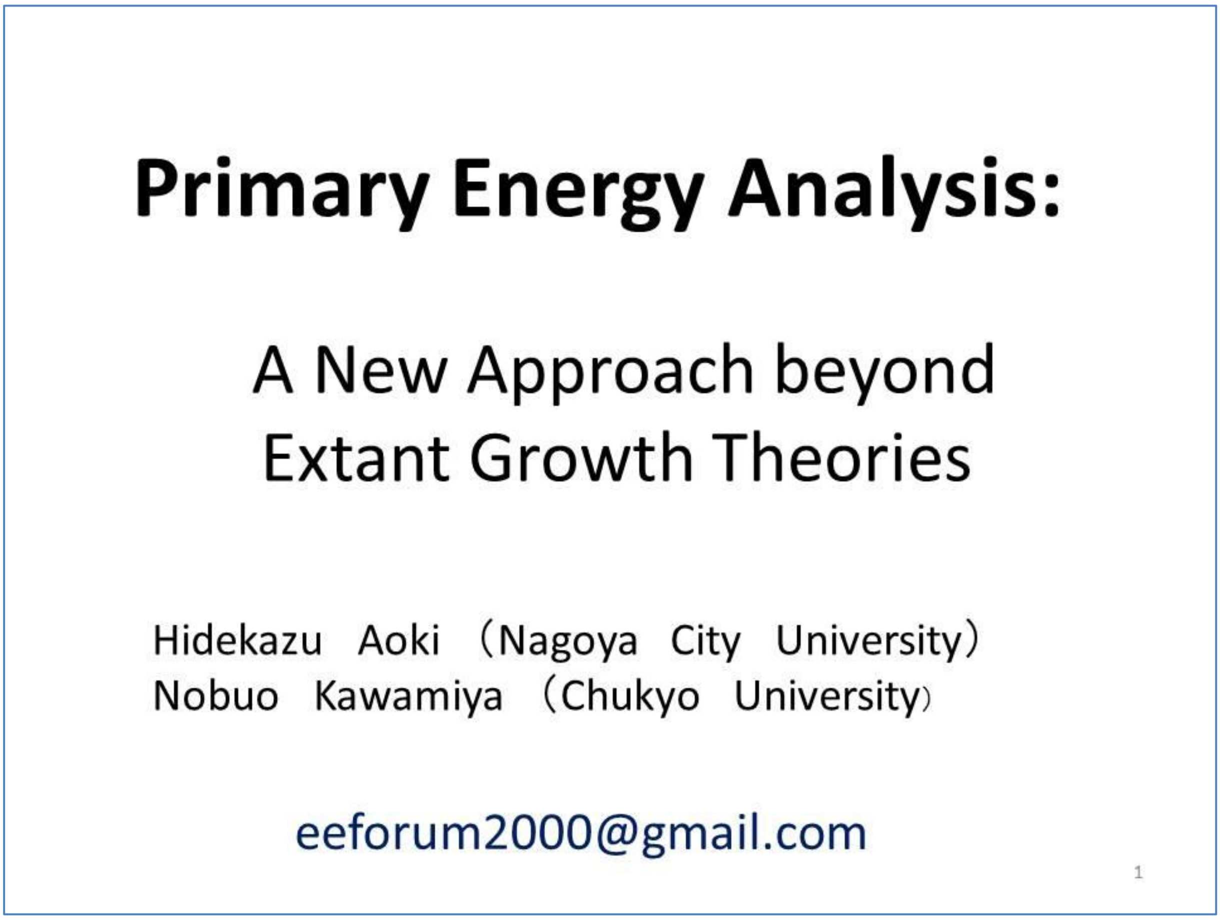
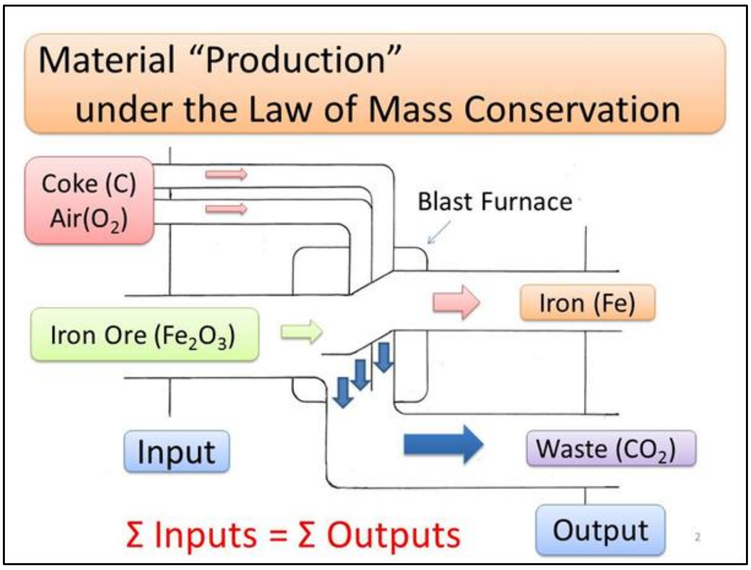


