JIDEA Model Research Report #3

Deregulation and its Aftermath: The Likely Response of the Japanese Economy to Deflation

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Introduction

This paper is a report on a study on the effects of the "deregulation" of the Japanese economy. It is well known that prices in many "non-tradeable" sectors of the Japanese economy are much higher than corresponding prices in the U.S. The objective of this study is to analyze the effects of these prices falling to the level of comparable prices in the U.S. The prices are assumed to fall gradually, over a five year period, from 1996 to 2000. The study is an illustration of the use of the JIDEA interindustry model of Japan, constructed by the International Institute of Trade and Investment (IITI) in partnership with INFORUM. It was undertaken in response to a request from the Small and Medium Enterprise Agency (SMEA) of the Japanese Ministry of International Trade and Investment (MITI). The study finds that although higher unemployment is a dangerous risk associated with such deregulation, the average consumer stands to benefit greatly in terms of an increase in real income per capita.

The "Wealthy Japanese"

In 1994, according to the Japanese National Accounts, the GDP of Japan was 467,978 billion Yen. At the average 1994 exchange rate of 102 Yen to the dollar, this is equivalent to $4588 billion. This compares to the U.S. GDP for 1994 of $6738 billion, ranking Japan as the second largest economy in the world.[1] The population of Japan in 1994 was 125.1 million, resulting in a per-capita GDP of $36,667. By comparison, in the U.S., with a population of 261 million in that year, per-capita GDP works out to $24,668. Therefore, in terms of dollar purchasing power, the average Japanese is roughly 50% richer than the average American.

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[1] Germany, with GDP at $1815 billion, is a rather distant third place, according to the database for the German INFORUM model.

In spite of these convincing figures, the average American visiting Japan is struck by the fact that the average Japanese is not 50% better off than the average American.[2] Houses are smaller, and ownership of consumer durables such as motor vehicles, refrigerators and washing machines is less prevalent. The average Japanese worker also spends more time commuting than his American counterpart, and working a longer work year, finds less time for quality time and vacation with his family.

How can these seemingly conflicting observations be reconciled? The answer lies in the other observation that soon strikes the average American visitor to Japan -- prices are higher! At the airport vending machines, you notice that all of the soft drinks are 110 Yen[3], and beer costs 230 Yen. Music CDs are between 2500 and 3000, apples and oranges are 350 per pound, and a night in the little hotel room at Asia Center House costs 6100! A pair of jeans costs between 7000 and 10000, and rice, one of the staples of the Japanese diet, is reputed to be 7 times the world price. It seems that one does not travel to Japan to get good shopping deals! Adjusting for the higher average prices found in Japan, living standards may be only 65% to 70% of U.S. levels.[4]

At the same time, Japan has a huge trade surplus with respect to the United States and Europe, and Japanese exports have staked out a large share in world markets in many industries, including motor vehicles, industrial machinery, specialty steel products and consumer electronics. If Japanese prices are really so high, then how can these products remain competitive on world markets, especially with the dramatic rise of the Yen that we have seen in the last few years?

The reason can be found in the fact that not all Japanese prices are high. The goods that Japan has been successful in exporting in the world market are generally made by the industries that have also experienced high productivity growth, resulting in falling prices. In the case of these industries, Japanese goods are often cheaper and of better quality than the same goods in other countries. Also, despite its "closed door" reputation, Japan *does* import quite a lot[5], particularly raw materials and non-competing agricultural and fisheries products, but imports of consumer goods are also on the increase. For many of these goods, the price at the port is similar to that paid in other countries.

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[2] Unless you are comparing him with the average American visiting Japan on an American salary!

[3] The current (February 1996) exchange rate is about 105 Yen per dollar. In June, 1995 it was about 80 Yen per dollar. The prices in this paragraph were more or less unchanged between June and February.

[4] This is the conclusion taken from Baumol and Wolff (1992?).

[5] Imports for the past 15 years have stood at between 8 and 15% of GDP in current prices.

However, by the time the good reaches the consumer, its price is significantly raised by large trade margins arising from many layers of distribution.

The Concept of Purchasing Power Parity

In order to measure the degree of price differences between Japan and the U.S., we can make use of the concept of *purchasing power parity*. Purchasing power parity, in its simplest form, is a theorem of "one good, one price". In a world of free trade and zero transactions costs, such a condition would be an equilibrium towards which all tradeable goods prices would converge. For example, if in the U.S. apples were $2 per pound, and the exchange rate were 100 Yen per dollar, then apples in Japan should be roughly 200 Yen per pound, assuming zero transport and marketing costs.

In most bilateral comparisons of different countries, prices of goods and services diverge from purchasing power parity for long periods of time, and in some cases, the divergence widens over time. This is partly due to the fact that trade restrictions do exist as do other barriers to trade, such as transportation costs, and fixed costs of setting up distribution systems. More importantly, many services are not in fact traded, so their prices are quite free to vary from those of similar services in other countries.

The way that purchasing power parity comparisons are usually constructed is with a Paasche index such as:

$$PPP_j^{XU(X)} = \frac{\sum_{i=1}^{n} P_{ij}^X Q_{ij}^X}{\sum_{i=1}^{n} P_{ij}^U Q_{ij}^X} \qquad (1)$$

where X and U are the two countries being compared, and the quantity weights chosen are of country X. A similar index can be constructed using quantity weights of country U. Often, a geometric average of the two price indices is taken to derive a more ideal index.

