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Crisis and Embodied Innovations

Volodymyr Ryaboshlyk

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Volodymyr Ryaboshlyk

This is an English version, revised and enlarged,
of the original book published in Ukrainian

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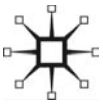

Softcover reprint of the hardcover 1st edition 2014 978-1-137-47706-4

Neodnoridna Ekonomika (in Ukrainian)
Osvita Ukrainy Publishers, 2010
ISBN 978–966–188–154–8

First published 2014 by
PALGRAVE MACMILLAN

Palgrave Macmillan in the UK is an imprint of Macmillan Publishers Limited, registered in England, company number 785998, of Houndmills, Basingstoke, Hampshire RG21 6XS.

Palgrave Macmillan in the US is a division of St Martin's Press LLC, 175 Fifth Avenue, New York, NY10010.

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ISBN 978-1-349-50207-3 ISBN 978-1-137-47707-1 (eBook)
DOI 10.1057/9781137477071

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A catalogue record for this book is available from the British Library.

A catalog record for this book is available from the Library of Congress.

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Introduction

While it has become a commonplace that innovations drive growth, it remains unclear whether innovations drive contraction as well. This book clears it up and finally puts the embodied innovations into the circle of recognised causes of economic crises. Unlike financial innovations that have already been much discussed as an alleged cause of the recent crisis, the real ones are still out of sight and out of mind while they merit consideration on their own.

The problem is that modern protagonists of the real technological causes of crises seek the truth in the stochasticities of fluctuations around some *right* trend, while recessions are part and parcel of the *right* trend itself, and even of an optimal "trend".

This reproach concerns, first of all, real business cycle (RBC) theories and similar approaches. Still, many of today's critiques of the RBC are too harsh. They confuse the correct idea with its poor analytical and numerical tractability and throw the baby out with the bath water.

Therefore, this book's objective is to set this right and incorporate the fluctuations into the deterministic part of analysis. Such insight will open the way to predicting turning points in the economy in explicit terms of timing and figures of output and employment decline, rather than of probabilities and possibilities of crises onset.

The solution of this seemingly narrow problem involves consideration of a much wider range of tasks and issues.

First of all, this requires the prediction of the whole development cycle driven by innovations, which may include recession as an unavoidable phase.

Then the question arises how to alleviate such unavoidable but manageable recessions, which evokes, in turn, the issues of monetary policies during such periods and so on.

Finally, the book comes to a concise description of how an innovative economy works in general and fluctuates in particular, including the interplay between its real and financial aspects. In this context, the book could be also treated as an effort to put forward new basics of economic knowledge and new direction in economics called Objective Marginalism.

For these reasons the book challenges a good many established theoretical and computational machinery. It challenges the whole tradition of shocko-mania – chasing after a mysterious host of shocks that every now and then knock the economy astray. It is astonishing, that the Dynamic Stochastic General Equilibrium (DSGE) approach accounts a dozen types of shocks without any particular effect for its forecasting ability. Yet Bank of England and the European Central Bank still rely on all this. So, the book pretends to provide the most economical explanation of crises/recessions in the sense that no special efforts are wasted for chasing after shocks. The main concern, after all, is an innovative growth where recession sometimes arises as a troublesome by-product.

It also challenges the centennial tradition of demando-mania, of demand-deficient versions of crises culminated in the Keynesian "deficient effective demand". To clarify this in the most pure way, all the crisis analyses are carried out here under an absence of any problems from the demand side. Be the "demand" even unlimited, recessions would still occur.

These two "manias" belong to the mode of thinking that proceeds from an abnormality of crises. Surely, discoordination, imbalance, chaos and anarchy are capable to damage anything, not an economy only. While this book tries to contribute to the "normality thinking" and show that recession is a normal phase of innovative growth when progress is of a type of recession-fraught technological leap. This is in some sense an engineering type of recession that is not inherent specifically to capitalism or to any other social organisation.

At that, allowing for the universal and multi-directional character of modern technological advance, it is difficult to associate the leap with some of the most innovative innovation "guilty" for crisis, be it

nano, bio, ICT, "large scale" or "general purpose" ones. Consequently, the technological leap is an outcome of joint action of all the innovations and such nameless set of innovations is an unavoidable cause of the current crisis.

This overturns the dominant view that it is the financial crisis that has caused the economic crisis. In fact, the first falling dominoes triggering the domino effect of insolvency and bankruptcy are those individuals and firms who were deprived of their solvencies by virtue of unavoidable real recession. Of course, if over and above there are over-risky credits and over-indebtedness, all this aggravates the situation even more.

Thus, financial crisis has non-financial roots, and these are financial bubbles that are pricked by real structural changes, not the other way around. It should be remembered that the tradition of blaming the banking and monetary system for crises ascends to the first worldwide economic crisis of 1825. And it is natural enough that the blaming of real economy is not any younger, either, because just such was the defence put forward from the side of bankers. So, this book proposes a solution to fix this old dispute.

