312	0.012
(2) Effect to Tele equip (5%)	0.140	0.003	4.939	0.120	0.041	0.156	0.004
(3) Effect to Tele equip (1%)	0.016	-0.005	1.016	-0.001	0.039	0.031	-0.003

So, we calculated them in another model closure. In other words, an increase in real wages is fixed at an identical level (0.039% in this simulation) in both the case of 10% shift and the case of 1% shift, but employment is made endogenous instead. Therefore, a simulation has been made here, including the effect of an expansion of employment accompanying the generation of new demand. Table 5-5 shows the effect on the whole Japanese economy. Table 5-6 shows the effect on "Communications" and "Telecommunications equipment".

(Table 5-5) Effect on the Whole Japanese Economy
(including the effects on an expansion in employment)

(%)

	Real GDP	Consumption	Investment	Consumer Prices	Employment	Real wages	Capital stock	Capital price
(1) 10% shift	0.092	0.069	0.150	-0.020	0.074	0.039	0.075	-0.005
(2) 1% shift	0.027	0.035	0.014	-0.017	-0.002	0.039	0.021	-0.002
The difference	0.065	0.034	0.136	-0.003	0.076	0.000	0.054	-0.003

**(Table 5-6) The Effect on the Reformed Industries
(including the effects on an expansion in employment)**

(%)

	Output	Output price	Consump- tion	Employ-m ent	Real wages	Capital stock	Capital price
(1) Effect to Cmcn (10%)	3.794	-1.038	11.025	2.737	0.039	2.783	-0.008
(2) Effect to Cmcn (1%)	0.684	-1.035	2.026	-0.341	0.039	-0.296	-0.005
(1) Effect to Tele (10%)	0.362	-0.008	9.920	0.345	0.039	0.376	-0.006
(2) Effect to Tele (1%)	0.015	-0.005	1.014	-0.003	0.039	0.029	-0.003

The expansion effect of the economy would become smaller, even if the increase of demand simply occurs, so long as there are restrictions on supply such as employment. But if these restrictions are released, there would be an expansion in demand for the whole economy. It would be important to influence demand by making the market more attractive through diversifying goods and services provided at lower prices with an increase in the number of businesses' options as a result of regulatory reform. We can confirm this importance through these simulations.

(Table 5-7) Effect to Industries by Change of Consumers' Behavior (output)

	EPS	P3sig	Exogenous employment	Endogenous employment	Exogenous employment	Endogenous employment
	doubled	doubled	a3_s 1%	a3_s 1%	a3_s 10%	a3_s 10%
Crop cultivation	0.009	0.009	0.003	0.002	-0.125	-0.080
Livestock raising, sericulture	0.009	0.009	0.004	0.003	-0.126	-0.079
Agriculture services	0.008	0.008	0.002	0.001	-0.128	-0.084
Forestry	0.012	0.012	0.012	0.010	-0.081	0.010
Fisheries	0.009	0.009	0.003	0.002	-0.126	-0.080
Metal ores	0.014	0.014	0.015	0.012	-0.055	0.083
Non-metal ores	0.002	0.002	0.001	0.000	0.173	0.249
Coal and lignite	0.024	0.024	0.024	0.021	-0.043	0.081
Petroleum and natural gas	0.034	0.034	0.034	0.031	-0.088	0.017
Food product	0.009	0.009	0.003	0.002	-0.129	-0.085
Beverages	0.015	0.015	0.013	0.011	-0.120	-0.059
Feeds and organic fertilizers	0.009	0.010	0.004	0.003	-0.124	-0.077
Tobacco	0.019	0.019	0.017	0.015	-0.131	-0.064
Textile products	0.012	0.012	0.010	0.009	-0.103	-0.037
Apparel, other textile products	0.014	0.014	0.011	0.010	-0.112	-0.046
Timber and wooden products	0.020	0.020	0.019	0.018	-0.041	0.037
Furniture and fittings	0.022	0.022	0.022	0.020	-0.037	0.035
Pulp and paper	0.013	0.013	0.013	0.012	-0.034	0.036
Paper products	0.012	0.012	0.011	0.010	-0.059	0.004
Publishing and printing	0.011	0.011	0.012	0.010	-0.013	0.059
Chemical fertilizers	0.010	0.010	0.006	0.005	-0.105	-0.053
Inorganic chemical products	0.014	0.014	0.014	0.013	-0.048	0.022
Petrochemical basic products	0.014	0.014	0.014	0.013	-0.045	0.022
Synthetic resin	0.014	0.014	0.014	0.013	-0.030	0.039
Synthetic fibers	0.012	0.012	0.011	0.009	-0.084	-0.021
Final chemical products	0.017	0.017	0.017	0.015	-0.099	-0.023
Petroleum refinery products	0.015	0.015	0.015	0.013	-0.050	0.022
Coal products	0.009	0.009	0.009	0.008	0.054	0.125
Plastic products	0.014	0.014	0.014	0.012	-0.024	0.048
Rubber products	0.014	0.014	0.015	0.013	-0.032	0.042
Leather, fur products	0.012	0.012	0.012	0.010	-0.104	-0.017
Glass and glass products	0.014	0.014	0.016	0.014	-0.017	0.054
Cement and cement products	0.005	0.005	0.005	0.003	0.136	0.209
Pottery, china, earthenware	0.012	0.012	0.013	0.011	-0.016	0.051
Ceramic, stone, clay products	0.013	0.013	0.013	0.011	0.007	0.081
Pig iron and crude steel	0.015	0.015	0.015	0.014	-0.008	0.065
Steel products	0.015	0.015	0.015	0.014	-0.006	0.065
Steel castings, steel products	0.018	0.018	0.018	0.016	-0.016	0.057
Non-ferrous metals	0.018	0.018	0.019	0.017	-0.001	0.083
Non-ferrous metal products	0.013	0.013	0.015	0.013	0.026	0.098
Metal products for construction	0.016	0.016	0.015	0.014	0.021	0.094
Other metal products	0.016	0.016	0.016	0.015	-0.026	0.044
General industrial machinery	0.021	0.021	0.021	0.019	-0.020	0.046
Special industrial machinery	0.021	0.021	0.021	0.019	-0.018	0.047
Other general equipment	0.024	0.024	0.025	0.023	-0.026	0.047

(Table 5–7) Effect to Industries by Change of Consumers' Behavior (output)

	EPS	P3sig	Exogenous employment	Endogenous employment	Exogenous employment	Endogenous employment
	doubled	doubled	a3_s 1%	a3_s 1%	a3_s 10%	a3_s 10%
Machinery for office, services	0.023	0.023	0.023	0.021	-0.017	0.048
Household electric equipment	0.016	0.016	0.015	0.013	-0.086	-0.017
Telecommunication equipment	0.002	0.002	0.016	0.015	0.294	0.362
Heavy electrical equipment	0.019	0.019	0.020	0.018	0.013	0.082
Other electrical equipment	0.014	0.014	0.016	0.014	-0.011	0.066
Motor vehicles	0.018	0.018	0.018	0.016	-0.081	0.011
Ships and repair of ships	0.014	0.014	0.014	0.012	-0.067	0.014
Other transport equip., repair	0.026	0.026	0.025	0.024	-0.044	0.040
Precision instruments	0.019	0.019	0.019	0.017	-0.053	0.016
Other manufacturing products	0.019	0.019	0.018	0.017	-0.047	0.021
Construction	0.024	0.024	0.024	0.022	-0.044	0.031
Repair of construction	0.014	0.014	0.014	0.012	-0.059	0.015
Civil engineering	-0.007	-0.007	-0.008	-0.009	0.272	0.344
Electric power for enterprise use	0.013	0.013	0.012	0.011	-0.045	0.028
Gas and heat supply	0.016	0.016	0.015	0.014	-0.105	-0.031
Water supply	0.017	0.017	0.016	0.015	-0.076	-0.004
Waste disposal services	0.023	0.023	0.023	0.021	-0.035	0.039
Commerce	0.015	0.015	0.015	0.013	-0.055	0.011
Finance and insurance	0.016	0.016	0.016	0.014	-0.072	0.005
Real estate, rental services	0.012	0.012	0.012	0.010	-0.031	0.040
House rent	0.013	0.013	0.012	0.010	-0.155	-0.077
Railway transport	0.013	0.013	0.013	0.011	-0.090	-0.010
Road transport	0.011	0.011	0.011	0.009	-0.059	0.013
Water transport	0.013	0.013	0.012	0.011	-0.026	0.024
Air transport	0.014	0.014	0.014	0.012	-0.022	0.054
Storage facility service	0.013	0.013	0.013	0.011	-0.034	0.033
Other transport services	0.015	0.015	0.015	0.013	-0.056	0.015
Communication	0.689	0.688	0.686	0.684	3.714	3.794
Broadcasting	0.018	0.018	0.018	0.016	-0.034	0.041
Public administration	0.036	0.036	0.036	0.035	-0.009	0.065
Education	0.025	0.025	0.025	0.023	-0.042	0.036
Research	0.011	0.011	0.014	0.013	0.071	0.144
Medical service and health	0.014	0.014	0.014	0.012	-0.145	-0.061
Social security	0.028	0.028	0.027	0.026	-0.080	0.001
Other public services	0.020	0.020	0.019	0.018	-0.117	-0.033
Advertising, survey, information	0.013	0.013	0.013	0.011	-0.002	0.071
Goods renting and leasing	0.012	0.012	0.013	0.011	0.023	0.096
Car and machine repairing	0.012	0.012	0.012	0.011	-0.027	0.048
Other business services	0.008	0.008	0.008	0.006	0.053	0.127
Amusement and recreational	0.015	0.015	0.015	0.013	-0.133	-0.055
Eating and drinking places	0.008	0.008	0.008	0.007	-0.090	-0.040
Hotel and other lodging places	0.012	0.012	0.012	0.011	-0.097	-0.039
Other personal services	0.014	0.014	0.014	0.012	-0.146	-0.061
Not elsewhere classified	0.018	0.018	0.018	0.016	-0.023	0.059

(Table 5–8) Effect to Industries by Change of Consumers' Behavior (output prices)

	EPS	P3sig	Exogenous employment	Endogenous employment	Exogenous employment	Endogenous employment
	doubled	doubled	a3_s 1%	a3_s 1%	a3_s 10%	a3_s 10%
Crop cultivation	-0.004	-0.004	-0.004	-0.004	0.014	-0.007
Livestock raising, sericulture	-0.003	-0.003	-0.003	-0.002	0.013	-0.005
Agriculture services	0.001	0.001	0.001	0.002	0.020	-0.001
Forestry	0.005	0.005	0.005	0.005	0.024	0.002
Fisheries	-0.003	-0.003	-0.003	-0.002	0.015	-0.006
Metal ores	0.002	0.002	0.002	0.002	0.021	-0.001
Non-metal ores	-0.004	-0.004	-0.004	-0.004	0.014	-0.007
Coal and lignite	-0.006	-0.006	-0.006	-0.005	0.014	-0.009
Petroleum and natural gas	-0.012	-0.012	-0.012	-0.012	0.007	-0.015
Food product	-0.003	-0.003	-0.003	-0.003	0.014	-0.006
Beverages	-0.009	-0.009	-0.009	-0.009	0.009	-0.012
Feeds and organic fertilizers	-0.002	-0.002	-0.002	-0.002	0.010	-0.004
Tobacco	-0.012	-0.012	-0.012	-0.011	0.006	-0.015
Textile products	0.000	0.000	0.000	0.000	0.017	-0.003
Apparel, other textile products	-0.004	-0.004	-0.004	-0.003	0.014	-0.006
Timber and wooden products	0.001	0.001	0.001	0.002	0.017	-0.001
Furniture and fittings	-0.001	-0.001	-0.001	0.000	0.017	-0.003
Pulp and paper	-0.003	-0.003	-0.003	-0.003	0.013	-0.006
Paper products	-0.002	-0.002	-0.002	-0.001	0.017	-0.004
Publishing and printing	-0.006	-0.006	-0.006	-0.005	0.014	-0.008
Chemical fertilizers	-0.004	-0.004	-0.004	-0.004	0.013	-0.006
Inorganic chemical products	-0.003	-0.003	-0.003	-0.003	0.013	-0.006
Petrochemical basic products	-0.004	-0.004	-0.004	-0.004	0.010	-0.006
Synthetic resin	-0.004	-0.004	-0.004	-0.004	0.012	-0.006
Synthetic fibers	-0.003	-0.003	-0.003	-0.002	0.014	-0.005
Final chemical products	-0.011	-0.011	-0.011	-0.01	0.007	-0.013
Petroleum refinery products	-0.008	-0.008	-0.008	-0.007	0.001	-0.009
Coal products	-0.003	-0.003	-0.003	-0.003	0.008	-0.005
Plastic products	-0.003	-0.003	-0.003	-0.002	0.015	-0.005
Rubber products	-0.003	-0.003	-0.003	-0.003	0.014	-0.006
Leather, fur products	0.000	0.000	0.000	0.000	0.016	-0.003
Glass and glass products	-0.002	-0.002	-0.002	-0.001	0.016	-0.004
Cement and cement products	-0.002	-0.002	-0.002	-0.002	0.016	-0.005
Pottery, china, earthenware	0.001	0.001	0.001	0.002	0.020	-0.001
Ceramic, stone, clay products	-0.001	-0.001	-0.001	-0.001	0.017	-0.004
Pig iron and crude steel	-0.002	-0.002	-0.002	-0.002	0.012	-0.004
Steel products	-0.002	-0.002	-0.002	-0.002	0.014	-0.005
Steel castings, steel products	-0.001	-0.001	0.000	0.000	0.017	-0.003
Non-ferrous metals	-0.004	-0.004	-0.004	-0.004	0.007	-0.006
Non-ferrous metal products	-0.003	-0.003	-0.003	-0.002	0.010	-0.004
Metal products for construction	-0.003	-0.003	-0.003	-0.003	0.015	-0.006
Other metal products	0.000	0.000	0.000	0.001	0.019	-0.002
General industrial machinery	-0.002	-0.002	-0.002	-0.002	0.016	-0.005
Special industrial machinery	-0.002	-0.002	-0.002	-0.001	0.016	-0.004
Other general equipment	-0.002	-0.002	-0.002	-0.001	0.017	-0.005

(Table 5–8) Effect to Industries by Change of Consumers' Behavior (output prices)