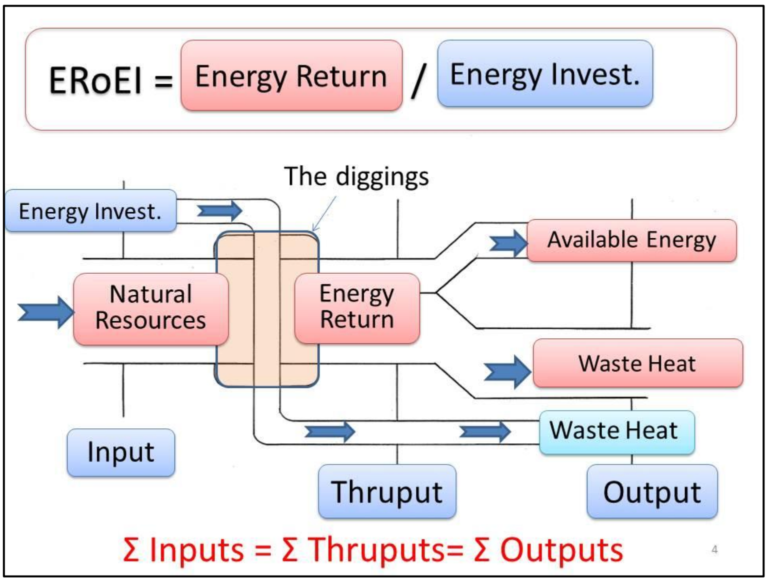
Slide 2



This chart shows how a Material “Production” fulfills the Law of Mass Conservation stating that no mass can ever be created nor lost (in chemical reactions). Let us deal with iron smelting as an example of material production. The major inputs (raw materials) are iron ore, coke (or charcoal), and air (or precisely, oxygen)

The outputs are iron (product) and carbon dioxide (by-products). The material inputs going into the furnace weigh exactly equal to the outputs coming out thereof. No atom (matter) is created or perished in this process.

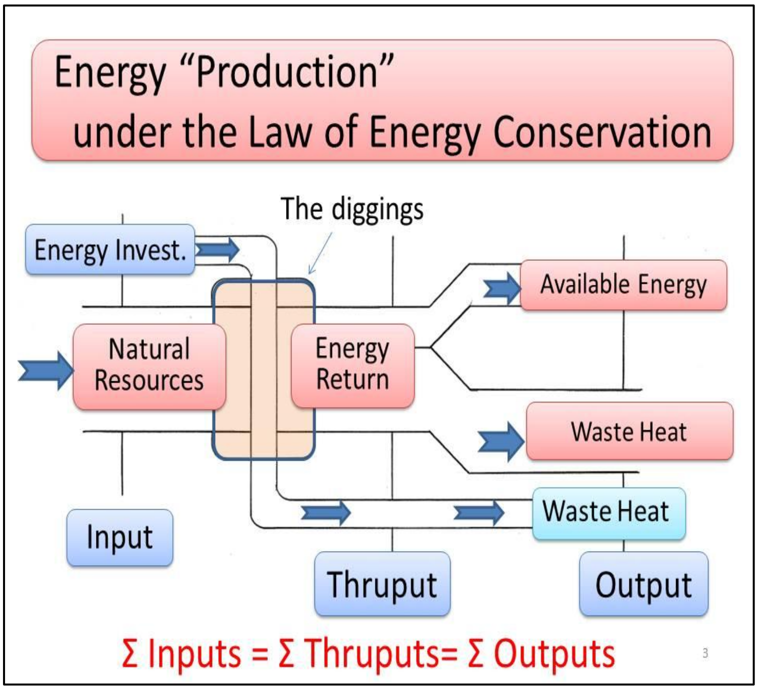
Slide 3



This chart shows how the Energy "Production" fulfills the Law of Energy Conservation stating that no energy can ever be created nor annihilated.
The word "production" is somewhat misleading because it is impossible to produce any energy.