The book can also be classified as a development of the theory of technological evolution. This theory has already thoroughly studied the processes of diffusion of many specific innovations. So now, it is naturally time to take another step forward and study the simultaneous diffusion of all the multitude of innovations in all industries. This insight has afforded to discover an irregular slumping S-curve of overall innovative development of a whole economy, in addition to the traditional regular non-slumping S-curves for specific innovations.

Further, the Solow growth theory is judged as an over-simplified one that has buried the fluctuations beneath aggregation, and this holds for the related apparatus – reflection of technology by Cobb-Douglas function; measurement of progress by total factor productivity (TFP); and the indicators of marginal factor productivity.

This touches the topic of marginalism – a very vague notion that has diverse interpretations. We adhere to an objective marginalism based on heterogeneity of real producers. Consequently, an integral marginal producer, where labour and capital are coupled in a synergy, replaces the marginal labourer and the marginal unit of capital decoupled and separated.

In the aspect of the financials, it is shown that the traditional general equilibrium is not altogether general and, in fact, is a special case of more general fundamental compromise.

The quantitative reflection of the above narratives is crystallised in a constructive framework capable to catch the turning points of the economy. The main distinctive features of the framework are: direct measurement of progress as the parameters of new technologies against old ones; reflection of the worker-workplace coupling; and holistic coverage of all technologies in all industries.

The peculiarity of the current state is that many elements of these theses have already featured in classic and modern works, showing that "the idea is in the air" and serving as inspirations for this book. The main of these inspirations are the following.

The *theoretical inspiration of the real part* is a forgotten seminal example left by David Ricardo to explain the "portion of inconvenience" from introduction of machinery.

In that example, a society had benefited from the redirection of its efforts to producing a machine not earlier than after some period of transition, being suffered from the decline in output of consumption goods at first. There was no need there neither in any additional crisis to induce the introduction of machinery, nor in compelling people to lose appetite to underpin a weak theory.

This logic of crisis – if an innovation requires an intensification of investment, then by the same token it requires a recession, because the intensification always runs at the expense of consumption – seems so simple that the science has not put much thought into it until now.

Anyway, even the most sophisticated modern quantitative schemes have managed to neglect this, whereby depriving themselves of the ability to catch the turning points in the economy instead of smooth trends and mere extrapolations.

So, this book does nothing but gradually carry Ricardo's line through to an explanation and foresight of modern crises. It turns out that the old-fashioned hardships of accumulation of old capital are still valid for accumulation of new capital, too, albeit not so much for the latter.

This is a more substantial vision of the innovations-crises relations than, say, of Kurzweil (2003):

> [E]xponential growth in the economy is a far more powerful force than periodic recessions. Even the "Great Depression" represents only a minor blip compared to the underlying pattern of growth. Most importantly, recessions, including the depression, represent only temporary deviations from the underlying curve. In each case, the economy ends up exactly where it would have been had the recession/depression never occurred.

Here again, the cause of recession looks like something mysterious and quite different from the cause of growth, and the so-called "underlying curve" is believed to be a very smooth one.

The *empirical inspiration* is the looked-at-but-not-seen phenomenon of jobless recovery, when the positive turn in output takes place earlier than the turn in employment. In such periods the production of fewer and fewer workers becomes higher and higher. Robert Hall, Chair-Director of NBER's Program of Research on Economic Fluctuations and Growth, has rightly pointed to "the unprecedented growth of productivity" as a cause of the jobless recovery. Meanwhile, this unprecedentedness sprang up in the heat of crisis and may be pointed to as a cause of the crisis, as well. Besides, there are also clear evidences of vigorous structural changes too.

These facts cast doubt on the common rhetoric that it is crisis that forces capitalists to introduce new technologies to survive. How then a financial disorder could induce such an order of events in the real sphere?

It is none the better for the decline of aggregate effective demand. As if people at once lost their appetite to consume – and got eagerness to produce work. All this still needs theoretical explanation and practical implications.

Alexander Field has already drawn the attention that even the Great Depression was accompanied with great technological leaps. And he posed a crucial question now to be solved in this book: "whether there is a necessary connection between depression and rapid productivity growth [so that the depressions are] sacrifices ... laying the foundation for a better tomorrow?"

This question is answered positively, so that the developed countries are first of all in the epicentre of technological and productivity leaps, and whereupon only in the epicentre of crisis. As for the catching-up economies like China or India, they are less touched by

the crisis, just because they are primarily technological followers, not leaders.

This overturns the poor clichés infecting all groups of the public, who are still sure it was the financial meltdown that dragged the real economy down, and who are still wondering where the double dip and the second wave comes from.

The *inspirations of the financial part* came again from Ricardo, who left behind him the idea of marginal producer now evolved into the equilibrium of marginal producers; and from Pareto, who attempted to introduce some sort of a "general" theory of general equilibrium and whose version of welfare economics has opened the door to determine the quantities produced and consumed without resorting to prices. Now it turns into a proof that quantity and price are separate and sequential tasks, not simultaneous ones. This afforded to explain a prehistoric economy without exchange and helped to get a better understanding of modern market economy too.

The *inspirations of the constructive framework* also feature in various quantifying methods, not being put together yet.