	EPS	P3sig	Exogenous employment	Endogenous employment	Exogenous employment	Endogenous employment
	doubled	doubled	a3_s 1%	a3_s 1%	a3_s 10%	a3_s 10%
Machinery for office, services	-0.004	-0.004	-0.004	-0.003	0.014	-0.006
Household electric equipment	-0.004	-0.004	-0.004	-0.004	0.014	-0.007
Telecommunication equipment	-0.005	-0.005	-0.005	-0.005	0.012	-0.008
Heavy electrical equipment	-0.002	-0.002	-0.002	-0.002	0.016	-0.005
Other electrical equipment	-0.002	-0.002	-0.002	-0.001	0.016	-0.004
Motor vehicles	-0.002	-0.002	-0.002	-0.001	0.017	-0.004
Ships and repair of ships	-0.001	-0.001	-0.001	0.000	0.018	-0.003
Other transport equip., repair	-0.001	-0.001	-0.001	-0.001	0.015	-0.004
Precision instruments	-0.002	-0.002	-0.002	-0.002	0.016	-0.005
Other manufacturing products	-0.005	-0.005	-0.005	-0.005	0.013	-0.008
Construction	0.001	0.001	0.001	0.001	0.020	-0.002
Repair of construction	-0.013	-0.013	-0.013	-0.012	0.006	-0.015
Civil engineering	-0.004	-0.004	-0.004	-0.004	0.015	-0.007
Electric power for enterprise use	-0.006	-0.006	-0.006	-0.006	0.010	-0.008
Gas and heat supply	-0.009	-0.009	-0.009	-0.009	0.007	-0.012
Water supply	-0.006	-0.006	-0.006	-0.005	0.007	-0.008
Waste disposal services	0.004	0.004	0.004	0.005	0.025	0.001
Commerce	-0.013	-0.013	-0.013	-0.012	0.008	-0.016
Finance and insurance	-0.012	-0.012	-0.012	-0.012	0.008	-0.015
Real estate, rental services	-0.001	-0.001	-0.001	-0.001	0.018	-0.004
House rent	-0.003	-0.003	-0.003	-0.002	0.016	-0.005
Railway transport	-0.003	-0.003	-0.003	-0.002	0.017	-0.005
Road transport	0.003	0.003	0.003	0.003	0.023	0.000
Water transport	-0.006	-0.006	-0.006	-0.005	0.009	-0.008
Air transport	-0.010	-0.010	-0.010	-0.009	0.008	-0.012
Storage facility service	-0.004	-0.004	-0.004	-0.004	0.015	-0.007
Other transport services	-0.009	-0.009	-0.009	-0.008	0.011	-0.011
Communication	-1.036	-1.036	-1.036	-1.035	-1.015	-1.038
Broadcasting	-0.026	-0.026	-0.026	-0.026	-0.007	-0.029
Public administration	0.000	0.000	0.000	0.000	0.020	-0.003
Education	0.011	0.011	0.011	0.011	0.032	0.008
Research	-0.015	-0.015	-0.015	-0.015	0.005	-0.018
Medical service and health	0.000	0.000	0.000	0.000	0.019	-0.003
Social security	-0.007	-0.007	-0.007	-0.006	0.014	-0.009
Other public services	-0.011	-0.011	-0.011	-0.010	0.009	-0.014
Advertising, survey, information	-0.026	-0.026	-0.026	-0.025	-0.006	-0.028
Goods renting and leasing	-0.008	-0.008	-0.008	-0.007	0.011	-0.010
Car and machine repairing	-0.004	-0.004	-0.004	-0.004	0.015	-0.007
Other business services	-0.009	-0.009	-0.009	-0.008	0.011	-0.012
Amusement and recreational	-0.005	-0.005	-0.005	-0.005	0.014	-0.008
Eating and drinking places	-0.003	-0.003	-0.003	-0.003	0.016	-0.006
Hotel and other lodging places	-0.006	-0.006	-0.006	-0.006	0.013	-0.009
Other personal services	-0.003	-0.003	-0.003	-0.002	0.017	-0.006
Not elsewhere classified	-0.007	-0.007	-0.007	-0.006	0.012	-0.009

(Table 5–9) Effect to Industries by Change of Consumers' Behavior (consumption)

	EPS	P3sig	Exogenous employment	Endogenous employment	Exogenous employment	Endogenous employment
	doubled	doubled	a3_s 1%	a3_s 1%	a3_s 10%	a3_s 10%
Crop cultivation	0.005	0.005	-0.004	-0.005	-0.139	-0.114
Livestock raising, sericulture	0.010	0.010	0.006	0.004	-0.146	-0.092
Agriculture services	0.003	0.003	-0.006	-0.007	-0.142	-0.117
Forestry	0.013	0.013	0.013	0.011	-0.158	-0.072
Fisheries	0.007	0.007	-0.002	-0.003	-0.141	-0.110
Metal ores	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Non-metal ores	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Coal and lignite	0.014	0.014	0.013	0.011	-0.148	-0.076
Petroleum and natural gas	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Food product	0.007	0.008	0	-0.001	-0.142	-0.105
Beverages	0.017	0.017	0.014	0.013	-0.146	-0.077
Feeds and organic fertilizers	0.008	0.008	0.001	0.000	-0.141	-0.104
Tobacco	0.018	0.018	0.015	0.014	-0.145	-0.076
Textile products	0.012	0.012	0.008	0.006	-0.147	-0.087
Apparel, other textile products	0.014	0.014	0.010	0.009	-0.146	-0.084
Timber and wooden products	0.011	0.011	0.008	0.006	-0.146	-0.087
Furniture and fittings	0.017	0.017	0.017	0.015	-0.153	-0.068
Pulp and paper	0.018	0.018	0.018	0.016	-0.152	-0.067
Paper products	0.016	0.016	0.016	0.014	-0.155	-0.069
Publishing and printing	0.020	0.020	0.020	0.018	-0.152	-0.065
Chemical fertilizers	0.017	0.017	0.017	0.015	-0.153	-0.068
Inorganic chemical products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Petrochemical basic products	0.019	0.019	0.019	0.017	-0.147	-0.067
Synthetic resin	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Synthetic fibers	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Final chemical products	0.022	0.022	0.022	0.020	-0.148	-0.063
Petroleum refinery products	0.020	0.020	0.020	0.018	-0.145	-0.066
Coal products	0.015	0.015	0.015	0.013	-0.149	-0.071
Plastic products	0.018	0.018	0.018	0.016	-0.153	-0.067
Rubber products	0.018	0.018	0.018	0.016	-0.151	-0.067
Leather, fur products	0.016	0.016	0.016	0.014	-0.150	-0.069
Glass and glass products	0.019	0.019	0.019	0.017	-0.147	-0.067
Cement and cement products	0.016	0.016	0.016	0.014	-0.152	-0.069
Pottery, china, earthenware	0.016	0.016	0.016	0.014	-0.153	-0.069
Ceramic, stone, clay products	0.015	0.015	0.015	0.013	-0.155	-0.070
Pig iron and crude steel	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Steel products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Steel castings, steel products	0.012	0.012	0.011	0.010	-0.142	-0.076
Non-ferrous metals	0.015	0.015	0.015	0.013	-0.144	-0.071
Non-ferrous metal products	0.016	0.016	0.016	0.014	-0.150	-0.070
Metal products for construction	0.018	0.018	0.018	0.016	-0.153	-0.067
Other metal products	0.016	0.016	0.016	0.014	-0.154	-0.069
General industrial machinery	0.015	0.015	0.013	0.012	-0.150	-0.075
Special industrial machinery	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Other general equipment	0.016	0.016	0.015	0.013	-0.151	-0.073

(Table 5–9) Effect to Industries by Change of Consumers' Behavior (consumption)

	EPS	P3sig	Exogenous employment	Endogenous employment	Exogenous employment	Endogenous employment
	doubled	doubled	a3_s 1%	a3_s 1%	a3_s 10%	a3_s 10%
Machinery for office, services	0.016	0.016	0.014	0.012	-0.151	-0.074
Household electric equipment	0.017	0.017	0.015	0.013	-0.150	-0.073
Telecommunication equipment	0.034	0.023	1.016	1.014	9.835	9.920
Heavy electrical equipment	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Other electrical equipment	0.015	0.015	0.013	0.012	-0.152	-0.075
Motor vehicles	0.017	0.017	0.017	0.015	-0.153	-0.068
Ships and repair of ships	0.012	0.012	0.012	0.011	-0.145	-0.074
Other transport equip., repair	0.018	0.018	0.018	0.016	-0.152	-0.067
Precision instruments	0.015	0.015	0.014	0.012	-0.150	-0.074
Other manufacturing products	0.016	0.016	0.014	0.013	-0.147	-0.074
Construction	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Repair of construction	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Civil engineering	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Electric power for enterprise use	0.016	0.016	0.014	0.013	-0.149	-0.074
Gas and heat supply	0.019	0.019	0.017	0.016	-0.147	-0.071
Water supply	0.015	0.015	0.014	0.012	-0.147	-0.075
Waste disposal services	0.007	0.007	0.007	0.005	-0.165	-0.077
Commerce	0.024	0.024	0.024	0.022	-0.148	-0.061
Finance and insurance	0.023	0.023	0.023	0.021	-0.149	-0.062
Real estate, rental services	0.013	0.013	0.013	0.011	-0.159	-0.072
House rent	0.013	0.013	0.012	0.010	-0.155	-0.077
Railway transport	0.014	0.014	0.014	0.012	-0.157	-0.071
Road transport	0.009	0.009	0.009	0.007	-0.163	-0.076
Water transport	0.017	0.017	0.017	0.015	-0.149	-0.069
Air transport	0.016	0.016	0.016	0.014	-0.145	-0.070
Storage facility service	0.015	0.015	0.015	0.013	-0.155	-0.070
Other transport services	0.019	0.019	0.019	0.017	-0.151	-0.066
Communication	2.035	2.035	2.028	2.026	10.928	11.025
Broadcasting	0.037	0.037	0.037	0.035	-0.134	-0.048
Public administration	0.012	0.012	0.012	0.010	-0.161	-0.073
Education	0.001	0.001	0.001	-0.001	-0.172	-0.083
Research	0.026	0.026	0.026	0.024	-0.146	-0.059
Medical service and health	0.012	0.012	0.012	0.010	-0.159	-0.073
Social security	0.018	0.018	0.018	0.016	-0.155	-0.067
Other public services	0.022	0.022	0.022	0.020	-0.150	-0.063
Advertising, survey, information	0.036	0.036	0.036	0.034	-0.136	-0.049
Goods renting and leasing	0.019	0.019	0.019	0.017	-0.152	-0.066
Car and machine repairing	0.015	0.016	0.015	0.013	-0.155	-0.069
Other business services	0.020	0.020	0.020	0.018	-0.152	-0.065
Amusement and recreational	0.017	0.017	0.017	0.015	-0.154	-0.068
Eating and drinking places	0.014	0.014	0.014	0.012	-0.155	-0.071
Hotel and other lodging places	0.016	0.016	0.016	0.014	-0.151	-0.069
Other personal services	0.014	0.014	0.014	0.012	-0.158	-0.071
Not elsewhere classified	0.011	0.011	0.011	0.010	-0.141	-0.076

(Table 5–10) Effect to Industries by Change of Consumers' Behavior (employment)

	EPS	P3sig	Exogenous employment	Endogenous employment	Exogenous employment	Endogenous employment
	doubled	doubled	a3_s 1%	a3_s 1%	a3_s 10%	a3_s 10%
Crop cultivation	0.003	0.003	-0.003	-0.004	-0.131	-0.086
Livestock raising, sericulture	0.005	0.005	-0.001	-0.002	-0.132	-0.084
Agriculture services	0.006	0.006	0.000	-0.001	-0.130	-0.087
Forestry	0.011	0.011	0.010	0.008	-0.083	0.008
Fisheries	0.006	0.006	0.000	-0.001	-0.130	-0.083
Metal ores	0.012	0.012	0.014	0.010	-0.057	0.082
Non-metal ores	-0.001	-0.001	-0.001	-0.003	0.170	0.246
Coal and lignite	0.023	0.023	0.023	0.020	-0.044	0.079
Petroleum and natural gas	0.031	0.031	0.030	0.027	-0.092	0.013
Food product	-0.003	-0.003	-0.009	-0.010	-0.143	-0.097
Beverages	-0.002	-0.002	-0.004	-0.005	-0.138	-0.075
Feeds and organic fertilizers	-0.004	-0.004	-0.009	-0.010	-0.139	-0.090
Tobacco	0.006	0.006	0.003	0.002	-0.146	-0.078
Textile products	0.004	0.004	0.002	0.000	-0.113	-0.045
Apparel, other textile products	0.003	0.003	0.000	-0.001	-0.125	-0.058
Timber and wooden products	0.009	0.009	0.009	0.007	-0.053	0.027
Furniture and fittings	0.010	0.010	0.011	0.009	-0.050	0.024
Pulp and paper	-0.003	-0.003	-0.003	-0.005	-0.053	0.020
Paper products	0.000	0.000	-0.001	-0.003	-0.073	-0.008
Publishing and printing	0.001	0.001	0.001	0.000	-0.025	0.049
Chemical fertilizers	-0.009	-0.009	-0.014	-0.015	-0.128	-0.073
Inorganic chemical products	-0.004	-0.004	-0.004	-0.006	-0.068	0.004
Petrochemical basic products	-0.008	-0.008	-0.008	-0.009	-0.070	0.000
Synthetic resin	-0.005	-0.005	-0.005	-0.007	-0.051	0.020
Synthetic fibers	0.001	0.001	-0.001	-0.002	-0.097	-0.032
Final chemical products	-0.002	-0.002	-0.002	-0.004	-0.120	-0.042
Petroleum refinery products	-0.003	-0.003	-0.003	-0.005	-0.071	0.004
Coal products	-0.013	-0.013	-0.013	-0.014	0.030	0.104
Plastic products	-0.002	-0.002	-0.002	-0.003	-0.041	0.033
Rubber products	0.001	0.001	0.001	0.000	-0.047	0.029
Leather, fur products	0.000	0.000	0.000	-0.002	-0.119	-0.030
Glass and glass products	-0.003	-0.003	-0.002	-0.003	-0.036	0.037
Cement and cement products	-0.009	-0.009	-0.009	-0.011	0.121	0.196
Pottery, china, earthenware	0.001	0.001	0.002	0.000	-0.029	0.040
Ceramic, stone, clay products	-0.001	-0.001	-0.001	-0.003	-0.009	0.068
Pig iron and crude steel	-0.005	-0.005	-0.004	-0.006	-0.031	0.045
Steel products	-0.003	-0.003	-0.002	-0.004	-0.026	0.048
Steel castings, steel products	0.006	0.006	0.006	0.004	-0.030	0.046
Non-ferrous metals	0.000	0.000	0.001	-0.001	-0.021	0.066
Non-ferrous metal products	-0.003	-0.003	-0.002	-0.004	0.008	0.082
Metal products for construction	0.004	0.004	0.004	0.002	0.008	0.083
Other metal products	0.005	0.005	0.005	0.003	-0.039	0.033
General industrial machinery	0.008	0.008	0.008	0.006	-0.036	0.033
Special industrial machinery	0.006	0.006	0.006	0.004	-0.038	0.032
Other general equipment	0.012	0.012	0.012	0.011	-0.040	0.035

(Table 5–10) Effect to Industries by Change of Consumers' Behavior (employment)