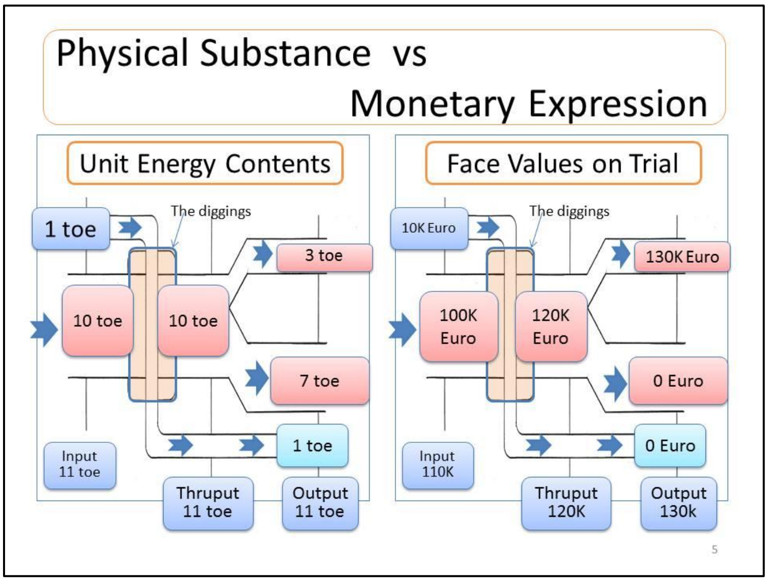
The essential conditions here are:
(1) the total Energy Input = the total Energy Thruput = the total Output: we cannot have any net gain or any loss;
(2) the Energy Return, however, is (should be) much larger than the Energy Investment;
(3) i.e. ER/EI is much greater than 1.
But why is (2) possible against (1)? Why the enhanced return (2) can survive the strict constraint (1) of energy conservation. The reason is: that the Energy "Return" comes from the natural resources, without any concern to the invested Energy: in fact it is not any "Return" but a new acquisition from the earth.
The right side shows the general thermodynamic constraint imposed on energy use. In overall average, ca. one third of the PES can convert into the available energy or the "exergy"; and the rest, into the waste heat.

Slide 4
This chart is of the same structure as the former one but has a little different title for the following reason.
From the thermodynamic viewpoint, we have no gain/ no loss on this process because the sum of Inputs = the sum of Thruputs or Outputs.



However, from the social viewpoint of Input/Output Analysis, we have a certain "gain" through this process: but how?
The energy cost we have to pay for is the Energy Investment alone: in fact we do not feed any energy for the natural resource.
Therefore we can acquire a "net" energy gain of (Energy Return –Energy Investment) and the rate of energy gain is the ratio of (Energy Return) / (Energy Investment).