Say, Leontief's approach does reflect the worker-workplace coupling but measures progress indirectly as a gradual improvement of average characteristics of industries from year to year. This misled Leontief to an over-optimistic conclusion that "the economy is able to achieve a smooth transition from the old to new technologies", while we would rewrite this in a more sober way: sometimes the economy is unable to achieve a smooth transition. Yet, although crises are unavoidable, their depth is manageable, and they eventually turn into growth.

On the other hand, the vintage capital growth theory does measure progress directly but does not reflect the worker-workplace coupling, whereby losing an ability to catch imbalances between them.

The practical effectiveness of the constructive framework has been confirmed both through the prototype economy and through the case of one of the actual crises.

These results proved that embodied innovations are most likely the main cause of crises. This by-innovations-driven cause stands out within the circle of other possible causes by its ability to replicate all the phases of actual business cycles acting purely alone. Besides, for the time being, this cause is one of the few that is articulately spelt out and explicitly forecast. Such a tool is able to reinforce the

forecasting and early warning teams with an ability to catch turning points in the economy instead of mere extrapolations.

Among other results, it is shown that the Keynesian easy monetary policy at crises is a paradoxical example of correct policy implications derived from an incorrect theory. The book backs up this type of anti-crisis policy with a more plausible theory and specifies its bounds more thoroughly.

Thus, the policy implications are that crisis is unavoidable but predictable and its depth is manageable. All that remains for policymakers is to learn to alleviate, not aggravate, the unavoidable. The same holds, of course, for better forecasting and influencing the innovative growth and development as such. As for the Great Depression, it was the case when the manageable depth had been unwittingly "managed" in the wrong direction, profoundly worsening the situation.

On the "third hand", the book could be considered as an effort to consolidate the ideas and critiques proposed or highlighted recently. These are the following:

- That "money and finance are part of this story, not the story" (Winnett and Winnett, 2010).
- That "'Blaming it on finance' is an easy option ... but the world is more complex and many drivers are present" (Winnett and Winnett, 2011).
- That there is a question "is something 'deeper' than financial instability happening?" (Ibid.).
- That "improvements in productivity can even lead to a fall in [employment]" (Kates, 2011).
- That "we need to take seriously ... the so-called 'real' issues of innovation and growth which underpin cycles. These may or, most probably, are not manageable by (conventional) policy" (Winnett and Winnett, 2010).
- That "cyclical activity may be impossible to avoid" (Kates, 2011).
- That "growth is itself a cyclical process, driven by the very nature of capitalist development ... [so that] ... capitalist economies exhibit all sorts of inherent ... instability" (Winnett and Winnett, 2011).
- That the "Keynesian-type policy interventions succeed only within tightly-defined limits" (Winnett and Winnett, 2010).

- That "it is absurd to explain the current recession by deficient aggregate demand" (Kates, 2011).
- That the Solowian growth theory should be criticised for "the continuous incrementalism of the sort of 'augmenting' ... technical progress" (Winnett and Winnett, 2011).
- That prices are "variables exhibiting particular kinds of distribution" (Toporowski, 2011).
- That "dealing with nebulous terms 'confidence', 'euphoria' or 'panic' means perception rather than explaining events" (Kates, 2011).
- That there is "an appreciation of the difficulty and complexity of modelling the effect of various sorts of shocks on the time paths of prices and outputs. General models may not be available and this is *anathema* to modern modellers" (Winnett and Winnett, 2011).
- That there are theories that " ... nominally explains 'everything' in fact explains nothing at all" (Mirowski, 2013).
- And, finally, that "one should return to the theories that modern macroeconomics replaced and that the classical teaching embodied some permanent truths of great significance" (Kates, 2011).

Most of these items are supported, but some are not.

Altogether, this book constitutes a new direction in economics – objective marginalism that is based on objective and real heterogeneity of producers. It explains economic development and cycle driven by innovations, and provides a tool for its practical application – constructive framework.

Just now, this direction resembles the periodic table rarely filled, yet, and this is promising for the future.

The book will be of value to the wide readership for three reasons:

1. The current crisis has impacted everyone's life;
2. Meaningful interpretation and visualisation as well as invoking narratives prevail over the underlying computational formalism; and
3. The ideas are so simple that everyone has nothing to do but wonder how he had not come up with these revelations himself.

The organisation of the book is as follows. It is divided into three parts and fourteen chapters.

Part I describes real aspects of the cycle driven by embodied innovations; Part II describes the financial/monetary aspect. Such a division of the indivisible is resorted to for two reasons: (1) principally, providing real welfare is a necessary precondition to get profits and other monetary incomes. Besides, historically, the real preceded the financial, and (2) technically, the tradition of grasping everything at once brings about a multi-dimensional multiplicity of infinities, making an involute labyrinth where a researcher easily gets lost. There is a countless set of feasible paths of innovative development, each of which can in turn be financed in countless ways too; and over and above, there are countless oscillations generated by the market adjustment mechanism.

So, sometimes scholars are too hurried to sum up the pay-offs yielded by innovations, while the real preconditions to get those pay-offs are worthwhile to be considered beforehand, and the book adheres to the two-stage analysis. Consequently, Part II complements Part I, and both provide a consistent and coherent description how an innovative and heterogeneous economy, that is, the actual economy, works in general and fluctuates in particular. This pulls together both novelties and trivialities, and is intended for those more interested in the essence than in the associated history of economic thought or in the battles between competing schools. These latter are considered mainly in Part III.