Table 1 shows a comparison for selected years of price comparisons between Japan and the U.S., constructed by Dirk Pilat as part of the International Comparisons of Output and Productivity (ICOP) project at the University of Groningen. The OECD (1992) has constructed similar comparisons. From this table one can observe that in 1980 and 1985, when the dollar was relatively high,

Table 1. Sectoral Relative Price Levels, Japan/U.S., 1973-90
(US = 100)

	1973	*1980*	*1985*	*1990*
Agriculture, forestry and fisheries	182	255	263	374
Mining and quarrying	189	68	51	121
Manufacturing	93	112	74	107
Electricity, gas and water	193	295	210	308
Construction	105	127	113	174
Transport and communications	111	157	135	226
Wholesale and retail trade	109	119	100	144
Finance, insurance and real estate	173	205	155	217
Services and government	69	95	76	114

Source: Pilat (1994), p. 200

manufactures, mining and services were actually cheaper in Japan. However, other sectors, such as agriculture, utilities, transportation, and finance were significantly higher. By 1990, with the high Yen, every major sector in Japan has become more expensive than in the U.S., and industries such as agriculture and utilities are more than three times the corresponding U.S. price! The sectors which show the highest prices compared to the U.S. are generally sectors that are not so involved in world trade. Ranking by the relative price in 1990, these are agriculture, utilities, transport and communications, finance, insurance and real estate, construction, and then wholesale and retail trade.

The reasons for the high prices in these sectors are diverse. In agriculture, there are inefficiencies generated by small farms and part-time farmers. The inefficiencies manage to continue because agriculture is closely protected by the politicians. To some extent, the Japanese culture also honors and values the rural lifestyle, although this sympathy is wearing thin, as Japanese consumers come to understand the costs of agricultural protection on their pocketbooks. The high cost of utilities is related to government regulation, and the mentality of operation that goes with a publicly regulated monopoly. In transport and communications, regulation is also a factor, although the landscape of Japan also plays a role in the high cost of land transportation. The high cost of construction goes hand in hand with the high land prices in Japan[6], public regulation, and some say, the Yakuza.[7] Finally, the high cost of trade is due to the many layers of wholesalers and retailers in

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[6] When the land prices are so high, the construction costs make up a smaller percentage of the total cost. This makes demand more inelastic.

[7] For those unfamiliar with Japanese life, the Yakuza is the Japanese mafia, although they are accorded

Table 2. Sectors Subject to Price Cut, and Target Price Cut Percentage

#	Sector Title	Target Price Cut Percentage
1	Agriculture for crops	37.2
67	Construction	33.0
69	Civil Engineering	33.0
70	Electric Power	10.0
71	Gas	10.0
72	Water Supply	10.0
74	Wholesale and retail trade	10.0
78	Railway transport	6.1
79	Road Transport	6.1
80	Water Transport	6.1
81	Air Transport	6.1
82	Storage facility services	6.1

Japan, as well as the small size of many retailers, and the highly labor-intensive nature of Japanese retailing.[8]

Reducing the Prices

The methods by which prices would actually be reduced in these sectors must be as varied as the reasons for which they are high. Since reduced prices for many imply reduced incomes for some, the political resistance to such price cutting would likely be strong. In this study we do not attempt to explain the policies that would be used to cut prices, but only assume that they are cut. This section explains how the price cuts were effected in the context of the JIDEA model.

Table 2 lists the industries that were targeted for this study to be subject to a price cut. The percentages in the right hand column indicate the target percentage cut with respect to the prices in a base case simulation. The set of industries and the desired percentages were specified by MITI.

The current value of output of a given industry is comprised of the intermediate costs, plus the labor costs, plus profit, indirect taxes and subsidies. In order to cut prices, we must explain which of

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a certain degree of respectibility.

[8] In the same space that you may be lucky to find one salesperson in an American department store, you will surely find twelve in a Japanese store.

Table 3. Input Cost Structure for Agriculture, Construction, Electric Power and Road Transport in 2000

Billions of Yen

1 Agriculture for Crops	
Current Price Output	**7968.5**
Wages and salaries	170.8
Operating surplus	4655.9
Depreciation of fixed capital	885.7
Indirect tax	168.1
Less: Subsidies	132.4
Total Value Added	**5793.4**
3 Agricultural services	272.1
22 Chemical fertilizer	204.7
29 Final chemical products	261.0
74 Trade	247.9
75 Financial and insurance services	347.7
Total Current Intermediate	**2175.1**

67 Construction	
Current Price Output	**57539.1**
Wages and salaries	21975.0
Operating surplus	1996.2
Depreciation of fixed capital	2194.0
Indirect tax	1107.4
Total value added	**28416.1**
17 Timber and wooden products	2108.4
45 Metal products for construction	2375.8
46 Other metal products	4043.9
74 Trade	2740.3
79 Road transport	2092.7
95 Other business services	2922.6
Total Current Intermediate	**29123.0**

70 Electric Power	
Current Price Output	**14548.1**
Wages and salaries	1954.7
Operating surplus	-844.6
Depreciation of fixed capital	6179.1
Indirect tax	1979.9
Subsidies	0.0
Total value added	**9632.1**
10 Natural gas	565.7
30 Petroleum refinery products	443.9
75 Financial and insurance services	928.8
97 Repair of machinery, other than mo	533.8
Total Current Intermediate	**4916.0**

79 Road Transportation	
Current Price Output	**20061.2**
Wages and salaries	13057.1
Operating surplus	679.4
Depreciation of fixed capital	1094.4
Indirect tax	423.8
Less: Subsides	89.7
Total value added	**15685.9**
30 Petroleum refinery products	544.4
83 Transport services	671.1
96 Repair of machinery, motor vehicle	1138.0
Total Current Intermediate	**4375.3**

Source: JIDEA Input Costs for 2000, in the Base Case

these components of overall cost must fall, while producing the same quantity of output. With respect to intermediate inputs, either the coefficients of input use can fall, or the prices of these inputs could fall. With respect to labor, either labor productivity could increase, or the wage rate could fall. Finally, the rate of profit could fall, or taxes could be reduced or subsidies increased. For the purposes of this study, it was decided to place the weight of the price cuts on labor productivity, wage rate, and profit rate changes.