Slide 5

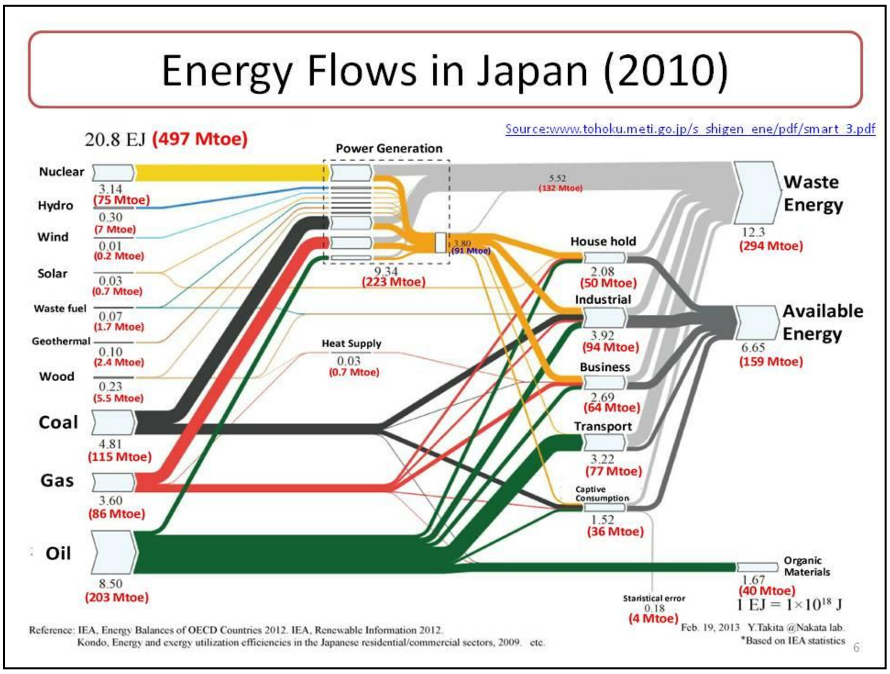


Let us compare the actual (physical) energy flows with the pricing system of the energy industry.
In this slide, the left chart shows a miniature model of a national energy flow.
The right chart shows the pricing system for the energy flow shown in the left chart, where the face values are given on trial. Noticeably the prices are seriously dissociated from the real energy content.
In the left chart, we first extract 10toe of oil by the use of 1toe Energy Investment, which together form the initial Input of 11toe.
Thus we obtain 10toe of Primary Energy from Natural Resources and 1toe of Waste Heat from EI. This Thruput on a transitional stage is also 11toe.

The final Output is the Available Energy, 3toe, and the Waste Heat, 8toe: the sum total is again 11toe.
The right chart shows a pricing sample on the energy flow in the left chart.
Here,
Thermodynamic Efficiency = E available / Primary Energy = 3toe/10toe = 30%
Note that the denominator of this equation does not include the Energy Investment necessary to acquire the Primary Energy.
Taking this EI into the denominator, we have another efficiency concept: i.e.
"Operational Efficiency" = E available / {Primary Energy + EI} = 3toe/(10toe + 1toe) = 27%
Expense Ratio on the price term is shown as following:
Cost (NR price & EI price) / Exergy Price = (10KEu + 100KEu)/130KEu = 0.8 < 1.0
One and the same energy flux has two different aspects:
a pricing (virtual) aspect to generate a monetary value added and
a physical (real) aspect to degenerate (dissipate) a thermodynamic value.

What has occurred is that the diminished energy 3toe has an enlarged price 130K Euro fully covering the cost of the total input, 11toe.

Slide 6

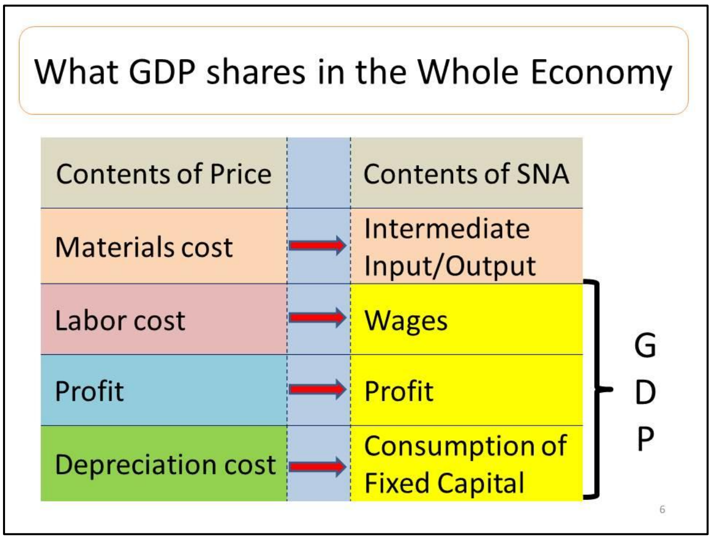


This chart represents the energy flows in Japan's Economy
The left side shows the P. E. S. by source:
Japan's P. E. S. amounts to 500 MTOE.
This goes half into power generation and half into fuel use, which together make the Secondary Energy.
Then, the Secondary Energy, or electricity and fuels, provide all the

industrial sectors with adequate kinds of energy.

This third stage describes how much energy is assigned to each industrial sector whose economic activity is fully controlled and measured by each energy assigned in the aspect of thermodynamic performance.
These data make an excellent indicator to represent the performance of each industrial sector because:
(1) It shows the quantity and quality of each industrial sector in terms of energy, i.e. without being disturbed by instabilities of the currency values or the exchange rates;
(2) Therefore it makes a reliable measure for studying a long-term historical change and/or a wide international comparison;
(3) These sectors well correspond to the row or the column of the inter-industrial table;
(4) We can collate the energy intake and the economic production (in face value) by each sector, or by Japan's economy as a whole.
(5) Thus, we can regard the amount of energy taken into each sector or a unit economy as a best possible measure of the industrial activity (production) thereof rather than as a mere physical/technical quantity, so we may call this energy measure as "Energy Content Value";