More specifically, in Part I, a constructive framework is proposed – a practical framework sufficient to catch output and employment declines and other turning points in the economy numerically. Then, with an aid of this framework, the link of crises with embodied innovations is successively shown on an old example of a prototype economy and on concrete crises in modern economies. This has allowed, inter alia, to integrate the short and long runs together, and to answer the question posed by Nobel Prize-winning Professor Pissarides regarding the cyclical nature of fluctuations. At that, the notions of recession-fraught innovative situation and of irregular slumping S-shaped curve of overall innovative development are introduced.

In Part II, the financial and monetary aspects are overbuilt. Its theoretical foundation is Paretian welfare economics upgraded with objective marginalism. This afforded to propose a fundamental production-consumption compromise determining quantities produced and consumed without resorting to prices. Then, prices

are determined by the condition of equality of marginal producers or rule of invisible hand. At that, the traditional general equilibrium and the supply-demand paradigm are revisited. Apart of price, the categories of wage, profit, interest rate, money and non-neutrality of money, leverage, and stock price are also considered.

The material is illustrated with a simple example of heterogeneous economy, which threads throughout, growing in complexity with the unfolding of the narrative: from natural exchange of products to stock exchange and monetary policy.

Finally, this is crowned with a quantitative demonstration of dynamic interplay between prices, interest rates, savings and investments, wages, profits, losses, stock prices, and monetary policies at all the phases of a cycle driven by embodied innovations.

Part III is less systematic and contains in-depth discussion around some theoretical fundamentals and other issues of the previous parts. This relates to the concept or price, Ricardian and Marxian views of the connection of crises with accumulation and investment, prehistory of the Keynesian so-called effective demand and comparative analysis of some other approaches.

I am grateful to Ivan Beyko, Boris Bobko, Mabel Fong, Yuriy Kovalenko, Oleg Oleksiy, Vasyl Stolyarov and Oleksiy Vyalov for valuable suggestions and comments to the manuscript; to Ivan Vasjunyk, Mykola Katerynchuk, Victor Pynzenyk, Tamara Ryaboshlyk, Olexander Turchinov and Yulia Tymoshenko for providing all the favourable conditions for the book's creation; to Rachel Sangster, Laura Pacey and entire team at Palgrave Macmillan for their support in all aspects of the preparation of the volume for publication; and to Vidhya Jayaprakash and entire team at Newgen Knowledge Works for the final vetting of the manuscript.

Part I

Crises and Cycles Driven by Embodied Innovations: Real Aspects

Sometimes scholars are too hurried to sum up the pay-offs yielded by innovations, while the real preconditions to get those pay-offs are worthwhile to be considered beforehand.

2
State of the Art Around the Innovations-Crisis Link

The true devotees of truth admire the old truths

Pavlov (1918)

2.1 Leap-like progress

A leap-like pattern of technical progress originated in past epochs of industrialisation is universally recognised.

Ricardo (1821) considered the case when "improved machinery is *suddenly* discovered".

Marx considered "radical change in the mode of production" (1867) or "decisive changes" (1878) and "revolution in the instruments of labour" (1867). He wrote:

> [that the] instruments of labour are largely modified all the time by the progress of industry. Hence, they are not replaced in their original, but in their modified form. On the one hand ... [there is a] reason for the only gradual pace of the introduction of new machinery ... On the other hand competition compels the replacement of the old instruments of labour by new ones before the expiration of their natural life, especially when decisive changes occur. Such premature renewals of factory equipment on a rather large social scale are mainly enforced by catastrophes or crises. (Marx, 1878)

Schumpeter (1939a) considered "jerks and rushes" of progress.

Such paraphrases are still very common up to now, for example: "massive swell of basic innovations" (Mensch, 1979); "technological discontinuities" (Rothaermel, 2000); "irruption of the technological revolution", "big revolutionary leaps in technology", "discontinuous leaps", "real leap ahead" or "quantum jump in productivity" (Pérez, 2002); "the rhythm of technical progress" (Parisi, 2004); "discontinuous advances and radical innovation" (Porter, 2009). And lastly, "a great leap forward" (Field, 2011, 2013). "Technological impulse" and not a very happy term "technological shock" also spring to mind, and so on, and so forth.

After all, mere common sense suggests that not many managers would commit to shift to new technology for a gain of just a few percents, but rather times as much.

As to the possibility of any link between crises and progress, the community would rather universally recognise that innovations drive growth than that innovations drive contraction. Moreover, even those who do recognise this are not all in agreement as to where the essence of the link lies.

To be more precise, the link of innovations with the contraction in employment had already been evident as early as in the time of Luddites. So, only the link with the contraction in output remains murky. But as to the quantitative descriptions, they are murky for both.

2.2 Explanation by David Ricardo: starting accumulation of new machines

Ricardo (1821, "On Machinery" chapter) was most likely really the first to consider the impact of innovations.