Like most INFORUM models, the JIDEA model can be used to analyze the components of the value of current output for any year. Table 3 shows the projected input cost structure in the year 2000 of four of the industries in question. Total current output is equal to the sum of current price intermediate flows (only the largest are shown), and total value added. In agriculture, the income

indicated as "operating surplus" actually consists of returns to the farmer both as owner and as laborer. This was the target item for cutting in this sector. In order to calculate the extent to which operating surplus must be cut to obtain a 37% cut in price, first calculate the ratio

$$S = \Pi/Q \qquad (2)$$

where Π is operating surplus, Q is current price output, and S is the share of value added to be cut.

If we denote by R the ratio of the price cut, then the proportion C by which the value added components in question must be cut can be calculated simply as

$$C = R/S \qquad (3)$$

As Table 3 shows, the share S for agriculture is .584 (=4655.9/7968.5) and C must therefore be .637 (= .372/.584). In other words, to obtain the 37% cut in agricultural prices, operating surplus must be cut by 63.7%, if that is the only input item to be cut.[9] In Table 4 below, in the Profit column, this is reflected by a coefficient of .363 (1 - .637).

In other industries, such as construction, both the profit and the wages component were cut. The cut in total wages was effected by a combination of a labor productivity increase (reduction in labor

Table 4. Profit, Wage Rate and Labor/Output Ratio Coefficients Necessary to Achieve Price Cuts

#	Sector Title	Target Price Cut Percentage	2000 Profit Cut Coef	2000 Wage Cut Coef	2000 Emp Cut Coef
1	Agriculture for crops	37.2	0.363	N/A	N/A
67	Construction	33.0	0.231	0.769	0.462
69	Civil Engineering	33.0	0.283	0.785	0.498
70	Electric Power	10.0	N/A	0.779	0.485
71	Gas	10.0	N/A	0.833	0.609
72	Water Supply	10.0	0.457	0.837	0.620
74	Wholesale and retail trade	10.0	N/A	0.948	0.879
78	Railway transport	6.1	N/A	0.961	0.909
79	Road Transport	6.1	0.914	0.974	0.940
80	Water Transport	6.1	0.726	0.918	0.808
81	Air Transport	6.1	0.804	0.941	0.863
82	Storage facility services	6.1	0.847	0.954	0.893

[9] For agriculture, operating surplus is the only item that could be cut enough to yield a 37% price

hours/output) and a wage rate decrease. The final simulation results were constructed so that 80% of the wages cut came through a productivity increase, and 20% through a wage rate decrease.[10]

Other industries, such as electric power, already had negative profits in the base case, in 2000. For such industries, only the wage component was cut. All changes were phased in linearly over a five year period, with one-fifth of the total price cut being added in each year.[11] After a few false first starts, we input the fixes into the model to see what would happen.

What Do We Expect In A Deflationary Economy?

A frequent criticism of econometric forecasting is that the forecasters do not let their models alone to forecast the future, but are always going back and adjusting the model in light of their own *a priori* assumptions and expectations. I would confront such a critic by calling him out of his ivory tower and asking him if he has ever tried seriously building a working model himself. The chances are that he hasn't. In fact, there is no such thing as a model that doesn't embody such assumptions and expectations. We choose variables to use in our econometric equations in light of what is economically *sensible* and *natural*. We keep only those equations that have signs or magnitudes which are *reasonable* and *correct*. If the parameters are not to our liking, we do not hesitate to softly constrain them to be so.[12] Note that the italicized words in the above sentences imply that we are being subjective, yet to give the model meaningful content, we must be subjective.

After a model is constructed, the model builder watches it to see how similar it is to the real economy he is trying to model. If the model displays some quirk of unreality, then it is re-examined, in hopes of finding the offending equation or structure. An equation may frequently be respecified and replaced, not because it doesn't fit the data well, but because it doesn't give the model the desired properties.

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reduction.

[10] This split was made on an *ad hoc* basis, on the basis of the argument by MITI that wages should fall, with lower demand. In an earlier simulation, a wage equation was used in which higher productivity translated into higher wages. This wage equation was replaced by an equation not sensitive to productivity.

[11] Productivity fixes were implemented as actual fixes. Profit and wage rate cuts were implemented as multiplicative fixes. These multiplicative, or "mul" fixes can be problematic, as they may interact with other variables in the model, either counteracting or exaggerating the effects. They were used out of convenience, and we always checked the model results to see how big the actual price cut would turn out.

[12] *Soft* constraints, as opposed to *hard* constraints, allow the model builder to build an equation with an objective function based on both equation fit as well as closeness of parameters to some pre-specified value, with an explicit trade-off or slope between the two or more objectives.

During the current study, we (and our MITI clients) had certain expectations of the model, based both on economic theory, as well as observations on how the Japanese economy had performed in the past. Economic theory suggests that productivity increases should eventually result in higher standards of living. GDP growth is roughly a function of labor productivity growth added to labor force growth, assuming that average hours worked and unemployment rates remain constant. Almost 60 years after the publication of Keynes *General Theory*, there is still no general agreement about whether or not an economy should get itself into a protracted slump, but the undeniable history of the great depression, as well as the current evidence of Spain and other countries suggests that double-digit unemployment rates are possible. On the other hand, there is a general feeling in Japan that any unemployment rate over 4% is surely unthinkable, as the rate has varied only between 1% and 3.2% since 1950[13]. Surely the government would do something if the rate started to climb higher than that. Also, many industries in Japan have been achieving double-digit productivity growth rates, with no visible effect on unemployment. Furthermore, the nature of the Japanese labor market is such that changes in demand are cushioned somewhat by changes in short-run labor productivity cycles, hours worked, and female labor force participation.