	EPS	P3sig	Exogenous employment	Endogenous employment	Exogenous employment	Endogenous employment
	doubled	doubled	a3_s 1%	a3_s 1%	a3_s 10%	a3_s 10%
Machinery for office, services	0.008	0.008	0.008	0.007	-0.035	0.034
Household electric equipment	0.001	0.001	0.000	-0.001	-0.104	-0.031
Telecommunication equipment	-0.015	-0.015	-0.001	-0.003	0.272	0.345
Heavy electrical equipment	0.005	0.005	0.006	0.004	-0.003	0.068
Other electrical equipment	0.000	0.000	0.002	0.000	-0.027	0.052
Motor vehicles	0.006	0.006	0.006	0.004	-0.096	-0.001
Ships and repair of ships	0.005	0.005	0.005	0.003	-0.078	0.005
Other transport equip., repair	0.015	0.015	0.015	0.013	-0.060	0.030
Precision instruments	0.007	0.007	0.007	0.005	-0.068	0.005
Other manufacturing products	0.007	0.007	0.006	0.005	-0.061	0.010
Construction	0.010	0.010	0.010	0.008	-0.060	0.018
Repair of construction	-0.001	-0.001	-0.001	-0.003	-0.076	0.000
Civil engineering	-0.019	-0.019	-0.019	-0.021	0.259	0.332
Electric power for enterprise use	-0.013	-0.013	-0.014	-0.015	-0.074	0.002
Gas and heat supply	-0.003	-0.003	-0.004	-0.006	-0.126	-0.050
Water supply	-0.002	-0.002	-0.002	-0.005	-0.110	-0.021
Waste disposal services	0.016	0.016	0.016	0.014	-0.042	0.032
Commerce	0.005	0.005	0.005	0.004	-0.066	0.002
Finance and insurance	0.005	0.005	0.005	0.003	-0.084	-0.005
Real estate, rental services	-0.009	-0.009	-0.009	-0.011	-0.054	0.020
House rent	-0.014	-0.014	-0.015	-0.017	-0.185	-0.103
Railway transport	-0.007	-0.007	-0.007	-0.009	-0.113	-0.030
Road transport	0.005	0.005	0.005	0.003	-0.066	0.008
Water transport	0.000	0.000	0.000	-0.001	-0.040	0.012
Air transport	0.004	0.004	0.004	0.002	-0.034	0.044
Storage facility service	-0.001	-0.001	-0.002	-0.003	-0.050	0.019
Other transport services	-0.006	-0.006	-0.006	-0.008	-0.079	-0.005
Communication	-0.337	-0.337	-0.339	-0.341	2.656	2.737
Broadcasting	0.006	0.006	0.006	0.005	-0.047	0.030
Public administration	0.036	0.036	0.036	0.034	-0.010	0.065
Education	0.022	0.022	0.022	0.020	-0.046	0.033
Research	0.005	0.005	0.009	0.007	0.064	0.139
Medical service and health	0.006	0.006	0.006	0.004	-0.154	-0.068
Social security	0.026	0.026	0.025	0.024	-0.082	-0.001
Other public services	0.015	0.015	0.015	0.013	-0.122	-0.038
Advertising, survey, information	0.003	0.003	0.003	0.002	-0.013	0.061
Goods renting and leasing	-0.017	-0.017	-0.016	-0.018	-0.010	0.068
Car and machine repairing	0.001	0.001	0.002	0.000	-0.041	0.037
Other business services	-0.001	-0.001	-0.001	-0.003	0.043	0.118
Amusement and recreational	-0.003	-0.003	-0.003	-0.005	-0.154	-0.073
Eating and drinking places	-0.003	-0.003	-0.003	-0.004	-0.104	-0.052
Hotel and other lodging places	-0.002	-0.002	-0.002	-0.004	-0.113	-0.053
Other personal services	0.001	0.001	0.001	-0.001	-0.161	-0.074
Not elsewhere classified	-0.006	-0.006	-0.006	-0.008	-0.051	0.036

Chapter 6 Simulation 3 - Analysis of the Labor Market

1.Introduction

One argument used to oppose regulatory reform is the huge cost of adjustment. Some businesses may lose the significant profits they had earned under the regulated market as a result of excessive competition, drops in revenue, business bankruptcies, an increase in unemployment and/or pay cuts. There is especially a feeling of uneasiness that regulatory reform might raise unemployment.

The labor market is assumed to be in equilibrium with regard to supply and demand in the standard AGE model. Moreover, as it is a comparative static model, the process of adjusting both labor and wages can be implemented in a single stroke. Thus, we cannot see the interim process of adjustments being made.

However, we can make assumptions about the state of the different stages, ranging from short-term to long-term, by writing scenarios of the adjustment process, taking into consideration what mechanisms and processes would cause shocks instigated by regulatory reform to converge to a state of equilibrium. For this purpose, it is necessary during the stage of designing a model closure to take measures to swap the endogenous variables for exogenous ones. It is recognized that a scenario with exogenous variables for the prices of primary factors can be drawn up such as unemployment or new employment.

In the standard model, it is assumed that the supply and demand of labor is entirely flexible. However, they are not so flexible in reality. Nonetheless, even in the labor market, regulatory reform has been implemented. Fee-charging employment placement services, worker dispatch services, and other measures are also being taken to ensure smooth adjustments in the supply and demand of labor. Herein, it is also necessary to see how much of a difference in the speed of adjustment is reflected in the difference in economic effect.

2. Endogenous Total Employment

2.1 Demand for labor in the ORANI model

In a standard long-term closure, the variable of total employment “employ_i” is exogenous. Thus, under the condition of total employment being fixed, employment in each industry is allocated using the ultimate price adjustment mechanism so that the changes of wages in all industries remain uniform. However, in this closure, it was impossible to see how much aggregate employment is influenced by regulatory reform.

To see the effect on total employment, the closure needs to be amended by replacing exogenous variables with endogenous variables. Herein, it is necessary to give some presupposition to wages. In other words, when studying a change in total employment, total employment “employ_i” should be an endogenous variable, and variables concerning wages, such as real “Realwage” or nominal wages “p1lab_o(i)”, should be exogenous.

2.2 Model simulation

As we saw in Chapter 5, real wages would increase as productivity enhances as a result of regulatory reform, assuming no change in total employment. Accordingly, in case where real wages remain the same in spite of improvements in productivity, total employment would increase.

The effects on nominal wages are related to rises in productivity; thus, when total employment is fixed, nominal wages would sometimes increase and sometimes decrease. Therefore, when total employment is endogenous and nominal wages are exogenous, output prices would usually decrease and real wages would increase due to a rise of productivity. Subsequently, real wages would increase, so the effect on total employment depends on presuppositions, method of setting the disclosure, and other variables. In other words, when productivity rises, total employment would increase if real wages are fixed. But, if nominal wages are fixed, total employment would sometimes increase and sometimes decrease.

The simulations in this chapter analyze the case in which the productivity of labor only in "commerce" is assumed to increase with the implementation of regulatory reform. In Case (1), the output prices in each industry are endogenously determined while nominal wages are fixed. The shock we give to the model is a 2% rise in the labor productivity in the commercial sector with the preposition that labor productivity

is raised to reduce output prices in the commercial sector by around 1%.¹ As the output prices in each industrial sector are endogenously decided, those in other industries would change according to a fall in prices in the commercial sector. Case (1) in Table 6-1 shows the results of this simulation. If all industries, with nominal wages being stable, set their prices according to a fall in prices caused by an increase in productivity in the commercial sector, demand would expand due to the fall in prices and total employment would ultimately increase, resulting in an expansion of the Japanese economy.²

On the contrary, if total employment happened to decrease, it would mean that the price adjustment mechanism among industries is not functioning properly for some reason. Then, we will consider the second simulation as Case (2) in which nominal wages are constant but output prices only in the commercial sector decrease by 1% due to a labor productivity rise by 2%, while output (selling) prices in other industries do not change. In this case, there is a difference between the selling prices and costs in each industry, but it is assumed that the difference is appropriated as a profit in the model. Case (2) in Table 6-1 shows the results of this simulation.

**(Table 6-1) Effect on the Whole Japanese Economy
(Endogenous total employment)**

(%)

	Real GDP	Consump- tion	Invest-me nt	Consumer Prices	Employ-m ent	Real wages	Capital stock	Capital price
Case (1)	0.819	0.821	0.856	-0.343	0.488	0.344	0.793	-0.284
Case (2)	0.045	0.095	-0.062	-0.156	-0.199	0.157	-0.103	-0.080

Because the ripple effect of a price decline in the commercial sector has been intercepted to the other industries in Case (2), the decrease in consumer prices would be half of that in Case (1), the expansion in demand caused by the price fall would thus be smaller, and the change in total employment in Japan would be negative. In addition, in Case (2), the difference between the sales amount and costs is regarded as the profit. As such profits are not thrown into consumption and investment in this model, it should be noted that the shrinking effect due to the handling of profits is taken into

¹ When the increase in the labor productivity in the commercial sector is 1%, the sector would create a loss if its prices were decreased by 1%. Thus, it is necessary to further raise productivity. When the increase in productivity is 2%, the effect on the profit variables is almost zero.

² Productivity reform in the commercial sector has a significant effect in that it reduces consumer prices, as discussed in Chapter 4.

account.

Table 6-2 shows the effect on the commercial sector in each case. In that sector, output would increase and employment would decrease because of the 2% rise in labor productivity. When price adjustments function well among all industries, there would be a significant ripple effect from the other industries. Thus, the increase in output would be bigger and the decrease in employment smaller.³

(Table 6-2) Effect on the Reformed Industry (Commercial Sector)
(Endogenous total employment)

(%)

	Output	Output prices	Consumption	Employment	Nominal wages	Capital stock	Capital price
Case (1)	0.873	-1.123	1.735	-0.456	0.000	-1.362	-0.273
Case (2)	0.150	-1.000	0.949	-1.086	0.000	-2.335	-0.061

When regulatory reform is conducted in an industrial sector and its productivity rises, we have found that unemployment would occur if wages in each industry are fixed and the output prices in the other sectors are lacking in flexibility; in other words, the regulatory reform effect is blocked. Furthermore, if the effect of regulatory reform is not blocked within reformed industries while the other industries reflect price falls triggered by regulatory reform in their price system, there would be an entirely different effect on total employment.

3. Comparison of Labor Flexibility

3.1 Labor Market in the ORANI Model

In the ORANI model, it is presumed that the labor supply in each industry is provided so that the rate of change in wages among all industries would become uniform. Wages by industry and by occupation “p1lab(i,o)” are determined using shift parameters as follows:

$$p1lab(i,o) = p3tot + f1lab_io + f1lab_o(i) + f1lab_i(o) + f1lab(i,o)$$

³ The effect by each industry is shown in Table 6-5 at the end of this chapter.

Because the parameters "f1lab_o(i)", "f1lab_i(o)" and "f1lab(i,o)" are exogenous, the rates of increase in wages in all industries are uniformly decided. Labor demand in each industry "x1lab_o(i)" is determined as follows:

$$\begin{aligned} x1lab_o(i) &= a1lab_o(i) \\ &= x1prim(i) - SIGMA1PRIM(i) * [p1lab_o(i) + a1lab_o(i) - p1prim(i)] \\ V1LAB_IO * employ_i &= \sum\{i, IND, V1LAB_O(i) * x1lab_o(i)\} \end{aligned}$$

To put it briefly, what is assumed here is a perfectly flexible labor market in which adjustments in employment are implemented so as to converge to the same rate of changes in wages among all industries. However, the labor market is not so flexible in reality. Therefore, we can analyze a scenario of labor adjustment by amending the model in the following manner, but not by using adjustments resulting in uniform wage increases across all industries.

$$x1lab_o(i) = employ_i + ETRAEL * [p1lab_io - p1lab_o(i)]$$

"ETRAEL" is the price (wage) elasticity of labor supply. When a value of ETRAEL is large, adjustments in employment are made through changes in the amount of employment; when it is smaller, the adjustments are made through changes in wages.

3.2 Model simulation

As discussed above, the labor supply in this model is determined in such a way that wage increases become uniform in each industry, and a perfectly flexible labor market is thus assumed. However, the labor market is not so flexible in reality. Therefore, in this section, we are going to use a simulation to see the macroeconomic effect of changes implemented at different speeds with regard to adjustments in employment. In this simulation, we have changed the wage elasticity coefficient "ETRAEL" to see the difference. The shock in this simulation is a 1% increase in labor productivity in the commercial sector. The closure used is the standard long-term one.

Table 6-3 shows the effect on the whole Japanese economy when there are

changes in the flexibility of labor movement. The more flexible the labor market is, the stronger the effect of expanding real GDP, would be. As for the effect on the prices of commodities, it is apparent that the higher the flexibility is, the smaller the decline in consumer prices. The rate of increase in real wages is also smaller when the flexibility is higher.

(Table 6-3) Effect on the Whole Japanese Economy
(Changes in labor supply flexibility)

(%)

	Real GDP	Consumption	Investment	Consumer prices	Employment	Real wages	Capital stock	Capital price
ETRAEL = - 0.1	0.163	0.150	0.190	-0.197	0.000	0.259	0.144	-0.130
ETRAEL = - 0.5	0.166	0.156	0.190	-0.153	0.000	0.210	0.153	-0.101
ETRAEL = - 1	0.168	0.159	0.190	-0.135	0.000	0.200	0.158	-0.091
ETRAEL = - 10	0.170	0.164	0.189	-0.107	0.000	0.188	0.165	-0.076
ETRAEL = $-\infty$	0.171	0.165	0.189	-0.103	0.000	0.186	0.166	-0.073

Table 6-4 shows the effect on the commercial sector. Table 6-6 at the end of this chapter shows the differences in the effect on each industry. Now, when flexibility in the commercial sector gets larger, there are the following tendencies: (1) output decreases, (2) the decrease in output prices becomes smaller, (3) employment is reduced, and (4) wages increase. As for industries other than commerce, they can be divided into two groups: (1) industries with gradually larger increases in output and smaller decreases in product prices, and (2) industries with gradually smaller increases in output and larger decreases in product prices. However, a common feature to both of the groups is that the rate of increase in wages becomes roughly smaller and that of employment becomes roughly larger.⁴

⁴ The effects on each industry are shown in Table 6-6 at the end of the chapter.

(Table 6-4)Effect on Commercial Sector
(Changes in labor supply flexibility)

(%)

	Output	Output price	Consump- tion	Employ-m ent	Nominal wages	Capital stock	Capital price
ETRAEL = - 0.1	0.252	-0.942	0.916	-0.086	-0.793	-1.881	-0.123
ETRAEL = - 0.5	0.237	-0.744	0.769	-0.237	-0.418	-1.459	-0.093
ETRAEL = - 1	0.230	-0.654	0.701	-0.309	-0.245	-1.260	-0.082
ETRAEL = - 10	0.218	-0.509	0.589	-0.428	0.037	-0.932	-0.068
ETRAEL = - ∞	0.215	-0.485	0.571	-0.447	0.083	-0.879	-0.066

In conclusion, when the labor market is not flexible, "reformed industries" must reduce their wage levels if they are to implement adjustments through capital stocks instead of keeping employment, even though labor productivity is increased due to regulatory reform. On the contrary, industries other than the "reformed industries" are compelled to take measures to increase their capital stock so they can expand production. In other words, price adjustments are implemented in each industry; thus, quantity adjustments would not take place, which means inefficient resource distribution from the viewpoint of the whole economy.