His opening declaration – that the case was about "a subject of great importance, and one which appears never to have been investigated in a manner to lead to any certain or satisfactory results" – can definitely be repeated almost 200 years later. For example, Hirooka (2006, p. 6) writes, "Various theories have been put forward to explain the cause of business fluctuation, but no conclusive explanation has yet been provided."

Ricardo (1821), being of opinion that "an application of machinery … was a general good", had to admit that it was "accompanied … with … portion of inconvenience".

Firstly, he indicated at structural changes – "the removal of capital and labour from one employment to another" – and later on he added other "inconveniences".

A general description of the starting recession and further recovery was outlined by Ricardo as follows:

> All I wish to prove, is, that the discovery and use of machinery may be attended with a diminution of gross produce; and whenever that is the case, it will be injurious to the labouring class, as some of their number will be thrown out of employment ... But with every increase of capital he would employ more labourers; and, therefore, a portion of the people thrown out of work in the first instance, would be subsequently employed. (Ricardo, 1821)

Let us point out here that by using expressions such as "may be" or "whenever that is the case", Ricardo had underlined that not all the discoveries are obligatory command crises, but only some of them. Besides this, it is important that, while giving much attention to the financials, Ricardo also examined the purely real aspect: "I mean always quantity of commodities and not value." He also backed his reasoning by explanatory examples and we shall retell two of them concerning the problems encountered in the process of implementation of discoveries.

The first example explained the diminution of the production of consumer goods. Suppose that in first starting year of the introduction, the capitalist redirected half his men in producing a machine, and the other half was left in producing food as usual. During this first year, people consumed the produce of the previous year as usual; but what would be the case the following year?

While the machine was being made, only one-half of the usual quantity of food would be obtained in this first year, whereas the finished machine would yield harvest only at the end of the following second year.

Thus, the society would have benefited from the investment in productive machine not earlier than from the third year of transition, suffering from the crisis of consumption decline at first.

Another example illustrated an employment decline. Even though it was about a substitution of horses for men, replace "horse" with

"machine", and you would come to the mechanism working up to now. This is as follows.

> If I employed one hundred men on my farm, and if I found that the food bestowed on fifty of those men, could be diverted to the support of horses, and afford me a greater return of raw produce ... it would be advantageous to me to substitute the horses for the men, ... but this would not be for the interest of the men, and unless the income I obtained, was so much increased as to enable me to employ the men as well as the horses, it is evident that the population would become redundant, and the labourers' condition would sink in the general scale. It is evident he could not, under any circumstances, be employed in agriculture; but if the produce of the land were increased by the substitution of horses for men, he might be employed in manufactures, or as a menial servant. (Ibid.)

As it could be seen, apart from structural unemployment and structural change, Ricardo foresaw here the explosion of tertiary industry too.

All this also meant a bust-boom sequence of the phases and the direction of causality running from innovation to crisis. Unfortunately, Ricardo's vein was followed in the nineteenth century only, namely by Roscher (1854) and Böhm-Bawerk (1884), who considered the starting hardships of a single inventor before benefiting from his investment in realisation of his invention. Now our task is to fill this gap.

2.3 Marx and "Marxists": who has put the cart before the horse?

Marx (1878) adhered to the opposite causality and in his opinion, these were "catastrophes or crises" which enforced renewals of equipment.

Such a from-crisis-to-innovation way of thinking is dominant until now. Some examples are the following to name a few: "under the pressure of those crises ... the economy implemented a massive swell of basic innovations" (Mensch, 1979); or "With the aggravation of social tension a search for new directions of economic activity begins" (Glaziev, 1991); or "The recession forces

capitalists ... to introduce new technologies to survive" (Dal-Pont Legrand and Hagemann, 2007); or "Only a crisis ... produces real change" (Friedman, 1962).

To think otherwise is to "put the cart before the horse", says Gerald Silverberg (from personal communication; see also Silverberg, 1988, 2003). Still, it remains unclear what produces a crisis itself? And all such Marxists have to search for other causes.

Juglar (1862) explained crisis as a consequence of overheating and overinvestment that meant a boom-bust sequence of the phases, opposite of Ricardo's explanation. At that, Juglar did not underline, as his later successors, that the case was about the overinvestments just in innovations; but he did leave a dictum, "the only cause of depression is prosperity", that had initiated the boom-bust rhetoric remaining in fashion up to now, quoted by Dal-Pont Legrand and Hagemann (2007). This was particularly highlighted by Schumpeter (1934, 1939a, 1950).

Kuznets (1930) was sure that it is a combination of technological change with demand effects that provide the answer "why not balanced growth?"

2.4 Convoluted explanations by Schumpeter

Schumpeter supposed that the problem is that progress is not duly coordinated across industries: "Progress ... not only proceeds by jerks and rushes but also by one-sided rushes productive of consequences other than those which would ensue in the case of *coordinated rushes*" (1939a, here and in the collection below italics are added).

Besides, Schumpeter's convoluted texts contain many other related thoughts – of contradictory nature, though. In doing so, sometimes he reinvented Ricardo's insights, not being aware of this.