In summary, our general expectations of what should happen in the economy were that with lower prices, especially those supported by productivity increases, the full-employment potential of the economy should rise, and any higher unemployment should only occur in a short-run transition in response to the falling prices.

What Did We Find?

What we found in our first attempts at a price cut simulation could be summarized by some of the charts comprising Figure A on the next page.[14] In the upper left hand corner we see a comparison of real GDP in the base case ("base") and in the price cut scenario ("alt"). GDP falls slightly as the price cuts are taking effect, but then is slightly higher by 2003 to 2005. The percentage differences between the two runs can be seen by looking at Table 5 on the next two pages following the charts. The GDP deflator is significantly lower in the alternate case. By 2000, prices are on average 7.5% lower. The reduced ratio of domestic prices to foreign prices stimulates exports and investment[15],

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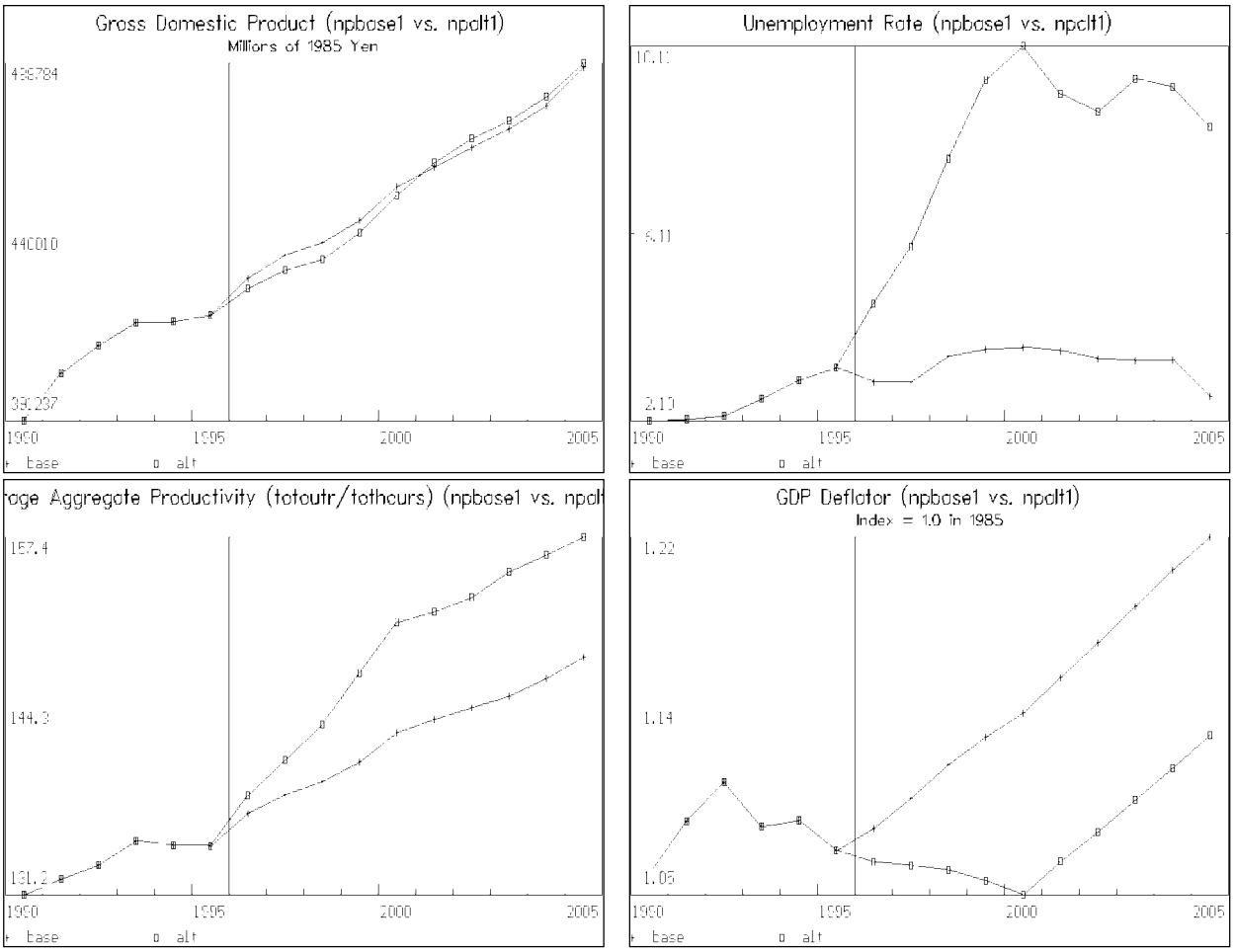
[13] 3.2% was the unemployment rate in 1995.

[14] A fuller set of charts is provided in the Attachments following the text of this paper.

[15] MITI held strongly to the assumption that equipment investment should respond negatively to the ratio

Figure 1 - Base Case vs. Price Cut Case With No Profit Scaler Function
Selected Variables



and chokes back imports, by 2003. Consumption is lower throughout the simulation (see Table 5), since real disposable income is lower. Average labor productivity is significantly raised relative to the base case (up 8.5% by 2000), but the result is mostly seen as higher unemployment. Unemployment reaches a peak of 10.1% by 2000, and then is pulled down somewhat as the model's economic stabilizers come into play.

How successful were we in obtaining the degree of price cuts that had been suggested? Table 5B shows the price index in the base case, and the percentage difference in the alternate case. Table 6 summarizes the price cuts specified versus the price cuts that were actually obtained in this set of

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of the domestic to the foreign price. The rationale of this assumption is that when domestic prices are lower, it will be advantageous to produce output domestically rather than build the investment in other countries, as foreign direct investment. The investment equations were changed to include this term, and the parameter was softly contrained to yield an elasticity of -0.5.