(Table 6-5) Effect to industries (endogenous employment)

	Output	Output	Output	Output
			prices	prices
	Case 1	Case 2	Case 1	Case 2
Crop cultivation	0.575	0.090	-0.289	0
Livestock raising, sericulture	0.590	0.092	-0.248	0
Agriculture services	0.535	0.075	-0.219	0
Forestry	0.980	0.024	-0.179	0
Fisheries	0.579	0.094	-0.245	0
Metal ores	1.502	0.071	-0.169	0
Non-metal ores	0.850	-0.086	-0.232	0
Coal and lignite	1.188	0.023	-0.130	0
Petroleum and natural gas	1.098	0.029	-0.204	0
Food product	0.558	0.092	-0.271	0
Beverages	0.767	0.130	-0.282	0
Feeds and organic fertilizers	0.600	0.099	-0.211	0
Tobacco	0.891	0.169	-0.298	0
Textile products	0.891	0.198	-0.206	0
Apparel, other textile products	0.949	0.270	-0.264	0
Timber and wooden products	0.858	-0.063	-0.204	0
Furniture and fittings	0.746	-0.098	-0.220	0
Pulp and paper	0.850	0.085	-0.261	0
Paper products	0.768	0.096	-0.233	0
Publishing and printing	0.864	0.109	-0.208	0
Chemical fertilizers	0.646	0.087	-0.197	0
Inorganic chemical products	0.839	0.088	-0.199	0
Petrochemical basic products	0.823	0.102	-0.171	0
Synthetic resin	0.847	0.090	-0.188	0
Synthetic fibers	0.818	0.165	-0.191	0
Final chemical products	0.864	0.098	-0.205	0
Petroleum refinery products	0.888	0.105	-0.156	0
Coal products	0.852	0.004	-0.147	0
Plastic products	0.887	0.086	-0.224	0
Rubber products	0.947	0.122	-0.211	0
Leather, fur products	1.178	0.257	-0.228	0
Glass and glass products	0.850	0.057	-0.210	0
Cement and cement products	0.802	-0.100	-0.219	0
Pottery, china, earthenware	0.763	0.018	-0.197	0
Ceramic, stone, clay products	0.858	0.007	-0.205	0
Pig iron and crude steel	0.898	0.026	-0.198	0
Steel products	0.868	0.022	-0.217	0
Steel castings, steel products	0.925	0.043	-0.242	0
Non-ferrous metals	1.077	0.067	-0.170	0
Non-ferrous metal products	0.894	0.044	-0.172	0
Metal products for construction	0.783	-0.094	-0.209	0
Other metal products	0.843	0.044	-0.204	0
General industrial machinery	0.816	-0.001	-0.222	0
Special industrial machinery	0.934	0.121	-0.220	0
Other general equipment	1.039	0.117	-0.214	0

(Table 6–5) Effect to industries (endogenous employment)

	Output	Output	Output	Output
			prices	prices
	Case 1	Case 2	Case 1	Case 2
Machinery for office, services	0.736	–0.088	–0.270	0
Household electric equipment	0.951	0.214	–0.245	0
Telecommunication equipment	0.889	0.068	–0.225	0
Heavy electrical equipment	0.933	0.086	–0.225	0
Other electrical equipment	0.936	0.050	–0.218	0
Motor vehicles	1.184	0.110	–0.248	0
Ships and repair of ships	0.981	0.078	–0.231	0
Other transport equip., repair	1.043	0.104	–0.191	0
Precision instruments	0.933	0.151	–0.216	0
Other manufacturing products	0.878	0.128	–0.239	0
Construction	0.785	–0.123	–0.214	0
Repair of construction	0.808	0.027	–0.244	0
Civil engineering	0.814	–0.104	–0.211	0
Electric power for enterprise use	0.818	0.036	–0.194	0
Gas and heat supply	0.755	0.004	–0.178	0
Water supply	0.758	0.025	–0.142	0
Waste disposal services	0.793	0.056	–0.093	0
Commerce	0.873	0.150	–1.123	–1.000
Finance and insurance	0.801	0.026	–0.138	0
Real estate, rental services	0.828	0.070	–0.194	0
House rent	0.773	–0.018	–0.218	0
Railway transport	0.801	0.019	–0.142	0
Road transport	0.794	0.041	–0.113	0
Water transport	0.499	0.025	–0.117	0
Air transport	0.762	0.024	–0.144	0
Storage facility service	0.821	0.067	–0.156	0
Other transport services	0.759	0.031	–0.171	0
Communication	0.799	0.038	–0.136	0
Broadcasting	0.823	0.045	–0.178	0
Public administration	0.820	0.091	–0.080	0
Education	0.789	0.061	–0.074	0
Research	0.912	0.080	–0.152	0
Medical service and health	0.819	–0.011	–0.198	0
Social security	0.784	0.037	–0.112	0
Other public services	0.778	–0.007	–0.137	0
Advertising, survey, information	0.839	0.066	–0.173	0
Goods renting and leasing	0.852	0.029	–0.285	0
Car and machine repairing	0.838	0.023	–0.233	0
Other business services	0.841	0.028	–0.152	0
Amusement and recreational	0.780	–0.014	–0.217	0
Eating and drinking places	0.506	–0.012	–0.233	0
Hotel and other lodging places	0.558	–0.012	–0.206	0
Other personal services	0.804	–0.014	–0.178	0
Not elsewhere classified	0.951	0.032	–0.232	0

(Table 6–5) Effect to industries (endogenous employment)

	Employment	Employment	Profit	Profit
	Case 1	Case 2	Case 1	Case 2
Crop cultivation	0.509	0.072	0	0.090
Livestock raising, sericulture	0.529	0.075	0	0.046
Agriculture services	0.500	0.060	0	0.087
Forestry	0.956	0.014	0	0.046
Fisheries	0.539	0.080	0	0.088
Metal ores	1.483	0.064	0	0.047
Non-metal ores	0.815	–0.097	0	0.048
Coal and lignite	1.175	0.020	0	0.021
Petroleum and natural gas	1.059	0.017	0	0.055
Food product	0.399	0.030	0	0.090
Beverages	0.532	0.032	0	0.104
Feeds and organic fertilizers	0.414	0.022	0	0.087
Tobacco	0.702	0.092	0	0.119
Textile products	0.786	0.162	0	0.069
Apparel, other textile products	0.823	0.232	0	0.129
Timber and wooden products	0.733	–0.105	0	0.085
Furniture and fittings	0.616	–0.146	0	0.081
Pulp and paper	0.664	0.039	0	0.099
Paper products	0.621	0.054	0	0.065
Publishing and printing	0.715	0.043	0	0.065
Chemical fertilizers	0.429	0.027	0	0.045
Inorganic chemical products	0.631	0.024	0	0.052
Petrochemical basic products	0.597	0.051	0	0.032
Synthetic resin	0.644	0.040	0	0.034
Synthetic fibers	0.693	0.129	0	0.056
Final chemical products	0.664	0.048	0	0.054
Petroleum refinery products	0.657	0.024	0	0.071
Coal products	0.646	–0.021	0	0.049
Plastic products	0.678	0.006	0	0.064
Rubber products	0.765	0.051	0	0.071
Leather, fur products	0.993	0.174	0	0.100
Glass and glass products	0.644	–0.004	0	0.059
Cement and cement products	0.639	–0.150	0	0.059
Pottery, china, earthenware	0.620	–0.033	0	0.071
Ceramic, stone, clay products	0.706	–0.034	0	0.064
Pig iron and crude steel	0.681	–0.012	0	0.046
Steel products	0.676	–0.019	0	0.038
Steel castings, steel products	0.781	0.001	0	0.086
Non-ferrous metals	0.871	0.006	0	0.076
Non-ferrous metal products	0.720	0.006	0	0.060
Metal products for construction	0.624	–0.156	0	0.058
Other metal products	0.691	–0.019	0	0.064
General industrial machinery	0.649	–0.077	0	0.069
Special industrial machinery	0.750	0.027	0	0.071
Other general equipment	0.866	0.042	0	0.070

(Table 6–5) Effect to industries (endogenous employment)

	Employment	Employment	Profit	Profit
	Case 1	Case 2	Case 1	Case 2
Machinery for office, services	0.555	–0.176	0	0.100
Household electric equipment	0.762	0.131	0	0.076
Telecommunication equipment	0.681	–0.019	0	0.064
Heavy electrical equipment	0.746	0.003	0	0.075
Other electrical equipment	0.751	–0.023	0	0.071
Motor vehicles	1.041	0.060	0	0.057
Ships and repair of ships	0.867	0.032	0	0.078
Other transport equip., repair	0.943	0.047	0	0.053
Precision instruments	0.769	0.065	0	0.080
Other manufacturing products	0.722	0.062	0	0.089
Construction	0.622	–0.172	0	0.074
Repair of construction	0.624	–0.036	0	0.089
Civil engineering	0.672	–0.149	0	0.068
Electric power for enterprise use	0.564	–0.009	0	0.043
Gas and heat supply	0.525	–0.068	0	0.051
Water supply	0.644	–0.075	0	0.058
Waste disposal services	0.719	0.038	0	0.025
Commerce	–0.456	–1.086	0	0.029
Finance and insurance	0.670	–0.010	0	0.030
Real estate, rental services	0.612	0.045	0	0.035
House rent	0.501	–0.022	0	0.014
Railway transport	0.609	–0.005	0	0.000
Road transport	0.715	0.011	0	0.038
Water transport	0.358	–0.009	0	0.027
Air transport	0.643	–0.017	0	0.026
Storage facility service	0.646	0.007	0	0.036
Other transport services	0.554	–0.003	0	0.035
Communication	0.616	–0.001	0	0.029
Broadcasting	0.676	–0.012	0	0.037
Public administration	0.815	0.087	0	0.019
Education	0.746	0.042	0	0.022
Research	0.830	0.047	0	0.045
Medical service and health	0.701	–0.065	0	0.086
Social security	0.757	0.027	0	0.038
Other public services	0.708	–0.038	0	0.047
Advertising, survey, information	0.692	0.001	0	0.037
Goods renting and leasing	0.445	–0.151	0	0.102
Car and machine repairing	0.694	–0.054	0	0.092
Other business services	0.710	–0.029	0	0.050
Amusement and recreational	0.548	–0.081	0	0.062
Eating and drinking places	0.361	–0.050	0	0.093
Hotel and other lodging places	0.397	–0.037	0	0.066
Other personal services	0.634	–0.067	0	0.054
Not elsewhere classified	0.705	0.031	0	0.051

(Note) profitslack means the ratio of profit (loss) to total sales.

(Table 6-6) Effect to industries (Change of flexibility in labor market)

	Output	Output	Output	Output prices	Output prices	Output prices
	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞
Crop cultivation	0.168	0.150	0.138	-0.113	-0.090	-0.075
Livestock raising, sericulture	0.160	0.149	0.139	-0.082	-0.075	-0.064
Agriculture services	0.135	0.131	0.124	0.096	-0.027	-0.038
Forestry	0.076	0.151	0.186	0.095	0.021	-0.015
Fisheries	0.143	0.145	0.136	0.011	-0.051	-0.054
Metal ores	0.068	0.184	0.288	0.100	0.038	-0.012
Non-metal ores	0.136	0.163	0.174	0.002	-0.042	-0.047
Coal and lignite	0.043	0.120	0.184	0.084	0.044	0.009
Petroleum and natural gas	0.110	0.169	0.199	0.016	-0.015	-0.030
Food product	0.155	0.143	0.132	-0.110	-0.088	-0.070
Beverages	0.216	0.195	0.181	-0.130	-0.093	-0.073
Feeds and organic fertilizers	0.169	0.155	0.143	-0.104	-0.077	-0.060
Tobacco	0.276	0.243	0.222	-0.142	-0.103	-0.082
Textile products	0.230	0.230	0.223	0.015	-0.023	-0.039
Apparel, other textile products	0.304	0.277	0.255	-0.025	-0.054	-0.065
Timber and wooden products	0.140	0.157	0.167	-0.048	-0.042	-0.042
Furniture and fittings	0.094	0.119	0.135	-0.084	-0.052	-0.042
Pulp and paper	0.211	0.199	0.191	-0.121	-0.087	-0.070
Paper products	0.190	0.181	0.174	-0.064	-0.052	-0.047
Publishing and printing	0.199	0.194	0.191	-0.013	-0.025	-0.032
Chemical fertilizers	0.177	0.161	0.149	-0.057	-0.044	-0.036
Inorganic chemical products	0.210	0.196	0.188	-0.055	-0.043	-0.038
Petrochemical basic products	0.217	0.199	0.188	-0.044	-0.036	-0.032
Synthetic resin	0.214	0.202	0.194	-0.045	-0.037	-0.033
Synthetic fibers	0.209	0.206	0.199	-0.019	-0.028	-0.033
Final chemical products	0.187	0.182	0.181	-0.043	-0.038	-0.035
Petroleum refinery products	0.224	0.211	0.203	-0.083	-0.057	-0.044
Coal products	0.202	0.194	0.190	-0.057	-0.040	-0.033
Plastic products	0.219	0.210	0.205	-0.059	-0.049	-0.045
Rubber products	0.249	0.235	0.227	-0.030	-0.036	-0.039
Leather, fur products	0.323	0.309	0.299	-0.032	-0.045	-0.054
Glass and glass products	0.201	0.193	0.189	-0.051	-0.041	-0.037
Cement and cement products	0.124	0.147	0.159	-0.063	-0.046	-0.040
Pottery, china, earthenware	0.158	0.158	0.157	-0.032	-0.029	-0.028
Ceramic, stone, clay products	0.178	0.180	0.182	-0.040	-0.035	-0.034
Pig iron and crude steel	0.236	0.215	0.205	-0.081	-0.056	-0.046
Steel products	0.221	0.205	0.197	-0.081	-0.057	-0.048
Steel castings, steel products	0.229	0.221	0.216	-0.068	-0.058	-0.054
Non-ferrous metals	0.306	0.274	0.258	-0.062	-0.049	-0.044
Non-ferrous metal products	0.223	0.213	0.208	-0.053	-0.042	-0.038
Metal products for construction	0.111	0.136	0.149	-0.073	-0.044	-0.036
Other metal products	0.198	0.193	0.189	-0.023	-0.028	-0.032
General industrial machinery	0.214	0.198	0.189	-0.044	-0.044	-0.043
Special industrial machinery	0.334	0.283	0.251	-0.018	-0.036	-0.043
Other general equipment	0.348	0.305	0.275	0.036	-0.014	-0.036

(Table 6-6) Effect to industries (Change of flexibility in labor market)

	Output	Output	Output	Output prices	Output prices	Output prices
	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞
Machinery for office, services	0.148	0.150	0.152	-0.114	-0.084	-0.067
Household electric equipment	0.296	0.267	0.246	-0.049	-0.054	-0.055
Telecommunication equipment	0.253	0.233	0.217	-0.045	-0.047	-0.046
Heavy electrical equipment	0.291	0.260	0.238	-0.019	-0.037	-0.044
Other electrical equipment	0.216	0.212	0.212	-0.050	-0.044	-0.043
Motor vehicles	0.276	0.278	0.285	-0.035	-0.046	-0.055
Ships and repair of ships	0.196	0.210	0.220	-0.024	-0.037	-0.045
Other transport equip., repair	0.233	0.239	0.242	-0.002	-0.022	-0.034
Precision instruments	0.263	0.248	0.235	-0.008	-0.029	-0.040
Other manufacturing products	0.243	0.225	0.212	-0.051	-0.053	-0.053
Construction	0.092	0.125	0.142	-0.090	-0.048	-0.036
Repair of construction	0.138	0.150	0.158	-0.102	-0.065	-0.051
Civil engineering	0.139	0.159	0.169	-0.056	-0.036	-0.034
Electric power for enterprise use	0.152	0.162	0.167	-0.066	-0.044	-0.036
Gas and heat supply	0.098	0.120	0.134	-0.067	-0.039	-0.027
Water supply	0.115	0.131	0.141	-0.066	-0.035	-0.022
Waste disposal services	0.123	0.142	0.152	0.134	0.066	0.031
Commerce	0.252	0.230	0.215	-0.942	-0.654	-0.485
Finance and insurance	0.117	0.133	0.146	-0.005	0.011	0.007
Real estate, rental services	0.181	0.179	0.178	-0.060	-0.031	-0.024
House rent	0.081	0.107	0.127	-0.089	-0.050	-0.038
Railway transport	0.091	0.117	0.135	-0.016	0.002	0.002
Road transport	0.115	0.142	0.156	0.093	0.047	0.019
Water transport	0.103	0.093	0.084	-0.020	-0.011	-0.004
Air transport	0.106	0.118	0.129	-0.020	-0.009	-0.007
Storage facility service	0.199	0.192	0.187	0.011	0.005	-0.004
Other transport services	0.129	0.136	0.141	-0.043	-0.020	-0.012
Communication	0.121	0.137	0.147	-0.011	0.007	0.008
Broadcasting	0.144	0.156	0.163	-0.032	-0.018	-0.016
Public administration	0.132	0.155	0.163	0.679	0.119	0.037
Education	0.068	0.111	0.136	0.146	0.082	0.042
Research	0.228	0.219	0.212	0.199	0.046	-0.001
Medical service and health	0.083	0.108	0.130	-0.077	-0.037	-0.027
Social security	0.043	0.092	0.124	0.070	0.046	0.021
Other public services	0.054	0.084	0.112	-0.016	0.010	0.007
Advertising, survey, information	0.178	0.178	0.178	0.009	-0.003	-0.012
Goods renting and leasing	0.176	0.180	0.182	-0.134	-0.093	-0.071
Car and machine repairing	0.150	0.164	0.171	-0.071	-0.051	-0.046
Other business services	0.165	0.172	0.176	0.042	0.017	-0.001
Amusement and recreational	0.100	0.117	0.130	-0.102	-0.056	-0.037
Eating and drinking places	0.077	0.083	0.086	-0.125	-0.072	-0.046
Hotel and other lodging places	0.080	0.085	0.089	-0.096	-0.053	-0.032
Other personal services	0.085	0.103	0.120	-0.077	-0.031	-0.015
Not elsewhere classified	0.207	0.208	0.200	-0.051	-0.053	-0.047