Say, Schumpeter also believed

- that the employment of labourers "in the machine industry will *temporarily reduce the supply of consumers' goods*" (1939a);
- that "times of *innovation are times of effort and sacrifice*, of work for the future, while the *harvest comes after*" (1939a);
- that "the output of producers' goods should at first increase *at the expense of the output of consumers' goods*. The latter should even absolutely decline" (1939b, p. 502); and

- that "As a rule the boom finally means a step in the direction of mechanizing the productive process and hence necessarily a diminution of the labor required per unit of product; and often ... it also involves *a diminution of the quantity of labor* demanded in the industry in question in spite of the extension of production which occurs" (1934).

At other times, the above-mentioned did not prevent Schumpeter from an opposite declaration that "*saving-investment mechanism*, as such, does not produce anything that could qualify for the role of an *explanation of crises* or depressions" (1939a, p. 73). So that all the previous points were left unhighlighted together with the long list of more or less important points where one can encounter such examples as: "variations in marriage rates are obviously the reflex of business fluctuations and do not cause them" (1939a, p. 68).

In one place, Schumpeter expressed his principal position that

> [regarding] all the fluctuations, crises, booms, depressions ... there is *no single cause or prime mover* which accounts for them. Nor is there even any set of causes which account for all of them ... Any answer in terms of a single cause is sure to be wrong. (1939a, p. 25)

Nowadays this line is followed, for example, by Pérez (2002), who recognises the link under condition that innovations should on no account be considered separately from financial, social and institutional factors. So that "waves are not economic cycles but a much wider systemic phenomenon"; "Nor can prediction be made about the length or depth of the recession"; and that the focus should be "shifted from economic measurement to the qualitative understanding" (Pérez, 2002).

This direction is an example of such an explanation of crisis where innovations figure only as a "victim" of other factors not related to innovations. When expressed in terms of technological wave (TW), this sounds as follows:

> With ... exhaustion of the possibilities of further technological improvement in the life cycle of each TW, a phase of decay sets in ... Further growth ... requires new investment to be channeled to the radically new technologies of the next TW. The latter ... already exist in the form of inventions, R&D results, and

> design documentation. However, their pervasive diffusion is restricted by inadequate socioeconomic conditions… A high level of inertia in socioeconomic institutions leads to prolonged depression. … the growth rates of all macroeconomic indicators decrease… It is only with the implementation of corresponding institutional changes… the economy embarks on a new expansion path of economic growth. (Glaziev, 1991)

So, this version assumes as if radical innovations ready for commercial implementation were almost always at hand, waiting for a crisis to activate them.

In another place, however, Schumpeter left a chance for innovations to be a single prime mover of crisis: "*innovation would suffice to produce alternating prosperities and depression*… Our proposition that innovation… is actually the dominant element which *accounts for those historical and statistical phenomena*, is so far only a working hypothesis" (1939a, p. 143). In addition, his prominent Creative Destruction – which is no more than a bizarre expression for "substitution" and "structural change" – also might be interpreted in favour of the from-innovation-to-crisis causality.

Finally, the Schumpeterian understanding of the connection between innovation and crisis is understood by Fels (2004, p. 9) in the following: "previous innovation must have made possible a great increase in output that imposed hardship – symptoms of depression – on all parts of the economy *unable to adapt to the new conditions*".

We would note, running a bit ahead of the narrative, that innovation could impose hardship even then, when all the parts are able to pursue an ideal policy of adaptation and coordination.

2.5 Real business cycle theory – right idea and wrong tractability

Schumpeter's heritage is deemed to lay the foundations for the real business cycle (RBC) theory, which outwardly connects real fluctuations with technological changes, setting aside monetary and other aspects. Yet, the devil lies in the details and Prescott (1986b) has explained the details in this way (italics added):

- "we follow Lucas (1977, p. 9) in defining the business cycle phenomena as the recurrent *fluctuations of output about trend*

and the co-movements among other *aggregate* time series. Fluctuations are by definition *deviations from some slowly varying path*";

- The RBC theory "*correctly predicts* the amplitude of these fluctuations, their serial correlation properties ... " Moreover, it displays "fluctuations with *statistical properties similar* to those which the American economy has displayed";
- the growth model displays the business cycle phenomena *only then* "when *uncertainty in the rate of technological change* is incorporated into [it]", so that "the *technology shocks ... are ... random variables*";
- "Economic fluctuations are *optimal responses to uncertainty in the rate of technological change*";
- the technological change itself is measured by "*the Solow residual*" also called Total Factor Productivity (TFP).

The initial reasoning for the TFP concept looks rather convincing: if there are no changes in quantities of labour and capital, then all the increase in output should be ascribed to progress, namely, to the said total factor productivity, the "individual" contributions of labour and of capital being deemed zero. But it is not so clear for the case when labour, capital and other inputs are changing simultaneously. Consequently, econometricians and statisticians infinitely elaborate their techniques for this inconvenient but realistic case. However, whichever sophistications might be, this approach still remains essentially indirect and overly aggregated;

- besides, the fluctuations depend on "people's willingness and ability to *substitute consumption and leisure*" (Prescott, 1986a).