Table 5A. Comparison of Base and Price Cut Case with No Profits Scaler Function

Comparison table with no profits scaler.

JIDEA Macro Summary

Titles of Alternate Runs
Line 1: NPBASE1 -- Base with no profit scalar.
Line 2: NPALT1 -- Alt with no profit scalar.

Alternatives are shown in percentage deviations from base.

GDP Components by Expenditure Category
Billions of 1985 Yen

	1996	1997	1998	1999	2000	2003	2005
Gross Domestic Product	430079.2	436311.3	439735.1	445748.6	454926.2	470865.1	487478.6
	-0.7	-0.9	-1.0	-0.7	-0.5	0.4	0.3
Consumption of Households	266622.5	268470.2	270662.2	274353.0	278601.2	282136.5	287121.3
	-1.3	-1.5	-1.5	-1.2	-1.6	-0.9	-1.5
Consumption of Government	38167.3	38893.6	39626.3	40363.8	41104.6	43338.7	44833.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business Investment	92709.2	93816.1	93626.6	94029.0	94354.4	94205.0	92857.5
	0.0	-1.2	-2.2	-2.1	-1.0	3.4	3.0
Exports	64056.6	66343.2	67005.6	70111.6	74418.6	80035.8	88798.5
	0.3	0.5	0.8	1.0	1.3	1.3	1.1
Imports	76792.4	78196.4	79917.9	82975.9	85831.6	87635.3	89388.4
	-0.6	-1.0	-1.4	-1.4	-2.5	-0.5	-2.1

Current Price GDP by Income Category
Billions of Yen

Gross Domestic Product	466217.3	479104.4	489768.8	502336.2	517860.1	559627.7	595322.8
	-2.2	-3.8	-5.4	-6.7	-8.0	-7.3	-7.4
Labor Compensation	272940.2	281174.0	288290.8	296252.3	305673.4	332306.1	352569.5
	-2.7	-4.9	-7.2	-9.2	-11.2	-11.1	-11.4
Surplus (Profits, Rent, Interest	79489.6	80006.4	79990.3	80371.1	81305.1	82939.4	86266.8
	-2.5	-4.3	-5.9	-7.1	-8.1	-5.4	-4.9

Employment and Population
Units (thousands of persons)

	1996	1997	1998	1999	2000	2003	2005
Total Industry Employment	68570.4	68964.8	69019.4	69315.1	69687.9	71070.7	72400.4
	-1.5	-2.6	-3.7	-5.0	-5.6	-5.2	-5.1
NIPA Employment	65183.9	65578.3	65633.0	65928.6	66301.4	67684.2	69013.9
	-1.6	-2.7	-3.9	-5.3	-5.9	-5.5	-5.3
Total Hours Worked (millions)	11045.2	11067.2	11020.5	11030.9	11057.4	11123.3	11242.5
	-2.0	-3.8	-5.4	-7.0	-7.9	-7.6	-7.2
Average Productivity (outr/hours)	0.085	0.086	0.087	0.089	0.090	0.093	0.096
	1.489	3.076	4.719	6.873	8.335	8.949	8.350

Wages and Income

	1996	1997	1998	1999	2000	2003	2005
Total Wages	272940.2	281174.0	288290.8	296252.3	305673.4	332306.1	352569.5
	-2.7	-4.9	-7.2	-9.2	-11.2	-11.1	-11.4
Disposable Income	313007.9	319536.6	325493.3	332344.2	340403.7	362776.9	380292.3
	-1.9	-3.4	-4.9	-6.2	-7.5	-7.5	-7.8
Per Capita Income	2480.2	2489.6	2500.1	2518.6	2542.9	2555.4	2585.5
	-1.3	-2.3	-3.3	-3.9	-5.0	-4.6	-5.3
Savings	46174.9	47204.5	47870.4	48179.2	48552.5	52340.7	55202.8
	-2.4	-8.0	-15.0	-22.1	-27.5	-29.0	-29.9
Savings Rate	14.75	14.77	14.71	14.50	14.26	14.43	14.52
	-0.42	-4.73	-10.55	-16.96	-21.65	-23.22	-23.94
Real (1985Y) Disposable Income	312044.0	314207.4	316458.1	319900.0	323873.0	328399.2	334391.2
	-1.3	-2.3	-3.3	-3.9	-4.9	-4.6	-5.3
Real Savings	46032.7	46417.2	46541.6	46375.2	46194.7	47380.8	48539.8
	-1.7	-6.9	-13.5	-20.2	-25.5	-26.7	-28.0