(Table 6-6) Effect to industries (Change of flexibility in labor market)

	Employment	Employment	Employment	Nominal	Nominal	Nominal
	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞	wage	wage	wage
	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞
Crop cultivation	0.038	0.094	0.102	0.447	0.158	0.083
Livestock raising, sericulture	0.041	0.096	0.105	0.468	0.160	0.083
Agriculture services	0.057	0.102	0.105	0.637	0.166	0.083
Forestry	0.035	0.128	0.173	0.415	0.193	0.083
Fisheries	0.053	0.110	0.115	0.597	0.174	0.083
Metal ores	0.037	0.166	0.278	0.430	0.230	0.083
Non-metal ores	0.054	0.130	0.155	0.599	0.194	0.083
Coal and lignite	0.023	0.108	0.177	0.291	0.172	0.083
Petroleum and natural gas	0.037	0.131	0.178	0.430	0.195	0.083
Food product	0.009	0.038	0.047	0.151	0.102	0.083
Beverages	0.007	0.038	0.056	0.130	0.102	0.083
Feeds and organic fertilizers	0.007	0.034	0.044	0.130	0.098	0.083
Tobacco	0.024	0.091	0.122	0.297	0.155	0.083
Textile products	0.037	0.130	0.166	0.434	0.194	0.083
Apparel, other textile products	0.041	0.146	0.186	0.478	0.210	0.083
Timber and wooden products	0.012	0.065	0.101	0.185	0.130	0.083
Furniture and fittings	0.001	0.032	0.061	0.070	0.096	0.083
Pulp and paper	0.012	0.061	0.091	0.182	0.125	0.083
Paper products	0.016	0.070	0.096	0.227	0.134	0.083
Publishing and printing	0.020	0.080	0.112	0.263	0.145	0.083
Chemical fertilizers	0.005	0.027	0.032	0.109	0.091	0.083
Inorganic chemical products	0.010	0.051	0.076	0.160	0.115	0.083
Petrochemical basic products	0.008	0.045	0.066	0.147	0.109	0.083
Synthetic resin	0.011	0.056	0.085	0.168	0.120	0.083
Synthetic fibers	0.025	0.098	0.132	0.309	0.163	0.083
Final chemical products	0.008	0.046	0.073	0.139	0.110	0.083
Petroleum refinery products	0.009	0.051	0.079	0.153	0.115	0.083
Coal products	0.008	0.049	0.078	0.144	0.113	0.083
Plastic products	0.014	0.063	0.094	0.199	0.127	0.083
Rubber products	0.021	0.090	0.130	0.273	0.154	0.083
Leather, fur products	0.033	0.138	0.200	0.396	0.202	0.083
Glass and glass products	0.010	0.051	0.078	0.160	0.115	0.083
Cement and cement products	0.003	0.040	0.072	0.095	0.104	0.083
Pottery, china, earthenware	0.012	0.056	0.080	0.181	0.120	0.083
Ceramic, stone, clay products	0.013	0.066	0.100	0.193	0.130	0.083
Pig iron and crude steel	0.010	0.055	0.087	0.162	0.119	0.083
Steel products	0.012	0.061	0.093	0.181	0.125	0.083
Steel castings, steel products	0.024	0.098	0.139	0.299	0.162	0.083
Non-ferrous metals	0.022	0.098	0.148	0.285	0.162	0.083
Non-ferrous metal products	0.016	0.075	0.114	0.219	0.140	0.083
Metal products for construction	0.001	0.034	0.064	0.073	0.098	0.083
Other metal products	0.018	0.076	0.108	0.245	0.141	0.083
General industrial machinery	0.016	0.067	0.094	0.220	0.131	0.083
Special industrial machinery	0.027	0.105	0.141	0.336	0.169	0.083
Other general equipment	0.040	0.141	0.182	0.467	0.206	0.083

(Table 6-6) Effect to industries (Change of flexibility in labor market)

	Employment	Employment	Employment	Nominal	Nominal	Nominal
				wage	wage	wage
	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞	ETRAEL= 0.1	ETRAEL= 1	ETRAEL=∞
Machinery for office, services	0.003	0.027	0.048	0.088	0.091	0.083
Household electric equipment	0.025	0.102	0.141	0.315	0.166	0.083
Telecommunication equipment	0.013	0.065	0.098	0.191	0.129	0.083
Heavy electrical equipment	0.027	0.102	0.137	0.328	0.166	0.083
Other electrical equipment	0.015	0.072	0.113	0.211	0.137	0.083
Motor vehicles	0.030	0.133	0.204	0.367	0.197	0.083
Ships and repair of ships	0.027	0.108	0.157	0.330	0.172	0.083
Other transport equip., repair	0.027	0.117	0.173	0.337	0.181	0.083
Precision instruments	0.025	0.102	0.142	0.314	0.167	0.083
Other manufacturing products	0.024	0.094	0.126	0.304	0.158	0.083
Construction	-0.002	0.025	0.054	0.039	0.089	0.083
Repair of construction	0.002	0.032	0.059	0.085	0.096	0.083
Civil engineering	0.008	0.057	0.094	0.145	0.121	0.083
Electric power for enterprise use	0.000	0.017	0.029	0.065	0.081	0.083
Gas and heat supply	-0.006	-0.001	0.010	0.002	0.063	0.083
Water supply	-0.003	0.008	0.027	0.030	0.073	0.083
Waste disposal services	0.021	0.082	0.112	0.269	0.146	0.083
Commerce	-0.086	-0.309	-0.447	-0.793	-0.245	0.083
Finance and insurance	0.005	0.042	0.075	0.107	0.106	0.083
Real estate, rental services	0.004	0.035	0.060	0.100	0.100	0.083
House rent	-0.008	-0.015	-0.022	-0.017	0.049	0.083
Railway transport	-0.003	0.012	0.031	0.035	0.076	0.083
Road transport	0.019	0.080	0.114	0.252	0.145	0.083
Water transport	0.003	0.014	0.008	0.096	0.078	0.083
Air transport	0.006	0.039	0.063	0.126	0.103	0.083
Storage facility service	0.013	0.063	0.093	0.192	0.127	0.083
Other transport services	0.000	0.017	0.030	0.065	0.081	0.083
Communication	0.001	0.025	0.048	0.074	0.089	0.083
Broadcasting	0.009	0.053	0.084	0.150	0.117	0.083
Public administration	0.099	0.146	0.159	1.056	0.211	0.083
Education	0.018	0.078	0.113	0.239	0.142	0.083
Research	0.052	0.141	0.169	0.587	0.206	0.083
Medical service and health	0.000	0.032	0.067	0.065	0.096	0.083
Social security	0.014	0.071	0.109	0.198	0.135	0.083
Other public services	0.002	0.038	0.075	0.082	0.102	0.083
Advertising, survey, information	0.016	0.070	0.101	0.221	0.134	0.083
Goods renting and leasing	-0.009	-0.023	-0.035	-0.024	0.041	0.083
Car and machine repairing	0.007	0.052	0.087	0.133	0.116	0.083
Other business services	0.017	0.074	0.106	0.231	0.138	0.083
Amusement and recreational	-0.007	-0.005	0.005	-0.007	0.059	0.083
Eating and drinking places	-0.004	0.002	0.008	0.020	0.066	0.083
Hotel and other lodging places	-0.004	0.000	0.001	0.019	0.064	0.083
Other personal services	-0.005	0.008	0.030	0.015	0.072	0.083
Not elsewhere classified	0.003	0.038	0.065	0.093	0.102	0.083

(Table 6-6) Effect to industries (Change of flexibility in labor market)

	Capital stock ETRAEL= 0.1	Capital stock ETRAEL= 1	Capital stock ETRAEL=∞	Capital price ETRAEL= 0.1	Capital price ETRAEL= 1	Capital price ETRAEL=∞
Crop cultivation	0.173	0.153	0.139	-0.120	-0.088	-0.074
Livestock raising, sericulture	0.183	0.159	0.145	-0.134	-0.105	-0.087
Agriculture services	0.252	0.175	0.151	-0.186	-0.140	-0.114
Forestry	0.151	0.192	0.210	-0.164	-0.123	-0.102
Fisheries	0.202	0.168	0.150	-0.146	-0.113	-0.095
Metal ores	0.156	0.237	0.316	-0.167	-0.127	-0.105
Non-metal ores	0.201	0.189	0.188	-0.140	-0.100	-0.082
Coal and lignite	0.105	0.159	0.206	-0.121	-0.081	-0.064
Petroleum and natural gas	0.140	0.184	0.207	-0.084	-0.071	-0.064
Food product	0.359	0.287	0.250	-0.161	-0.120	-0.098
Beverages	0.381	0.318	0.279	-0.203	-0.147	-0.116
Feeds and organic fertilizers	0.353	0.292	0.256	-0.179	-0.132	-0.106
Tobacco	0.573	0.422	0.340	-0.192	-0.140	-0.111
Textile products	0.764	0.507	0.379	-0.141	-0.105	-0.086
Apparel, other textile products	0.802	0.525	0.385	-0.124	-0.090	-0.075
Timber and wooden products	0.420	0.359	0.314	-0.138	-0.103	-0.086
Furniture and fittings	0.269	0.283	0.273	-0.142	-0.104	-0.085
Pulp and paper	0.388	0.321	0.280	-0.116	-0.082	-0.067
Paper products	0.457	0.352	0.295	-0.122	-0.090	-0.075
Publishing and printing	0.583	0.440	0.361	-0.183	-0.140	-0.115
Chemical fertilizers	0.289	0.247	0.224	-0.116	-0.084	-0.070
Inorganic chemical products	0.369	0.311	0.277	-0.125	-0.092	-0.077
Petrochemical basic products	0.315	0.271	0.245	-0.097	-0.070	-0.059
Synthetic resin	0.352	0.300	0.268	-0.103	-0.074	-0.063
Synthetic fibers	0.553	0.407	0.323	-0.110	-0.082	-0.069
Final chemical products	0.319	0.282	0.260	-0.108	-0.078	-0.065
Petroleum refinery products	0.385	0.332	0.296	-0.145	-0.108	-0.089
Coal products	0.294	0.263	0.244	-0.082	-0.056	-0.049
Plastic products	0.426	0.359	0.317	-0.128	-0.107	-0.094
Rubber products	0.559	0.433	0.359	-0.153	-0.118	-0.099
Leather, fur products	0.764	0.569	0.449	-0.182	-0.139	-0.114
Glass and glass products	0.357	0.309	0.279	-0.115	-0.089	-0.076
Cement and cement products	0.284	0.289	0.275	-0.127	-0.094	-0.079
Pottery, china, earthenware	0.425	0.344	0.297	-0.147	-0.109	-0.090
Ceramic, stone, clay products	0.402	0.336	0.293	-0.115	-0.084	-0.070
Pig iron and crude steel	0.346	0.293	0.262	-0.104	-0.069	-0.056
Steel products	0.375	0.311	0.273	-0.106	-0.073	-0.060
Steel castings, steel products	0.564	0.421	0.342	-0.129	-0.094	-0.078
Non-ferrous metals	0.543	0.421	0.350	-0.128	-0.094	-0.078
Non-ferrous metal products	0.416	0.342	0.296	-0.099	-0.072	-0.061
Metal products for construction	0.298	0.309	0.293	-0.162	-0.120	-0.098
Other metal products	0.537	0.413	0.343	-0.166	-0.126	-0.103
General industrial machinery	0.503	0.389	0.326	-0.165	-0.125	-0.101
Special industrial machinery	0.661	0.472	0.368	-0.166	-0.122	-0.098
Other general equipment	0.849	0.569	0.425	-0.173	-0.133	-0.109

(Table 6–6) Effect to industries (Change of flexibility in labor market)

	Capital stock ETRAEL= 0.1	Capital stock ETRAEL= 1	Capital stock ETRAEL=∞	Capital price ETRAEL= 0.1	Capital price ETRAEL= 1	Capital price ETRAEL=∞
Machinery for office, services	0.325	0.300	0.280	-0.167	-0.125	-0.101
Household electric equipment	0.622	0.466	0.372	-0.158	-0.122	-0.101
Telecommunication equipment	0.445	0.366	0.313	-0.151	-0.109	-0.088
Heavy electrical equipment	0.660	0.480	0.380	-0.174	-0.134	-0.110
Other electrical equipment	0.484	0.399	0.345	-0.161	-0.122	-0.100
Motor vehicles	0.651	0.500	0.407	-0.124	-0.093	-0.077
Ships and repair of ships	0.644	0.477	0.384	-0.159	-0.119	-0.097
Other transport equip., repair	0.625	0.470	0.375	-0.136	-0.099	-0.077
Precision instruments	0.668	0.496	0.394	-0.194	-0.145	-0.116
Other manufacturing products	0.617	0.450	0.359	-0.166	-0.124	-0.101
Construction	0.241	0.283	0.280	-0.134	-0.095	-0.079
Repair of construction	0.326	0.314	0.296	-0.146	-0.105	-0.086
Civil engineering	0.409	0.369	0.326	-0.141	-0.101	-0.083
Electric power for enterprise use	0.192	0.199	0.203	-0.087	-0.063	-0.055
Gas and heat supply	0.164	0.198	0.214	-0.133	-0.095	-0.079
Water supply	0.183	0.203	0.208	-0.118	-0.082	-0.061
Waste disposal services	0.676	0.468	0.367	-0.120	-0.084	-0.069
Commerce	-1.881	-1.260	-0.879	-0.123	-0.082	-0.066
Finance and insurance	0.323	0.299	0.275	-0.145	-0.097	-0.076
Real estate, rental services	0.254	0.238	0.226	-0.098	-0.061	-0.049
House rent	0.082	0.108	0.129	-0.089	-0.049	-0.037
Railway transport	0.147	0.179	0.197	-0.083	-0.057	-0.049
Road transport	0.726	0.532	0.424	-0.168	-0.123	-0.102
Water transport	0.337	0.278	0.264	-0.102	-0.079	-0.069
Air transport	0.423	0.371	0.338	-0.122	-0.093	-0.081
Storage facility service	0.575	0.453	0.377	-0.142	-0.104	-0.086
Other transport services	0.269	0.264	0.261	-0.095	-0.065	-0.055
Communication	0.291	0.296	0.289	-0.099	-0.071	-0.061
Broadcasting	0.409	0.356	0.316	-0.167	-0.124	-0.101
Public administration	1.621	0.542	0.359	-0.147	-0.102	-0.076
Education	0.574	0.442	0.366	-0.201	-0.146	-0.118
Research	1.027	0.570	0.410	-0.184	-0.134	-0.109
Medical service and health	0.333	0.336	0.319	-0.198	-0.145	-0.117
Social security	0.476	0.393	0.335	-0.168	-0.119	-0.097
Other public services	0.354	0.351	0.328	-0.197	-0.145	-0.118
Advertising, survey, information	0.558	0.432	0.360	-0.208	-0.152	-0.122
Goods renting and leasing	0.207	0.214	0.218	-0.195	-0.147	-0.118
Car and machine repairing	0.559	0.483	0.412	-0.195	-0.140	-0.110
Other business services	0.555	0.430	0.358	-0.195	-0.144	-0.117
Amusement and recreational	0.169	0.196	0.211	-0.146	-0.101	-0.080
Eating and drinking places	0.271	0.275	0.274	-0.143	-0.096	-0.075
Hotel and other lodging places	0.219	0.226	0.233	-0.114	-0.071	-0.055
Other personal services	0.202	0.229	0.240	-0.149	-0.104	-0.084
Not elsewhere classified	0.230	0.227	0.215	-0.087	-0.048	-0.036