The RBC theorists also acknowledge that their method is "highly abstract" and aggregated. Nevertheless, they believe that something "can be learned from such quantitative theoretical exercises" Prescott (1986b). However, the largest learning derived from these stochastic simulations is a stochastic proof of the existence of technological cause in principle, without specifying definite times and figures of the advent of the crisis. So, RBC still seeks the truth in the stochasticities of fluctuations around trend, while the trend itself fluctuates too.

The RBC closely relates to the dynamic stochastic general equilibrium (DSGE) approach – now the main central banks' tool for monetary policy analysis and forecasting. It is astonishing that the DSGE model developed for the European Central Bank (ECB) includes 40 stochastic and deterministic parameters of ten types of shocks introduced to explain only seven statistical macro data time series (Smets and Wouters, 2002).

The seven data are: GDP, consumption, investment, inflation, wages, employment and interest.

The ten types of shocks are: productivity shock; investment shock; labour supply shock; consumer preference shock; government spending shock; price and wage mark-up shock; equity premium shock; persistent monetary policy shock; and temporary monetary policy shock.

Under such an abundance of degrees of freedom, there is no problem calibrating the parameters for any theory. The alternative way of disaggregating and drilling into the data looks more fruitful than piling up a rich variety of parameters over a poor set of data.

2.6 Whether total factor productivity reflects progress

The above-mentioned total factor productivity also serves as a standard statistical measurement of progress. The narrowness of this method may be disclosed on an example of the air transportation industry of the US. It is chosen owing to Duke and Torres (2005), who have provided meaningful verbal descriptions of technological leaps just in this industry. This gives us an opportunity to match these events against the TFP, also called multifactor productivity (MFP).

These authors have noted the tremendous progress in the air transportation industry, over a half-century span, that made airplanes safer, faster and more efficient, as follows:

> In the 1960s, all major airlines were replacing their aging piston-engine types with jet aircraft. ... The introduction of these jet aircraft sharply reduced the time and cost of transporting passengers and freight. ... labor productivity in the commercial airline industry increased at an average annual rate of 7 percent during the 1960s, which was significantly higher than that of the U.S. economy as a whole ...

During the 1970s decade, widebody "Jumbo" jets ... were introduced into service. ... that allowed for more travelers to fly for a lower cost. ... The 1970s also saw the introduction of the second generation of jet airliners, such as Airbus.

During the 1980s, new aircraft were introduced with more powerful but quieter engines.

The most noteworthy commercial aircraft introduced in the United States in the 1990s were those in the Boeing 777 jetliner family ... [it is notable for] large scale use of composites ... and advanced and extremely powerful engines. ... It was designed as a replacement for the early generation 747s; and ... it burns one-third less fuel, and it features 40-percent lower maintenance costs. The development of large turbofan (fuel-efficient) engines during the 1990s is particularly important .... (Duke and Torres, 2005)

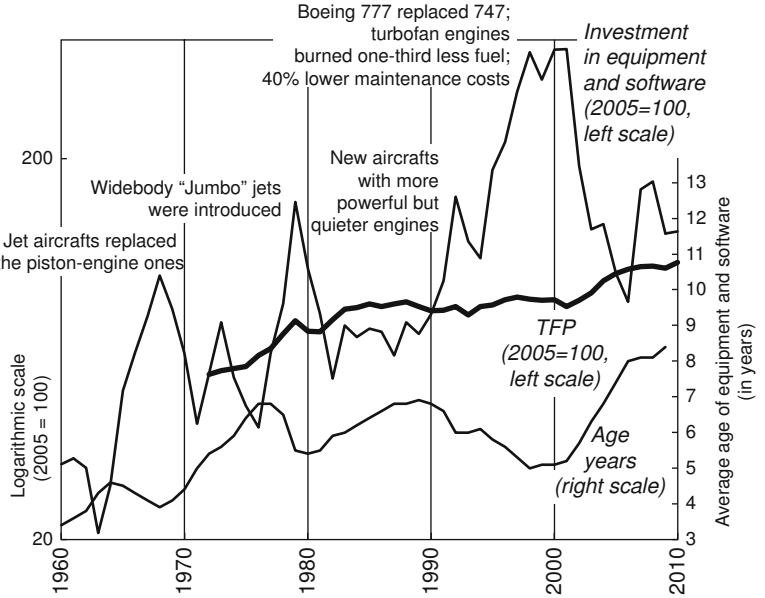

Figure 2.1 TFP reveals overall trend of progress only
(data of air transportation industry of the US, Code 481)

Sources: Indexes of Multifactor Productivity and Related Data, BLS; Chain-Type Quantity Indexes for Investment in Private Fixed Assets by Industry, BEA; Historical-Cost Average Age at Yearend of Private Equipment and Software by Industry, BEA; author's own calculations.

On Figure 2.1, these comments are added to the dynamics of three indicators of this industry: TFP (MFP); investment in equipment and software; and average age of the stock of equipment and software.

As one can see, the two latter ordinary indicators reflect (and signal) the changes in technologies much more clearly than the modern sophisticated TFP. And this is trivial, because in times of radical change, investment intensifies and capital becomes younger due to premature retirement of old capital. Consequently, their graphs are reflection-symmetric.