Table 5B. Comparison of Base and Price Cut Case with No Profits Scaler Function

	Prices						
	1996	1997	1998	1999	2000	2003	2005
Household Consumption Deflator	1.003	1.017	1.029	1.039	1.051	1.105	1.137
	-0.621	-1.133	-1.729	-2.402	-2.722	-3.058	-2.661
Aggregate Wage Index	1.775	1.866	1.961	2.061	2.165	2.514	2.777
	0.000	-0.036	-0.066	-0.100	-0.139	-0.178	-0.157
GDP Deflator	1.084	1.098	1.114	1.127	1.138	1.189	1.221
	-1.500	-2.902	-4.444	-6.019	-7.525	-7.692	-7.663
	Output Prices of Price Cut Sectors						
Agriculture	1.021	1.051	1.079	1.108	1.139	1.236	1.301
	-7.734	-15.530	-23.468	-31.494	-39.674	-40.417	-40.906
Construction	1.190	1.214	1.239	1.263	1.287	1.371	1.427
	-4.884	-9.739	-14.619	-19.409	-24.084	-24.527	-24.689
Civil Engineering	1.147	1.162	1.181	1.199	1.217	1.280	1.317
	-6.036	-11.112	-16.733	-22.144	-27.324	-26.103	-26.625
Electric Power	0.734	0.740	0.741	0.739	0.737	0.740	0.742
	-2.214	-4.039	-5.787	-7.460	-8.979	-8.880	-8.806
Gas and Hot Water Supply	0.580	0.573	0.561	0.554	0.547	0.532	0.523
	-2.450	-4.478	-6.456	-8.287	-9.879	-9.373	-9.033
Trade	0.984	0.991	1.001	1.009	1.015	1.056	1.082
	-0.823	-1.933	-3.166	-4.606	-5.912	-6.512	-6.507
Railway Transport	1.151	1.184	1.209	1.237	1.261	1.342	1.389
	-1.604	-2.924	-4.332	-5.681	-6.859	-6.845	-6.691
Road Transport	1.145	1.170	1.199	1.225	1.251	1.339	1.392
	-1.417	-2.179	-3.708	-4.836	-6.115	-6.292	-6.206
Water Transport	0.723	0.725	0.724	0.725	0.727	0.736	0.741
	-1.233	-2.369	-3.555	-4.642	-5.628	-4.869	-4.496
Air Transport	0.847	0.851	0.853	0.856	0.860	0.870	0.871
	-0.755	-1.702	-2.650	-3.610	-4.762	-4.557	-4.687
Storage	1.141	1.149	1.157	1.163	1.168	1.190	1.201
	-1.208	-2.388	-3.573	-4.753	-5.834	-5.686	-5.516

Table 6. Specified Price Cuts vs. Cuts Actually Obtained

#	*Sector Title*	*Target Price Cut Percentage*	*Actual Price Cut by 2000*
1	Agriculture for crops	37.2	39.6
67	Construction	33.0	24.1
69	Civil Engineering	33.0	27.3
70	Electric Power	10.0	9.0
71	Gas	10.0	9.9
72	Water Supply	10.0	9.9
74	Wholesale and retail trade	10.0	5.9
78	Railway transport	6.1	6.9
79	Road Transport	6.1	6.1
80	Water Transport	6.1	5.6
81	Air Transport	6.1	4.7
82	Storage facility services	6.1	5.8

simulations. In agriculture we have cut the price by slightly too much, as we were trying to cut by 37%, but in fact cut almost 40%. In construction and engineering, the price cut seems to have been somewhat less than that specified. In trade, we specified a price cut of 10% and obtained a cut of only 6%. Part of the reason that it is difficult to cut the prices by an exact amount is that most of the value added equations for each sector have been left free to vary. This is especially relevant in the case of the profits function. However, all in all, the price cuts are close to what were targeted.

Deus Ex Machina Enter Stage Left

One can defend these results by alluding to the experience of the Great Depression, or the recent experience of Spain. However, few Japanese (or Westerners for that matter!) would believe that the Japanese economy would respond to a productivity push with only higher unemployment. We would expect the deflation to strongly stimulate exports, and reduce imports, improving the trade balance. We would also expect nominal interest rates to fall, and this should stimulate investment. Also, with a given level of nominal disposable income, lower prices imply a higher real income, and therefore a higher consumption.

In fact, the JIDEA model was displaying these mechanisms, or the unemployment rate would have gone even higher.[16] Still, we were determined (with much pressure from MITI) to find a way for the model to show a more positive result. If only the extra labor freed up by the productivity increase could be hired somewhere, then GDP would increase, income would increase, and almost everyone would be better off. Why wasn't the labor being rehired? It seemed like this was always what had happed in response to productivity increases in the past in Japan. What was the mechanism that would bring the economy to its "natural rate" of unemployment?

Taking a cue from Doug Nyhus, I introduced an aggregate profits scaler function, that would reduce profits by a specified percentage when the unemployment rate was above some maximum threshold, and raise profits when unemployment fell below a certain minimum threshold.[17] I call this function the *Nyhus Profits Scaler*, making no claim to originality. It takes its seat next to the famous *Nyhus Time Trend* in the rumble seat of econometric tools.