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(Appendix 1) The variables of the ORANI-G model

set

COM	Commodities
SRC	Source of commodities
IND	Industries
OCC	Occupation types; skilled,unskilled
MAR	Margin commodities
NONMAR	Non-margin commodities
TRADEXP	Traditional export commodities
NTRADEXP	Nontraditional Export Commodities
EXOINV	'exogenous' investment industries
ENDOINV	'endogenous' investment industries

Variables (rates)

Basic demand for commodities

x1(c,s,i)	Intermediate basic demands
x2(c,s,i)	Investment basic demands
x3(c,s)	Household basic demands
x4(c)	Export basic demands
x5(c,s)	Government basic demands
delx6(c,s)	Inventories demands
p0(c,s)	Basic prices by commodity and source

Technical or taste change affecting basic demands

a1(c,s,i)	Intermediate basic tech change
a2(c,s,i)	Investment basic tech change
a3(c,s)	Household basic taste change
f5(c,s)	Government demand shift

Margin usage on basic flows

x1mar(c,s,i,m)	Intermediate margin demands
x2mar(c,s,i,m)	Investment margin demands
x3mar(c,s,m)	Household margin demands
x4mar(c,m)	Export margin demands
x5mar(c,s,m)	Government margin demands

Technical change in margin usage

a1mar(c,s,i,m)	Intermediate margin tech change
----------------	---------------------------------

a2mar(c,s,i,m)	Investment margin tech change
a3mar(c,s,m)	Household margin tech change
a4mar(c,m)	Export margin tech change
a5mar(c,s,m)	Government margin tech change

Powers of Commodity Taxes on Basic Flows

t1(c,s,i)	Power of tax on intermediate
t2(c,s,i)	Power of tax on investment
t3(c,s)	Power of tax on household
t4(c)	Power of tax on export
t5(c,s)	Power of tax on government

Purchaser's Prices (including margins and taxes)

p1(c,s,i)	Purchaser's price, intermediate
p2(c,s,i)	Purchaser's price, investment
p3(c,s)	Purchaser's price, household
p4(c)	Purchaser's price, exports
p5(c,s)	Purchaser's price, government

Variables relating to usage of labour, occupation o, in industry i

x1lab(i,o)	Employment by industry and occupation
p1lab(i,o)	Wages by industry and occupation
a1lab_o(i)	Labor augmenting technical change
f1lab(i,o)	Wage shift variable

Variables relating to usage of fixed capital in industry i

x1cap(i)	Current capital stock
p1cap(i)	Rental price of capital
a1cap(i)	Capital augmenting technical change
r1cap(i)	Current rates of return on fixed capital

Variables relating to usage of land

x1lnd(i)	Use of land
p1lnd(i)	Rental price of land
a1lnd(i)	Land augmenting technical change

Variables relating to "Other Costs"

x1oct(i)	Demand for "other cost" tickets
p1oct(i)	Price of "other cost" tickets
a1oct(i)	"other cost" ticket augmenting technical change

f1oct(i) Shift in price of "other cost" tickets

Variables relating to commodity supplies, import duties and stocks

q1(c,i) Output by commodity and industry

t0imp(c) Power of tariff

fx6(c,s) Shifter on rule for stocks

Demands for import/domestic commodity composites

x1_s(c,i) Intermediate use of imp/dom composite

x2_s(c,i) Investment use of imp/dom composite

x3_s(c) Household use of imp/dom composite

x3lux(c) Household - supernumerary demands

x3sub(c) Household - subsistence demands

Effective Prices of import/domestic commodity composites

p1_s(c,i) Price, intermediate imp/dom composite

p2_s(c,i) Price, investment imp/dom composite

p3_s(c) Price, household imp/dom composite

Technical or Taste Change Variables for import/domestic composites

a1_s(c,i) Tech change, intermediate imp/dom composite

a2_s(c,i) Tech change, investment imp/dom composite

a3_s(c) Taste change, household imp/dom composite

a3lux(c) Taste change, supernumerary demands

a3sub(c) Taste change, subsistence demands

Miscellaneous vector variables

a1prim(i) All factor augmenting technical change

a1tot(i) All input augmenting technical change

a2tot(i) Neutral technical change – investment

employ(i) Employment by industry

f0tax_s(c) General sales tax shifter

f1lab_i(o) Occupation-specific wage shifter

f1lab_o(i) Industry-specific wage shifter

f4p(c) Price (upward) shift in export demand schedule

f4q(c) Quantity (right) shift in export demands

finv(i) Investment shifter

p0com(c) Output price of locally-produced commodity

p0dom(c) Basic price of domestic goods = p0(c,"dom")

p0imp(c) Basic price of imported goods = p0(c,"imp")

p1lab_o(i) Price of labour composite
 p1prim(i) Effective price of primary factor composite
 p1tot(i) Average input/output price
 p2tot(i) Cost of unit of capital
 pe(c) Basic price of export commodity
 pf0cif(c) C.I.F. foreign currency import prices
 x0com(c) Output of commodities
 x0dom(c) Output of commodities for local market
 x0imp(c) Total supplies of imported goods
 x1lab_i(o) Employment by occupation
 x1lab_o(i) Effective labour input
 x1prim(i) Primary factor composite
 x1tot(i) Activity level or value-added
 x2tot(i) Investment by using industry

Scalar or macro variables

delB Balance of trade/GDP
 employ_i Aggregate employment: wage bill weights
 f1lab_io Overall wage shifter
 f1tax_csi Uniform % change in powers of taxes on intermediate usage
 f2tax_csi Uniform % change in powers of taxes on investment
 f3tax_cs Uniform % change in powers of taxes on household usage
 f3tot Ratio, consumption/GDP
 f4p_ntrad Upward demand shift, non-traditional export aggregate
 f4q_ntrad Right demand shift, non-traditional export aggregate
 f4tax_ntrad Uniform % change in powers of taxes on nontradtnl exports
 f4tax_trad Uniform % change in powers of taxes on tradtnl exports
 f5tax_cs Uniform % change in powers of taxes on government usage
 f5tot Overall shift term for government demands
 f5tot2 Ratio between f5tot and x3tot
 p0cif_c Imports price index, C.I.F.
 p0gdpexp GDP price index, expenditure side
 p0imp_c Duty-paid imports price index
 p0realdev Real devaluation
 p0toft Terms of trade
 p1cap_i Average capital rental
 p1lab_io Average nominal wage
 p2tot_i Aggregate investment price index
 p3tot Consumer price index
 p4_ntrad Price, non-traditional export aggregate

p4tot Exports price index
 p5tot Government price index
 p6tot Inventories price index
 phi Exchange rate, Yen/\$world
 q Number of households
 realwage Average real wage
 utility Utility per household
 w0cif_c C.I.F. Yen value of imports
 w0gdpexp Nominal GDP from expenditure side
 w0gdpinc Nominal GDP from income side
 w0imp_c Value of imports plus duty
 w0tar_c Aggregate tariff revenue
 w0tax_csi Aggregate revenue from all indirect taxes
 w1cap_i Aggregate payments to capital
 w1lab_io Aggregate payments to labour
 w1lnd_i Aggregate payments to land
 w1oct_i Aggregate "other cost" ticket payments
 w1tax_csi Aggregate revenue from indirect taxes on intermediate
 w2tax_csi Aggregate revenue from indirect taxes on investment
 w2tot_i Aggregate nominal investment
 w3lux Total nominal supernumerary household expenditure
 w3tax_cs Aggregate revenue from indirect taxes on households
 w3tot Nominal total household consumption
 w4tax_c Aggregate revenue from indirect taxes on export
 w4tot border value of exports
 w5tax_cs Aggregate revenue from indirect taxes on government
 w5tot Aggregate nominal value of government demands
 w6tot Aggregate nominal value of inventories
 x0cif_c Import volume index, C.I.F. weights
 x0gdpexp Real GDP from expenditure side
 x0imp_c Import volume index, duty-paid weights
 x1cap_i Aggregate capital stock, rental weights
 x1prim_i Aggregate output: value-added weights
 x2tot_i Aggregate real investment expenditure
 x3tot Real household consumption
 x4_ntrad Quantity, non-traditional export aggregate
 x4tot Export volume index
 x5tot Aggregate real government demands
 x6tot Aggregate real inventories
 Omega Economy-wide "rate of return"

Variables (volume or value)

V0CIF(c)	Total ex-duty imports of good c
V0CIF_C	Total import costs, excluding tariffs
V0GDPEXP	Nominal GDP from expenditure side
V0GDPINC	Nominal GDP from income side
V0IMP(c)	Total basic-value imports of good c
V0IMP_C	Total basic-value imports (includes tariffs)
V0TAR(c)	Tariff revenue
V0TAR_C	Total tariff revenue
V0TAX_CSI	Total indirect tax revenue
V1BAS(c,s,i)	Intermediate basic flows
V1CAP(i)	Capital rentals
V1CAP_I	Total payments to capital
V1LAB(i,o)	Wage bill matrix
V1LAB_I(o)	Total wages, occupation o
V1LAB_IO	Total payments to labour
V1LAB_O(i)	Total labour bill in industry i
V1LND(i)	Land rentals
V1LND_I	Total payments to land
V1MAR(c,s,i,m)	Intermediate margins
V1OCT(i)	Other cost tickets
V1OCT_I	Total other cost ticket payments
V1PRIM(i)	Total factor input to industry i
V1PRIM_I	Total primary factor payments
V1PUR(c,s,i)	Intermediate purch. value
V1PUR_S(c,i)	Dom+imp intermediate purch. value
V1PUR_SI(c)	Dom+imp intermediate purch. value
V1TAX(c,s,i)	Taxes on intermediate
V1TAX_CSI	Total intermediate tax revenue
V1TOT(i)	Total cost of industry i
V2BAS(c,s,i)	Investment basic flows
V2MAR(c,s,i,m)	Investment margins
V2PUR(c,s,i)	Investment purch. value
V2PUR_S(c,i)	Dom+imp investment purch. value
V2PUR_SI(c)	Dom+imp investment purch. value
V2TAX(c,s,i)	Taxes on investment
V2TAX_CSI	Total investment tax revenue
V2TOT(i)	Total capital created for industry i
V2TOT_I	Total investment usage

V3BAS(c,s)	Household basic flows
V3MAR(c,s,m)	Households margins
V3PUR(c,s)	Households purch. value
V3PUR_S(c)	Dom+imp households purch. value
V3TAX(c,s)	Taxes on households
V3TAX_CS	Total households tax revenue
V3TOT	Total purchases by households
V4BAS(c)	Export basic flows
V4MAR(c,m)	Export margins
V4NTRADEXP	Total non-traditional export earnings
V4PUR(c)	Export purch. value
V4TAX(c)	Taxes on export
V4TAX_C	Total export tax revenue
V4TOT	Total export earnings
V5BAS(c,s)	Government basic flows
V5MAR(c,s,m)	Government margins
V5PUR(c,s)	Government purch. value
V5TAX(c,s)	Taxes on government
V5TAX_CS	Total government tax revenue
V5TOT	Total value of government demands
V6BAS(c,s)	Inventories basic flows
V6TOT	Total value of inventories

(Appendix 2) Elasticity Coefficients in the Japanese Model

Various elasticity coefficients used in the Japanese AGE model have been shown in Table 3-1. These values are based on the GTAP model.

According to McDougall, et. al. (1998) , the substitute elasticity between domestic and imported products and the substitute elasticity among the primary factors in the GTAP model are identical to those used in the SALTER model. These values of elasticity play a crucial role in our model analysis, and they can considerably influence the outcomes of the simulation. In the following, we present a sensitivity analysis to discuss to what degree the simulation results are influenced by the value of the substitute elasticity among the primary factors so that the performance of the model can be evaluated.

Let the substitute elasticity among the primary factors “SIGMA1PRIM” be (1) the value established in the Japanese AGE model; (2) the value 1 in all industries; and (3) the value 0.5 in all industries. We then compare the result, assuming that the TFP in all nine industries involved in the regulatory reform goes up by 1% simultaneously (i.e., the identical hypothesis to (2) of Chapter 3, Section 3). The closure is long-term. The result is as follows (Appendix Tables 1 and 2):

(Appendix Table 1)
Sensitivity of the Elasticity Coefficient among Primary Factors

	Real GDP	Consump- tion	Invest-m ent	CPI	Real Wages	Capital stock
(1) Elasticity in the Japanese Model	0.662	0.687	0.647	-0.291	0.746	0.686
(2) Elasticity = 1.0 in all industries	0.601	0.668	0.495	-0.272	0.750	0.539
(3) Elasticity = 0.5 in all industries	0.512	0.638	0.281	-0.243	0.756	0.324

When productivity increases, the larger the substitute elasticity is among the primary factors, the larger the growth rate of real GDP would be. By the increase in productivity, real wages go up. However, when the elasticity is large, the demand for capital would also increase and more investment would be promoted. On the other hand, the wage increase would be restrained and the fall in prices would be intensified.