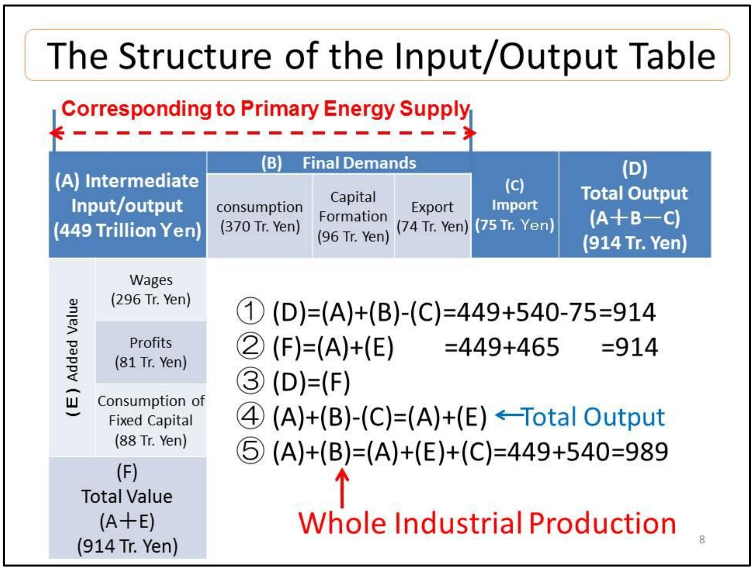
Slide 7



Let us reconsider the relation between the SNA sum (System of National Account) and the GDP. A domestic economy is an aggregate of consumer prices as shown in the left column.
Elements of SNA are consumer prices of the goods, in a national economy, of which contents break down into, respectively, material cost, labor cost, profit, and capital depreciation cost.
These elementary costs are to be aggregated into SNA, of which the GDP shares roughly (and only) half. Thus it is almost obvious that GDP (Added Value Section) is only a part of the whole domestic energy.
So we have to recognize that the fundamental measure of the size of an

economy is not the GDP but the SNA itself. Otherwise it will be impossible to make an exact argument of the growth/degrowth problems.

Slide 8



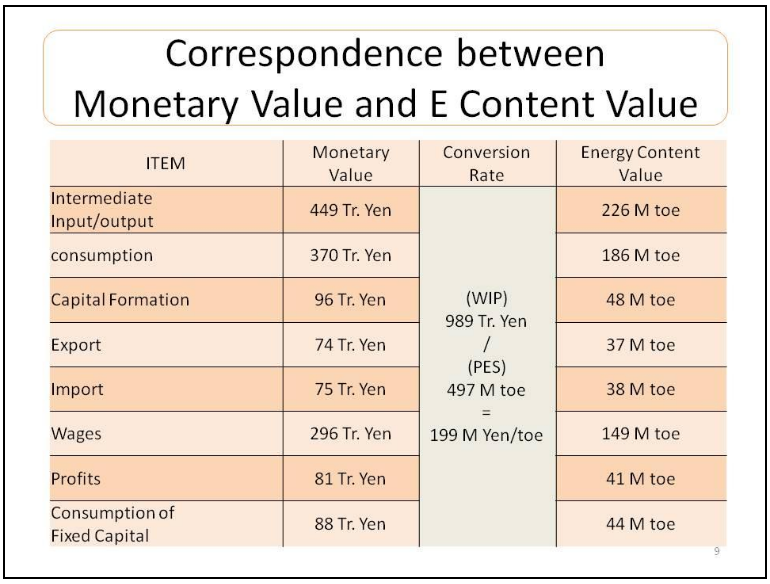
Thus far we have shown that the most basic data on macroeconomics are all the terms of the Inter-Industrial Input/Output Table, not restricted to the GDP or the added value section thereof.

The Inter-Industrial Table gives an account of the Total Output, which comprises the Intermediate Demand (Input/Output) and the Final Demand (Gross Added Value). Here, we consider it necessary to introduce a new concept of the "Whole Industrial Production" for the sum of {the Total Output and the Import}. This treatment is necessary to count the Intermediate Input/Output completely without deducting the Import. Thus, we suggest that this WIP is the true economic substance that utilizes the whole Primary Energy Supply.

In conclusion Japan's WIP is ca. 1000 Trillion Yen ($ 10 Tr.) and its GDP is ca. 500 Trillion Yen ($ 5 Tr.) and it is this WIP that makes use of Japan's plateau-like PES, 500 MTOE.

Slide 9

The PES expresses the total energy used for all the economic production per year.