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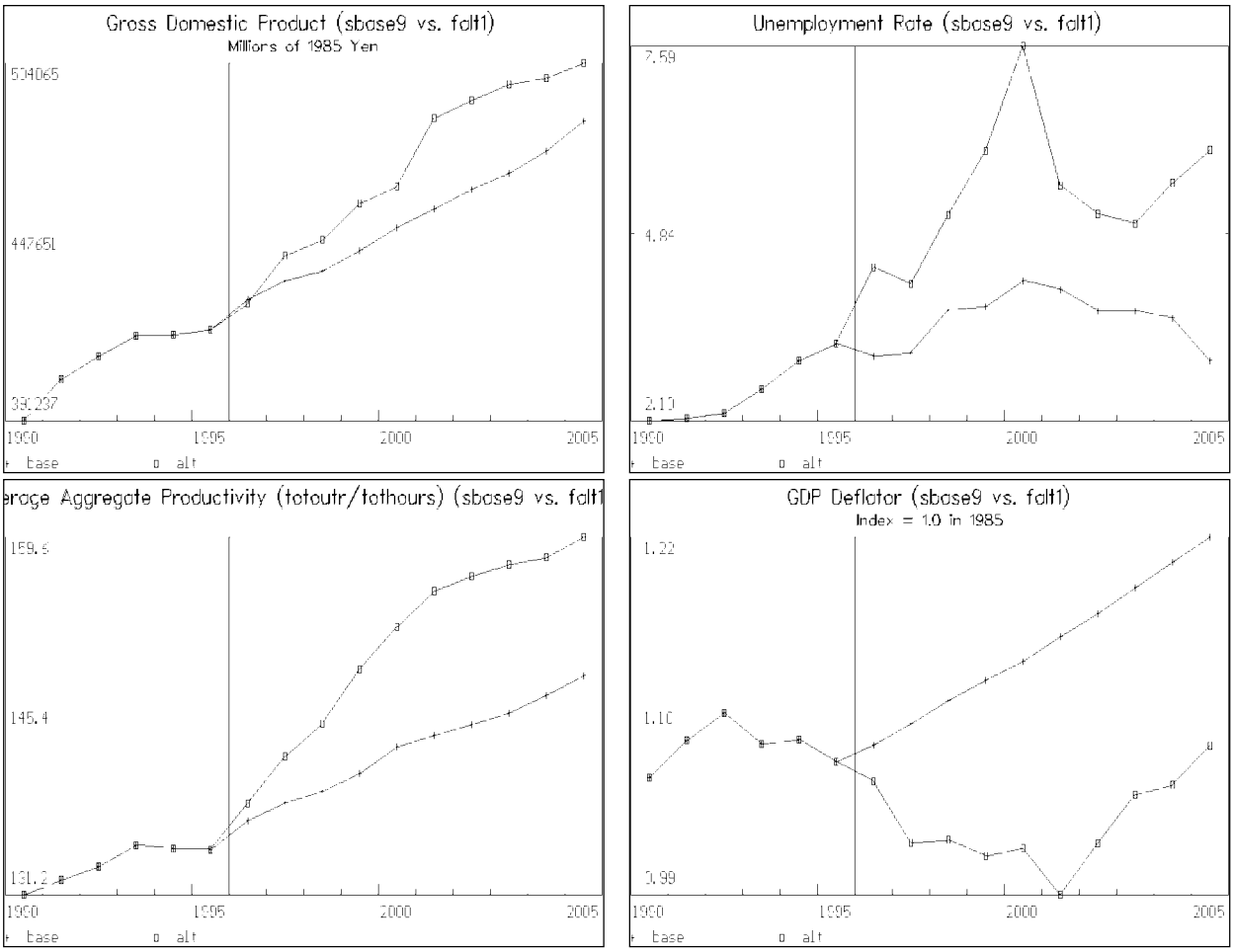
[16] In fact, it did. An earlier version of the model without such good stabilization properties allowed the unemployment rate to go up to 27%, but then the savings rate became negative!

[17] The function I introduced allows you to specify the tradoff, as well as the maximum and minimum unemployment rate. The "natural" unemployment range we chose was from 2% to 3.5%. The tradeoff rule was to reduce profits by 3% for each percentage that unemployment was above the threshhold.

Figure 2 - Base Case vs. Price Cut Case With Profit Scaler Function
Selected Variables



The charts comprising Figure 2 on the next page give a flavor of how the results changed using this profits scalar. A more detailed set of charts is in Appendix B at the back of the paper. The most obvious change is that the GDP growth path is higher, although the path is not smooth. In 2000, the price cut scenario GDP is almost 3% higher than in the base. By 2003 it is 6% higher, but then growth slows, and GDP is only 4% higher by 2005. The unemployment rate reaches its maximum of 7.6% in 2000, but then comes back down quickly to the neighborhood of 5%. Presumably, if the model were run out to 2010, then the unemployment rate would fall further. The largest percentage increase of GDP components is business investment, which was rather sluggish in the base case. The effects on consumption are determined by what happens to three important variables -- nominal disposable income, the consumption deflator, and the savings rate. Nominal income is lower in all years of the simulation, falling even more in the later years. The consumption deflator is also lower

Table 7A. Comparison of Base and Price Cut Case with Profits Scaler Function

Comparison table with profits scaler active.

JIDEA Macro Summary
Titles of Alternate Runs

Line 1: Sbase9 -> Labpar const
Line 2: FALT1 -> New "final" alt 1

Alternatives are shown in percentage deviations from base.

GDP Components by Expenditure Category
Billions of 1985 Yen

	1996	1997	1998	1999	2000	2003	2005
Gross Domestic Product	429560.2	435417.5	438393.1	444882.4	452218.5	469193.2	485692.9
	-0.3	1.8	2.3	3.3	2.8	6.0	3.8
Consumption of Households	266539.7	267997.8	270038.7	274402.1	277337.2	281654.7	286590.5
	-0.8	2.0	0.7	0.7	-0.8	-0.3	-1.1
Consumption of Government	38167.3	38893.6	39626.3	40363.8	41104.6	43338.7	44833.2
	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business Investment	92709.2	93580.4	93086.6	93247.9	93713.3	93095.1	92222.9
	0.0	-0.3	5.4	10.0	12.0	25.4	18.8
Exports	64058.4	66341.6	67005.4	70119.8	74420.6	80038.5	88796.8
	0.6	3.1	3.8	4.4	3.9	4.5	3.4
Imports	76729.5	78070.6	79723.6	82822.9	85437.2	87364.8	88763.5
	-0.5	-0.5	-1.7	-1.8	-2.3	-2.4	-1.4

Current Price GDP by Income Category
Billions of Yen

Gross Domestic Product	465715.3	478254.8	488175.4	501408.9	515312.3	557636.4	593555.2
	-2.6	-5.5	-6.2	-7.3	-8.3	-6.3	-8.0
Labor Compensation	272702.8	280767.7	287615.5	295697.3	304480.6	331334.0	351624.2
	-2.4	-3.5	-5.1	-6.7	-9.1	-7.7	-9.3
Surplus (Profits, Rent, Interest	79369.1	79805.8	79166.5	79879.4	79958.0	82125.5	85987.7
	-7.4	-24.2	-24.4	-28.4	-26.7	-21.7	-25.5

Employment and Population
Units (thousands of persons)