(Appendix Table 2) Effects to industries (Change of SIGMA1PRIM)

	Capital stock Japan model	Capital stock SIGMA1- PRIM =1	Capital stock SIGMA1- PRIM =0.5	Capital prices Japan model	Capital prices SIGMA1- PRIM =1	Capital prices SIGMA1- PRIM =0.5
Crop cultivation	0.428	0.426	0.386	-0.119	-0.099	-0.069
Livestock raising, sericulture	0.469	0.536	0.454	-0.193	-0.174	-0.146
Agriculture services	0.488	0.775	0.551	-0.202	-0.183	-0.154
Forestry	0.634	0.866	0.524	-0.174	-0.154	-0.125
Fisheries	0.463	0.644	0.492	-0.174	-0.154	-0.124
Metal ores	0.935	1.167	0.708	-0.182	-0.163	-0.133
Non-metal ores	0.569	0.630	0.307	-0.134	-0.114	-0.085
Coal and lignite	0.077	0.290	-0.086	-0.091	-0.071	-0.041
Petroleum and natural gas	0.280	0.328	0.136	-0.083	-0.063	-0.032
Food product	0.822	0.766	0.562	-0.170	-0.150	-0.120
Beverages	0.916	0.865	0.692	-0.203	-0.183	-0.154
Feeds and organic fertilizers	0.838	0.784	0.581	-0.188	-0.168	-0.139
Tobacco	1.115	1.054	0.847	-0.194	-0.174	-0.145
Textile products	1.159	1.006	0.720	-0.148	-0.128	-0.099
Apparel, other textile products	1.134	1.006	0.769	-0.125	-0.105	-0.077
Timber and wooden products	1.090	0.872	0.512	-0.147	-0.127	-0.097
Furniture and fittings	1.071	0.858	0.509	-0.149	-0.131	-0.104
Pulp and paper	0.729	0.604	0.388	-0.101	-0.081	-0.051
Paper products	0.725	0.590	0.347	-0.121	-0.101	-0.071
Publishing and printing	0.884	0.717	0.416	-0.203	-0.183	-0.154
Chemical fertilizers	0.737	0.652	0.497	-0.107	-0.087	-0.057
Inorganic chemical products	0.913	0.787	0.571	-0.121	-0.101	-0.071
Petrochemical basic products	0.771	0.668	0.495	-0.082	-0.062	-0.031
Synthetic resin	0.805	0.680	0.472	-0.088	-0.068	-0.038
Synthetic fibers	1.013	0.878	0.631	-0.102	-0.082	-0.051
Final chemical products	0.862	0.764	0.588	-0.096	-0.076	-0.046
Petroleum refinery products	0.766	0.646	0.440	-0.148	-0.128	-0.098
Coal products	0.691	0.538	0.301	-0.065	-0.045	-0.015
Plastic products	0.922	0.768	0.505	-0.164	-0.144	-0.114
Rubber products	1.044	0.872	0.577	-0.169	-0.149	-0.119
Leather, fur products	1.300	1.153	0.885	-0.208	-0.189	-0.160
Glass and glass products	0.878	0.734	0.492	-0.122	-0.102	-0.072
Cement and cement products	0.933	0.708	0.357	-0.126	-0.106	-0.077
Pottery, china, earthenware	0.949	0.767	0.456	-0.154	-0.134	-0.105
Ceramic, stone, clay products	0.988	0.805	0.503	-0.110	-0.090	-0.061
Pig iron and crude steel	0.842	0.693	0.454	-0.074	-0.054	-0.024
Steel products	0.885	0.723	0.459	-0.084	-0.064	-0.033
Steel castings, steel products	1.056	0.853	0.511	-0.125	-0.105	-0.075
Non-ferrous metals	1.089	0.922	0.646	-0.126	-0.106	-0.076
Non-ferrous metal products	0.866	0.695	0.414	-0.092	-0.072	-0.042
Metal products for construction	1.052	0.831	0.473	-0.169	-0.149	-0.120
Other metal products	1.065	0.868	0.531	-0.183	-0.163	-0.134
General industrial machinery	1.033	0.820	0.451	-0.179	-0.162	-0.136
Special industrial machinery	1.069	0.878	0.521	-0.175	-0.161	-0.139
Other general equipment	1.268	1.029	0.612	-0.192	-0.173	-0.144

(Appendix Table 2) Effects to industries (Change of SIGMA1PRIM)

	Capital stock Japan model	Capital stock SIGMA1- PRIM =1	Capital stock SIGMA1- PRIM =0.5	Capital prices Japan model	Capital prices SIGMA1- PRIM =1	Capital prices SIGMA1- PRIM =0.5
Machinery for office, services	1.056	0.835	0.490	-0.182	-0.166	-0.142
Household electric equipment	1.063	0.930	0.690	-0.178	-0.161	-0.134
Telecommunication equipment	0.858	0.678	0.381	-0.151	-0.135	-0.110
Heavy electrical equipment	0.961	0.746	0.369	-0.195	-0.176	-0.148
Other electrical equipment	1.017	0.827	0.510	-0.173	-0.154	-0.124
Motor vehicles	1.159	0.961	0.632	-0.129	-0.111	-0.084
Ships and repair of ships	1.151	0.941	0.569	-0.172	-0.153	-0.125
Other transport equip., repair	1.091	0.867	0.511	-0.142	-0.132	-0.117
Precision instruments	1.134	0.938	0.584	-0.213	-0.196	-0.172
Other manufacturing products	1.107	0.941	0.644	-0.179	-0.161	-0.133
Construction	1.132	0.869	0.524	-0.128	-0.108	-0.079
Repair of construction	0.868	0.680	0.432	-0.147	-0.128	-0.099
Civil engineering	1.012	0.691	0.281	-0.136	-0.117	-0.087
Electric power for enterprise use	-0.183	-0.265	-0.399	-0.080	-0.060	-0.030
Gas and heat supply	0.286	0.197	0.036	-0.122	-0.102	-0.072
Water supply	0.753	0.672	0.518	-0.121	-0.118	-0.113
Waste disposal services	1.285	0.930	0.641	-0.106	-0.086	-0.056
Commerce	0.321	-0.020	-0.315	-0.098	-0.078	-0.048
Finance and insurance	0.063	-0.080	-0.337	-0.120	-0.100	-0.070
Real estate, rental services	0.268	0.173	0.014	-0.062	-0.041	-0.011
House rent	0.593	0.571	0.536	-0.032	-0.012	0.018
Railway transport	0.283	0.194	0.037	-0.066	-0.046	-0.015
Road transport	0.620	0.195	-0.159	-0.176	-0.156	-0.126
Water transport	1.111	0.792	0.521	-0.116	-0.096	-0.066
Air transport	1.047	0.696	0.401	-0.134	-0.115	-0.087
Storage facility service	1.193	0.850	0.547	-0.142	-0.123	-0.093
Other transport services	0.631	0.392	0.176	-0.078	-0.058	-0.028
Communication	0.061	-0.201	-0.430	-0.092	-0.072	-0.042
Broadcasting	0.797	0.638	0.352	-0.179	-0.159	-0.129
Public administration	1.426	1.270	0.945	-0.151	-0.147	-0.142
Education	1.321	1.143	0.805	-0.212	-0.192	-0.163
Research	1.219	0.997	0.606	-0.188	-0.168	-0.138
Medical service and health	1.140	0.991	0.707	-0.206	-0.187	-0.158
Social security	1.259	1.089	0.764	-0.165	-0.144	-0.115
Other public services	1.102	0.924	0.589	-0.210	-0.190	-0.161
Advertising, survey, information	0.781	0.598	0.272	-0.221	-0.201	-0.172
Goods renting and leasing	0.531	0.428	0.269	-0.213	-0.194	-0.164
Car and machine repairing	1.170	0.777	0.440	-0.204	-0.189	-0.167
Other business services	0.886	0.681	0.324	-0.212	-0.192	-0.162
Amusement and recreational	0.811	0.730	0.578	-0.130	-0.110	-0.081
Eating and drinking places	1.005	0.719	0.495	-0.118	-0.098	-0.068
Hotel and other lodging places	0.928	0.688	0.495	-0.072	-0.052	-0.022
Other personal services	0.881	0.770	0.562	-0.136	-0.116	-0.086
Not elsewhere classified	0.571	0.474	0.327	-0.030	-0.009	0.021

(Appendix Table 2) Effects to industries (Change of SIGMA1PRIM)

	Employ-m ent Japan model	Employ-m ent SIGMA1- PRIM =1	Employ-m ent SIGMA1- PRIM =0.5	Nominal wage Japan model	Nominal wage SIGMA1- PRIM =1	Nominal wage SIGMA1- PRIM =0.5
Crop cultivation	0.292	-0.149	0.096	0.453	0.477	0.511
Livestock raising, sericulture	0.316	-0.115	0.125	0.453	0.477	0.511
Agriculture services	0.332	0.114	0.218	0.453	0.477	0.511
Forestry	0.508	0.233	0.205	0.453	0.477	0.511
Fisheries	0.338	0.013	0.174	0.453	0.477	0.511
Metal ores	0.807	0.523	0.385	0.453	0.477	0.511
Non-metal ores	0.451	0.038	0.009	0.453	0.477	0.511
Coal and lignite	-0.032	-0.257	-0.361	0.453	0.477	0.511
Petroleum and natural gas	0.173	-0.211	-0.135	0.453	0.477	0.511
Food product	0.122	0.138	0.246	0.453	0.477	0.511
Beverages	0.178	0.203	0.358	0.453	0.477	0.511
Feeds and organic fertilizers	0.118	0.137	0.256	0.453	0.477	0.511
Tobacco	0.385	0.400	0.517	0.453	0.477	0.511
Textile products	0.397	0.398	0.414	0.453	0.477	0.511
Apparel, other textile products	0.402	0.421	0.474	0.453	0.477	0.511
Timber and wooden products	0.330	0.266	0.207	0.453	0.477	0.511
Furniture and fittings	0.309	0.248	0.201	0.453	0.477	0.511
Pulp and paper	0.029	0.046	0.107	0.453	0.477	0.511
Paper products	0.000	0.011	0.056	0.453	0.477	0.511
Publishing and printing	0.054	0.056	0.083	0.453	0.477	0.511
Chemical fertilizers	0.030	0.087	0.213	0.453	0.477	0.511
Inorganic chemical products	0.187	0.208	0.279	0.453	0.477	0.511
Petrochemical basic products	0.096	0.129	0.223	0.453	0.477	0.511
Synthetic resin	0.121	0.135	0.197	0.453	0.477	0.511
Synthetic fibers	0.311	0.317	0.348	0.453	0.477	0.511
Final chemical products	0.168	0.210	0.309	0.453	0.477	0.511
Petroleum refinery products	0.007	0.041	0.135	0.453	0.477	0.511
Coal products	0.037	0.016	0.038	0.453	0.477	0.511
Plastic products	0.141	0.145	0.191	0.453	0.477	0.511
Rubber products	0.256	0.244	0.261	0.453	0.477	0.511
Leather, fur products	0.460	0.483	0.547	0.453	0.477	0.511
Glass and glass products	0.151	0.154	0.200	0.453	0.477	0.511
Cement and cement products	0.200	0.123	0.063	0.453	0.477	0.511
Pottery, china, earthenware	0.181	0.155	0.148	0.453	0.477	0.511
Ceramic, stone, clay products	0.275	0.236	0.216	0.453	0.477	0.511
Pig iron and crude steel	0.176	0.161	0.186	0.453	0.477	0.511
Steel products	0.206	0.181	0.187	0.453	0.477	0.511
Steel castings, steel products	0.324	0.270	0.218	0.453	0.477	0.511
Non-ferrous metals	0.355	0.337	0.351	0.453	0.477	0.511
Non-ferrous metal products	0.176	0.145	0.137	0.453	0.477	0.511
Metal products for construction	0.264	0.203	0.157	0.453	0.477	0.511
Other metal products	0.259	0.226	0.208	0.453	0.477	0.511
General industrial machinery	0.232	0.180	0.127	0.453	0.477	0.511
Special industrial machinery	0.273	0.238	0.195	0.453	0.477	0.511
Other general equipment	0.448	0.376	0.284	0.453	0.477	0.511

(Appendix Table 2) Effects to industries (Change of SIGMA1PRIM)

	Employ-m ent Japan model	Employ-m ent SIGMA1- PRIM =1	Employ-m ent SIGMA1- PRIM =0.5	Nominal wage Japan model	Nominal wage SIGMA1- PRIM =1	Nominal wage SIGMA1- PRIM =0.5
Machinery for office, services	0.252	0.191	0.163	0.453	0.477	0.511
Household electric equipment	0.263	0.290	0.366	0.453	0.477	0.511
Telecommunication equipment	0.094	0.065	0.070	0.453	0.477	0.511
Heavy electrical equipment	0.142	0.092	0.039	0.453	0.477	0.511
Other electrical equipment	0.224	0.195	0.191	0.453	0.477	0.511
Motor vehicles	0.421	0.371	0.334	0.453	0.477	0.511
Ships and repair of ships	0.358	0.308	0.250	0.453	0.477	0.511
Other transport equip., repair	0.337	0.256	0.196	0.453	0.477	0.511
Precision instruments	0.290	0.262	0.242	0.453	0.477	0.511
Other manufacturing products	0.305	0.300	0.321	0.453	0.477	0.511
Construction	0.315	0.282	0.229	0.453	0.477	0.511
Repair of construction	0.025	0.075	0.127	0.453	0.477	0.511
Civil engineering	0.183	0.096	-0.018	0.453	0.477	0.511
Electric power for enterprise use	-0.850	-0.797	-0.668	0.453	0.477	0.511
Gas and heat supply	-0.437	-0.380	-0.254	0.453	0.477	0.511
Water supply	0.028	0.077	0.205	0.453	0.477	0.511
Waste disposal services	0.340	0.365	0.356	0.453	0.477	0.511
Commerce	-0.602	-0.572	-0.593	0.453	0.477	0.511
Finance and insurance	-0.656	-0.654	-0.626	0.453	0.477	0.511
Real estate, rental services	-0.379	-0.343	-0.246	0.453	0.477	0.511
House rent	-0.019	0.082	0.289	0.453	0.477	0.511
Railway transport	-0.369	-0.327	-0.226	0.453	0.477	0.511
Road transport	-0.436	-0.435	-0.476	0.453	0.477	0.511
Water transport	0.151	0.218	0.232	0.453	0.477	0.511
Air transport	0.057	0.104	0.102	0.453	0.477	0.511
Storage facility service	0.187	0.249	0.244	0.453	0.477	0.511
Other transport services	-0.261	-0.142	-0.093	0.453	0.477	0.511
Communication	-0.849	-0.746	-0.704	0.453	0.477	0.511
Broadcasting	-0.001	0.002	0.032	0.453	0.477	0.511
Public administration	0.659	0.642	0.617	0.453	0.477	0.511
Education	0.476	0.470	0.467	0.453	0.477	0.511
Research	0.406	0.349	0.281	0.453	0.477	0.511
Medical service and health	0.305	0.325	0.372	0.453	0.477	0.511
Social security	0.475	0.464	0.449	0.453	0.477	0.511
Other public services	0.262	0.254	0.252	0.453	0.477	0.511
Advertising, survey, information	-0.070	-0.080	-0.070	0.453	0.477	0.511
Goods renting and leasing	-0.309	-0.242	-0.069	0.453	0.477	0.511
Car and machine repairing	0.061	0.110	0.100	0.453	0.477	0.511
Other business services	0.046	0.011	-0.013	0.453	0.477	0.511
Amusement and recreational	0.074	0.141	0.281	0.453	0.477	0.511
Eating and drinking places	0.043	0.143	0.205	0.453	0.477	0.511
Hotel and other lodging places	0.043	0.158	0.228	0.453	0.477	0.511
Other personal services	0.136	0.176	0.263	0.453	0.477	0.511
Not elsewhere classified	-0.037	-0.012	0.082	0.453	0.477	0.511