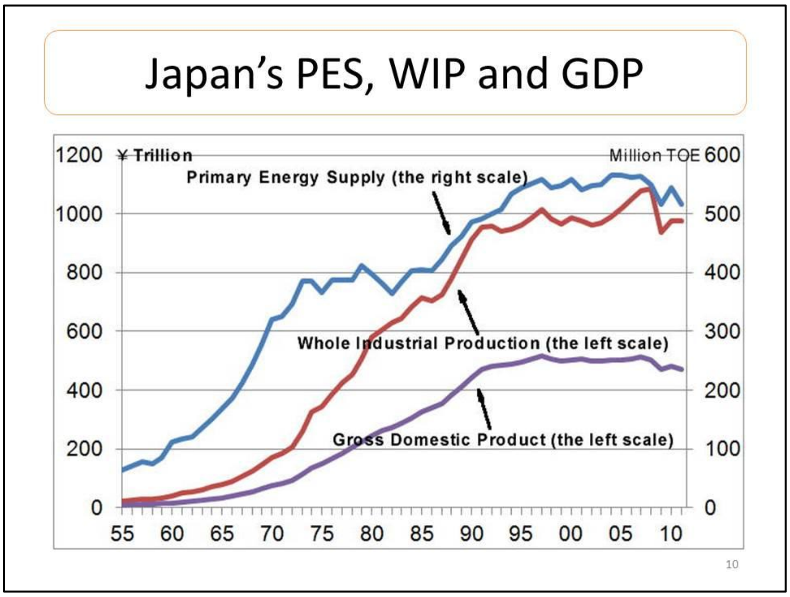


ITEM	Monetary Value	Conversion Rate	Energy Content Value
Intermediate Input/output	449 Tr. Yen	(WIP) 989 Tr. Yen / (PES) 497 M toe = 199 M Yen/toe	226 M toe
consumption	370 Tr. Yen		186 M toe
Capital Formation	96 Tr. Yen		48 M toe
Export	74 Tr. Yen		37 M toe
Import	75 Tr. Yen		38 M toe
Wages	296 Tr. Yen		149 M toe
Profits	81 Tr. Yen		41 M toe
Consumption of Fixed Capital	88 Tr. Yen		44 M toe

On the other hand, the WIP expresses the total monetary value of economic production per year. The former, PES, views all the economic activities in terms of energy.

The latter, WIP, views the same process on monetary evaluation. Therefore, we can recognize a proper correspondence between the PES and the WIP. Further, it is possible to convert each other through an appropriate "conversion rate". We adopt the "conversion rate" to the energy unit price (WIP/PES) and the specific energy consumption (PES/WIP).

Slide 10



This slide shows the historical transition of Japan's PES, WIP, and GDP. The PES to Japan made an enormous expansion from the early 1950s to 1973, the year of the First Oil Crisis, namely, from ca. 60 million to ca. 400 million TOE (Tons of Oil Equivalent), resulting in ca. 6.5 times rise during the two decades alone. On the contrary, Japan's PES has been restricted to around 500 million TOE for four decades after 1973. The WIP of Japan (in terms of nominal yen), on the other hand, began to make a very rapid rise after a time lag of ca. ten years against the rise of PES.
This time lag, we consider, had been an intrinsic result of the structural correlation between the PES rise and the WIP rise. In other words, the preceding (rapid) expansion of the PES is considered to have been an essential prerequisite for the rapid WIP growth in the post-war Japan.

The remarkably rapid rise of the PES suddenly and entirely ceased at the First Oil Crisis in 1973. On the contrary, Japan's WIP had barely survived this oil shock and successfully continued to rise for ca. twenty years, further prolonging the time lag against the PES rising. However, the WIP of Japan seems to have dissipated all its growth potential: gradually during the financial/fiscal bubble in the late 1980s and then precipitously at the bubble burst of 1990. This chart clearly shows that the dual but time-sequent expansions of the PES and the WIP should be a one-off (monocarpic, so to say) historical process. Japan's once brilliant growth of the PES-WIP pair must have ended forever.

Slide 11

Concluding Remarks

- 1990-91 saw Japan's Bubble Burst: this was the most advanced phenomena against all the other OECD countries.
- 1990s was the age of Massive Spending Policy as an only countermeasure effective (supposedly) to overcome the Bubble Burst recession: but this ended utterly in vain.
- 2000s was the age of record-breaking financial relaxation with virtually zero interest rate and abundant money supply.
- Whatever growth policy the government may take, Japan's economy persisted in a deep slump, as has been notorious.
- This demise from the growth path is considered to be an inevitable result of Japan's industrial history.