	1996	1997	1998	1999	2000	2003	2005
Total Industry Employment	68503.0	68858.2	68856.7	69220.2	69379.9	70860.9	72156.1
	-1.2	-0.9	-1.3	-2.0	-3.0	-1.2	-2.8
NIPA Employment	65116.5	65471.7	65470.2	65833.7	65993.4	67474.4	68769.6
	-1.3	-1.0	-1.3	-2.1	-3.2	-1.2	-2.9
Total Hours Worked (millions)	11033.3	11045.9	10988.3	11010.6	10995.6	11083.8	11197.5
	-1.7	-1.4	-2.3	-3.4	-5.0	-2.2	-4.7
Average Productivity (outr/hours)	0.085	0.086	0.087	0.089	0.090	0.093	0.096
	1.458	3.170	4.990	7.413	8.881	9.281	9.572

Wages and Income

	1996	1997	1998	1999	2000	2003	2005
Total Wages	272702.8	280767.7	287615.5	295697.3	304480.6	331334.0	351624.2
	-2.4	-3.5	-5.1	-6.7	-9.1	-7.7	-9.3
Disposable Income	312815.4	319230.6	324900.5	331968.9	339463.1	362014.4	379662.2
	-2.2	-4.4	-5.4	-6.6	-7.9	-7.0	-8.2
Per Capita Income	2479.1	2486.8	2496.5	2515.1	2534.4	2550.3	2577.4
	-0.8	0.9	-0.1	-0.3	-2.2	-1.2	-2.3
Savings	46060.0	47333.3	48018.4	47746.4	48716.6	52163.8	54715.0
	-2.6	-10.4	-10.1	-12.7	-15.9	-12.4	-15.4
Savings Rate	14.72	14.83	14.78	14.38	14.35	14.41	14.41
	-0.43	-6.25	-4.87	-6.46	-8.77	-5.79	-7.83
Real (1985Y) Disposable Income	311847.1	313861.1	316006.9	319530.6	322747.9	327773.8	333367.5
	-0.8	1.0	-0.1	-0.3	-2.2	-1.2	-2.3
Real Savings	45917.4	46537.1	46704.0	45957.4	46317.8	47230.0	48043.3
	-1.2	-5.3	-5.0	-6.8	-10.8	-6.9	-10.0

Table 7B. Comparison of Base and Price Cut Case with No Profits Scalar Function

Prices

	1996	1997	1998	1999	2000	2003	2005
Household Consumption Deflator	1.003	1.017	1.028	1.039	1.052	1.104	1.139
	-1.355	-5.320	-5.315	-6.323	-5.807	-5.859	-6.042
Aggregate Wage Index	1.775	1.866	1.961	2.061	2.165	2.514	2.777
	0.000	-0.079	-0.316	-0.315	-0.376	-0.453	-0.394
GDP Deflator	1.084	1.098	1.114	1.127	1.140	1.189	1.222
	-2.244	-7.173	-8.306	-10.321	-10.851	-11.564	-11.335

Output Prices of Price Cut Sectors

	1996	1997	1998	1999	2000	2003	2005
Agriculture	1.021	1.051	1.076	1.108	1.139	1.233	1.301
	-9.850	-25.520	-30.916	-38.171	-43.473	-44.405	-45.108
Construction	1.190	1.215	1.239	1.263	1.288	1.372	1.428
	-5.408	-12.536	-17.004	-21.837	-25.757	-26.541	-26.537
Civil Engineering	1.147	1.162	1.181	1.199	1.218	1.279	1.318
	-6.500	-13.622	-18.810	-24.254	-28.758	-27.919	-28.301
Electric Power	0.734	0.740	0.740	0.739	0.738	0.740	0.742
	-2.520	-5.313	-6.642	-8.379	-9.686	-9.309	-9.392
Gas and Hot Water Supply	0.580	0.573	0.561	0.554	0.548	0.532	0.524
	-3.012	-7.231	-8.794	-10.527	-11.424	-9.900	-10.127
Trade	0.985	0.992	1.002	1.010	1.019	1.058	1.084
	-1.294	-4.913	-5.990	-7.767	-8.336	-9.690	-9.206
Railway Transport	1.151	1.184	1.209	1.236	1.262	1.341	1.390
	-1.921	-4.621	-5.945	-7.386	-8.313	-8.159	-8.120
Road Transport	1.145	1.170	1.199	1.224	1.251	1.338	1.392
	-1.668	-3.977	-5.198	-6.531	-7.152	-7.565	-7.171
Water Transport	0.723	0.725	0.723	0.725	0.728	0.736	0.741
	-1.654	-4.742	-5.513	-6.810	-7.265	-6.533	-6.097
Air Transport	0.848	0.851	0.853	0.856	0.861	0.870	0.871
	-1.401	-5.382	-5.925	-7.349	-7.344	-7.987	-7.538
Storage	1.141	1.149	1.156	1.163	1.169	1.190	1.201
	-1.913	-6.302	-7.191	-8.736	-8.904	-9.042	-8.813

in the base, although not low enough to make real disposable income higher, except in 1997. Consumption falls by less than real disposable income falls because the savings rate also falls, in response to the higher unemployment rates. The overall GDP deflator is 10.8% lower than the base in 2000, and 11.3% lower by 2005. This is a direct result of the profits scalar. Note that aggregate profits are anywhere from 20% to 30% lower in the alternate case than in the base. This compares with a difference of 5% to 8% lower in the previous pair of simulations.

What Do You Think?

This study is not yet finished. Since these runs were created, Mr. Sasai has labored through three more cycles and presented them to MITI. I would appreciate your helpful comments on our methodology, and Mr. Sasai and I would like to continue to develop a paper together that would be suitable for publication. Any suggestions are welcome.