(Appendix Table 2) Effects to industries (Change of SIGMA1PRIM)

	Output	Output	Output	Output	Output	Output
	Japan	SIGMA1-	SIGMA1-	prices	prices	prices
	model	PRIM =1	PRIM =0.5	Japan	SIGMA1-	SIGMA1-
				model	PRIM =1	PRIM =0.5
Crop cultivation	0.423	0.404	0.375	-0.179	-0.160	-0.130
Livestock raising, sericulture	0.445	0.431	0.401	-0.234	-0.217	-0.192
Agriculture services	0.394	0.378	0.352	-0.072	-0.052	-0.022
Forestry	0.553	0.455	0.317	0.020	0.040	0.072
Fisheries	0.414	0.396	0.367	-0.101	-0.081	-0.052
Metal ores	0.840	0.690	0.468	-0.029	-0.008	0.023
Non-metal ores	0.517	0.370	0.176	-0.135	-0.116	-0.086
Coal and lignite	-0.005	-0.123	-0.294	-0.021	0.000	0.031
Petroleum and natural gas	0.249	0.172	0.058	-0.097	-0.077	-0.046
Food product	0.415	0.401	0.378	-0.157	-0.138	-0.111
Beverages	0.591	0.573	0.545	-0.183	-0.164	-0.135
Feeds and organic fertilizers	0.454	0.439	0.408	-0.203	-0.190	-0.171
Tobacco	0.720	0.700	0.669	-0.223	-0.204	-0.175
Textile products	0.599	0.559	0.495	-0.101	-0.083	-0.056
Apparel, other textile products	0.655	0.624	0.576	-0.115	-0.096	-0.068
Timber and wooden products	0.567	0.456	0.302	-0.070	-0.053	-0.028
Furniture and fittings	0.572	0.459	0.308	-0.061	-0.042	-0.013
Pulp and paper	0.400	0.341	0.256	-0.227	-0.210	-0.184
Paper products	0.286	0.240	0.171	-0.108	-0.089	-0.059
Publishing and printing	0.317	0.265	0.189	-0.035	-0.015	0.016
Chemical fertilizers	0.459	0.430	0.385	-0.149	-0.132	-0.105
Inorganic chemical products	0.591	0.530	0.441	-0.263	-0.246	-0.220
Petrochemical basic products	0.555	0.495	0.408	-0.155	-0.140	-0.117
Synthetic resin	0.529	0.460	0.361	-0.148	-0.131	-0.105
Synthetic fibers	0.556	0.513	0.447	-0.131	-0.113	-0.086
Final chemical products	0.568	0.529	0.470	-0.089	-0.070	-0.042
Petroleum refinery products	0.440	0.387	0.309	-0.147	-0.138	-0.123
Coal products	0.479	0.369	0.216	-0.146	-0.135	-0.118
Plastic products	0.530	0.455	0.347	-0.113	-0.094	-0.065
Rubber products	0.589	0.509	0.394	-0.099	-0.080	-0.052
Leather, fur products	0.793	0.749	0.681	-0.089	-0.072	-0.047
Glass and glass products	0.551	0.473	0.361	-0.106	-0.087	-0.058
Cement and cement products	0.515	0.374	0.189	-0.153	-0.134	-0.104
Pottery, china, earthenware	0.453	0.371	0.257	-0.031	-0.011	0.019
Ceramic, stone, clay products	0.576	0.476	0.337	-0.106	-0.087	-0.058
Pig iron and crude steel	0.623	0.518	0.366	-0.210	-0.195	-0.172
Steel products	0.597	0.493	0.344	-0.182	-0.165	-0.139
Steel castings, steel products	0.603	0.492	0.329	-0.149	-0.130	-0.102
Non-ferrous metals	0.754	0.655	0.511	-0.177	-0.165	-0.148
Non-ferrous metal products	0.532	0.429	0.280	-0.100	-0.087	-0.066
Metal products for construction	0.557	0.436	0.274	-0.078	-0.059	-0.030
Other metal products	0.538	0.448	0.319	-0.050	-0.030	0.000
General industrial machinery	0.558	0.440	0.259	-0.061	-0.041	-0.012
Special industrial machinery	0.659	0.548	0.353	-0.058	-0.039	-0.010
Other general equipment	0.760	0.625	0.409	-0.058	-0.038	-0.008

(Appendix Table 2) Effects to industries (Change of SIGMA1PRIM)

	Output	Output	Output	Output	Output	Output
	Japan	SIGMA1–	SIGMA1–	prices	prices	prices
	model	PRIM =1	PRIM =0.5	Japan	SIGMA1–	SIGMA1–
				model	PRIM =1	PRIM =0.5
Machinery for office, services	0.615	0.482	0.310	–0.107	–0.088	–0.059
Household electric equipment	0.625	0.580	0.513	–0.089	–0.070	–0.041
Telecommunication equipment	0.518	0.405	0.243	–0.075	–0.056	–0.027
Heavy electrical equipment	0.483	0.365	0.177	–0.055	–0.035	–0.006
Other electrical equipment	0.563	0.465	0.327	–0.057	–0.038	–0.010
Motor vehicles	0.713	0.605	0.452	–0.089	–0.069	–0.040
Ships and repair of ships	0.576	0.482	0.337	–0.082	–0.062	–0.032
Other transport equip., repair	0.597	0.467	0.305	–0.045	–0.028	–0.002
Precision instruments	0.602	0.511	0.368	–0.043	–0.023	0.006
Other manufacturing products	0.600	0.536	0.440	–0.093	–0.074	–0.046
Construction	0.633	0.510	0.344	–0.029	–0.009	0.021
Repair of construction	0.378	0.328	0.255	–0.092	–0.072	–0.042
Civil engineering	0.453	0.290	0.080	–0.035	–0.015	0.016
Electric power for enterprise use	0.686	0.631	0.550	–1.082	–1.065	–1.040
Gas and heat supply	1.012	0.980	0.931	–1.053	–1.035	–1.009
Water supply	0.486	0.452	0.402	–0.092	–0.078	–0.058
Waste disposal services	0.488	0.453	0.401	0.186	0.208	0.240
Commerce	0.624	0.565	0.478	–0.904	–0.883	–0.851
Finance and insurance	0.603	0.554	0.481	–0.971	–0.949	–0.917
Real estate, rental services	0.080	0.023	–0.062	–0.020	0.001	0.032
House rent	0.586	0.565	0.533	–0.123	–0.103	–0.073
Railway transport	1.052	1.011	0.949	–1.181	–1.160	–1.129
Road transport	0.714	0.657	0.573	–0.840	–0.819	–0.787
Water transport	1.451	1.402	1.331	–1.086	–1.070	–1.048
Air transport	1.306	1.257	1.185	–0.991	–0.973	–0.946
Storage facility service	0.519	0.447	0.344	0.029	0.051	0.082
Other transport services	0.167	0.114	0.036	0.017	0.038	0.069
Communication	0.531	0.483	0.413	–0.923	–0.902	–0.870
Broadcasting	0.269	0.217	0.140	–0.009	0.011	0.042
Public administration	0.675	0.656	0.624	0.223	0.245	0.277
Education	0.552	0.531	0.497	0.279	0.301	0.335
Research	0.552	0.466	0.340	0.063	0.084	0.116
Medical service and health	0.513	0.491	0.455	0.020	0.041	0.072
Social security	0.525	0.503	0.469	0.167	0.189	0.221
Other public services	0.387	0.353	0.302	0.114	0.136	0.168
Advertising, survey, information	0.185	0.123	0.033	0.025	0.046	0.078
Goods renting and leasing	0.409	0.331	0.220	–0.212	–0.192	–0.162
Car and machine repairing	0.349	0.283	0.188	–0.038	–0.018	0.012
Other business services	0.277	0.196	0.080	0.068	0.089	0.122
Amusement and recreational	0.520	0.497	0.460	–0.065	–0.045	–0.014
Eating and drinking places	0.326	0.312	0.290	–0.041	–0.021	0.009
Hotel and other lodging places	0.375	0.357	0.329	–0.067	–0.046	–0.016
Other personal services	0.458	0.433	0.393	0.046	0.067	0.099
Not elsewhere classified	0.509	0.424	0.302	–0.126	–0.107	–0.078

(Appendix Table 2) Effects to industries (Change of SIGMA1PRIM)

	Consump- tion Japan model	Consump- tion SIGMA1- PRIM =1	Consump- tion SIGMA1- PRIM =0.5	Consumer prices Japan model	Consumer prices SIGMA1- PRIM =1	Consumer prices SIGMA1- PRIM =0.5
Crop cultivation	0.289	0.283	0.272	-0.467	-0.448	-0.418
Livestock raising, sericulture	0.589	0.576	0.555	-0.412	-0.394	-0.367
Agriculture services	0.176	0.169	0.158	-0.072	-0.052	-0.021
Forestry	0.832	0.810	0.774	-0.317	-0.297	-0.267
Fisheries	0.350	0.343	0.330	-0.451	-0.432	-0.404
Metal ores	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Non-metal ores	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Coal and lignite	0.776	0.762	0.739	-0.338	-0.326	-0.307
Petroleum and natural gas	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Food product	0.395	0.386	0.371	-0.381	-0.363	-0.335
Beverages	0.737	0.719	0.691	-0.387	-0.368	-0.340
Feeds and organic fertilizers	0.494	0.486	0.472	-0.611	-0.595	-0.570
Tobacco	0.739	0.722	0.695	-0.389	-0.371	-0.344
Textile products	0.643	0.629	0.607	-0.370	-0.354	-0.329
Apparel, other textile products	0.754	0.738	0.713	-0.527	-0.507	-0.479
Timber and wooden products	0.657	0.645	0.624	-0.390	-0.375	-0.353
Furniture and fittings	0.947	0.925	0.889	-0.435	-0.415	-0.385
Pulp and paper	1.021	0.999	0.965	-0.510	-0.491	-0.463
Paper products	0.875	0.852	0.817	-0.360	-0.340	-0.311
Publishing and printing	0.924	0.901	0.864	-0.411	-0.390	-0.359
Chemical fertilizers	0.988	0.967	0.932	-0.477	-0.458	-0.429
Inorganic chemical products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Petrochemical basic products	1.048	1.031	1.002	-0.538	-0.523	-0.501
Synthetic resin	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Synthetic fibers	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Final chemical products	0.943	0.922	0.887	-0.431	-0.411	-0.383
Petroleum refinery products	0.896	0.880	0.855	-0.382	-0.369	-0.350
Coal products	0.793	0.778	0.753	-0.277	-0.264	-0.245
Plastic products	0.953	0.931	0.895	-0.441	-0.421	-0.391
Rubber products	0.965	0.945	0.912	-0.453	-0.435	-0.408
Leather, fur products	0.912	0.895	0.866	-0.399	-0.384	-0.361
Glass and glass products	1.097	1.080	1.053	-0.588	-0.574	-0.553
Cement and cement products	0.904	0.884	0.853	-0.390	-0.373	-0.348
Pottery, china, earthenware	0.896	0.876	0.844	-0.382	-0.365	-0.339
Ceramic, stone, clay products	0.810	0.789	0.754	-0.294	-0.275	-0.246
Pig iron and crude steel	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Steel products	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Steel castings, steel products	0.538	0.535	0.526	-0.014	-0.013	-0.011
Non-ferrous metals	0.780	0.770	0.752	-0.263	-0.255	-0.245
Non-ferrous metal products	0.774	0.757	0.728	-0.257	-0.242	-0.219
Metal products for construction	0.900	0.878	0.842	-0.386	-0.366	-0.336
Other metal products	0.898	0.877	0.841	-0.385	-0.365	-0.336
General industrial machinery	0.737	0.720	0.693	-0.295	-0.278	-0.254
Special industrial machinery	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Other general equipment	0.867	0.848	0.816	-0.442	-0.423	-0.394

(Appendix Table 2) Effects to industries (Change of SIGMA1PRIM)

	Consump- tion Japan model	Consump- tion SIGMA1- PRIM =1	Consump- tion SIGMA1- PRIM =0.5	Consumer prices Japan model	Consumer prices SIGMA1- PRIM =1	Consumer prices SIGMA1- PRIM =0.5
Machinery for office, services	0.749	0.730	0.699	-0.308	-0.290	-0.262
Household electric equipment	0.802	0.782	0.750	-0.368	-0.348	-0.319
Telecommunication equipment	0.775	0.755	0.724	-0.337	-0.318	-0.290
Heavy electrical equipment	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Other electrical equipment	0.757	0.738	0.708	-0.318	-0.299	-0.271
Motor vehicles	0.928	0.906	0.870	-0.415	-0.395	-0.366
Ships and repair of ships	0.596	0.588	0.573	-0.073	-0.068	-0.060
Other transport equip., repair	0.977	0.956	0.921	-0.466	-0.447	-0.418
Precision instruments	0.789	0.771	0.741	-0.353	-0.335	-0.309
Other manufacturing products	0.797	0.781	0.756	-0.362	-0.348	-0.326
Construction	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Repair of construction	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Civil engineering	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Electric power for enterprise use	1.439	1.421	1.391	-1.082	-1.065	-1.039
Gas and heat supply	1.412	1.394	1.364	-1.052	-1.034	-1.008
Water supply	0.558	0.544	0.519	-0.092	-0.078	-0.058
Waste disposal services	0.346	0.322	0.283	0.186	0.208	0.240
Commerce	1.405	1.381	1.343	-0.902	-0.880	-0.848
Finance and insurance	1.456	1.433	1.395	-0.954	-0.933	-0.902
Real estate, rental services	0.544	0.521	0.484	-0.020	0.001	0.032
House rent	0.586	0.565	0.533	-0.123	-0.103	-0.073
Railway transport	1.655	1.632	1.595	-1.155	-1.135	-1.105
Road transport	1.325	1.301	1.264	-0.820	-0.799	-0.768
Water transport	1.535	1.517	1.489	-1.033	-1.019	-0.997
Air transport	1.027	1.015	0.995	-0.517	-0.507	-0.493
Storage facility service	0.499	0.477	0.441	0.027	0.047	0.076
Other transport services	0.509	0.487	0.451	0.016	0.036	0.066
Communication	1.426	1.402	1.364	-0.923	-0.902	-0.870
Broadcasting	0.534	0.511	0.475	-0.009	0.011	0.042
Public administration	0.310	0.286	0.248	0.223	0.245	0.277
Education	0.256	0.232	0.193	0.279	0.301	0.335
Research	0.464	0.441	0.404	0.062	0.084	0.116
Medical service and health	0.505	0.482	0.446	0.020	0.041	0.072
Social security	0.364	0.340	0.302	0.167	0.189	0.221
Other public services	0.414	0.391	0.353	0.114	0.136	0.168
Advertising, survey, information	0.501	0.477	0.440	0.025	0.046	0.078
Goods renting and leasing	0.731	0.708	0.672	-0.212	-0.192	-0.162
Car and machine repairing	0.561	0.539	0.503	-0.038	-0.018	0.012
Other business services	0.460	0.437	0.399	0.067	0.089	0.120
Amusement and recreational	0.587	0.565	0.529	-0.065	-0.044	-0.014
Eating and drinking places	0.562	0.541	0.507	-0.039	-0.020	0.008
Hotel and other lodging places	0.575	0.557	0.527	-0.052	-0.036	-0.012
Other personal services	0.480	0.457	0.420	0.046	0.067	0.099
Not elsewhere classified	0.525	0.522	0.515	0.000	0.000	0.000