As for the TFP, it reveals an overall long-term positive trend of progress, not its leaps. Say, the TFP has not "noticed" the changes of 1990s until the 2000s. This is also trivial, because the TFP deals with total capital stock, while dealing with the parameters of new capital and investments opens the way for further insights.

2.7 Fluctuating trend vs fluctuations around trend

The current crisis has aroused some interest to its possible connection with real innovations, and Balaguer (2009) has proclaimed this quite straightforwardly: "Crises ... the inevitable reverse side of the same coin ... the most important moment occurs not in routine innovation, but in radical innovations."

On the other hand, the counter-attacks are not less straightforward. Lord Eatwell declares that "the idea that what happened over the past two years has anything to do with a negative technological shock is nuts. ... It is ludicrous. There is no possible link, but this is what most economics undergraduates in this country are being taught" (Simoney, 2009). Lord Skidelsky (2009a,b) adds that this crisis "left no monuments to human invention, only piles of financial ruin ... The 'creative destruction' theory of boom and bust is no guide to today's economic turbulence".

Ferguson (2010) is sure that "the big academic winners of this crisis have been the proponents of behavioural finance, in which the ups and downs of human psychology are the key" and that the opponents "have failed to learn from decades of economic research on expectations".

Even Pérez (2010) has downgraded the role of technological revolution here to being "directly relevant to financial innovation" only.

The origin of these collisions is that today the connection of crises with innovations is identified just with real business cycle theory.

This confuses the right idea with its poor analytical and numerical tractability and the baby is thrown out with the bath water.

From this point of view, this book upgrades the RBC with incorporation of the fluctuations into the deterministic part of the analysis, into the trend itself. After that, an appropriately modified stochastic part could be added, too, together with the labour-leisure preference as an additional factor. One of the early statistical evidences that that factor does act had been provided by Aftalion (1927), who noticed that "longer hours" of work are typical for the time of prosperity.

Speaking more generally, the book upgrades the existing approaches with an ability to deal with turning points in the economy instead of mere extrapolations and trends.

Figure 2.2 discloses the principal difference between the RBC and this book. The former deals with so-called detrended time series (deviations from exponential trend), being very anxious about the appropriateness of detrending; while the latter directly predicts turning

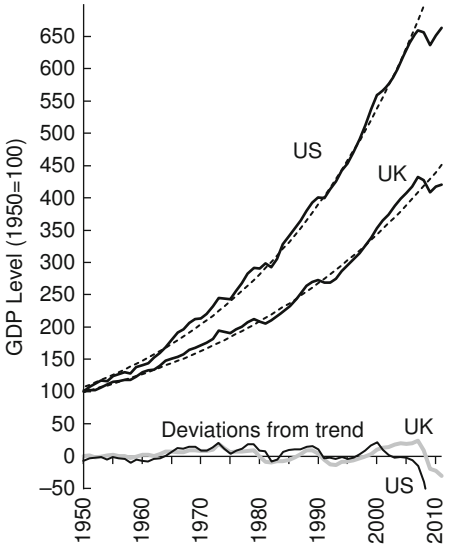

Figure 2.2 RBC deals with deviations from trend, while this book deals with actual turning points

Sources: Office for National Statistics of the UK; Bureau of Economic Analysis of the US.

points in the economy, setting aside any trends completely (together with any potential and natural outputs).

Apart of all this, inventors and innovators themselves have also scrutinised figures like Figure 2.2. For example, Kurzweil (2003, 2013) supports the common wisdom that these are new technologies, which drive the exponential trend of economic growth. In reference to what drives crises, he observes that:

> exponential growth in the economy is a far more powerful force than periodic recessions. Even the "Great Depression" represents only a minor blip compared to the underlying pattern of growth. Most importantly, recessions, including the depression, represent only temporary deviations from the underlying curve. In each case, the economy ends up exactly where it would have been had the recession/depression never occurred. (Kurzweil, 2003)

Here again, the cause of recession is something quite different from the cause of growth. Kurzweil (2003) sees this cause in "excessive commitments such as over-investment, excessive capital intensive projects and the overstocking of inventories"; and tackles it by means of "rapid dissemination of information, sophisticated forms of online procurement, and increasingly transparent markets" (Kurzweil, 2013, p. 247).

As for Kurzweil's crucial question – what would have been "had the recession/depression never occurred" – Field (2011, 2013) answers this a bit more cautiously. He doubts whether the advancements accompanying the Great Depression "would have happened without the Depression" or weren't they the unavoidable "sacrifices … laying the foundation for a better tomorrow?" (Field, 2013, p. 361).

This dilemma will be resolved rather in favour of the latter option.

The urgent need for enhancing the forecasting capacity is shown on Figure 2.3 on an example of poor GDP forecasting and understatement of the true decline in euro area. As can be seen, the decline of 2009 had been "predicted" not earlier than it actually came out. So, in the pre-crisis year of 2007 the official two-year forecast for 2008–2009 was a mere extrapolation of the previous data. By the end of 2008, the forecast for 2009 was a 0.4% decline, while the actual decline was tenfold deeper, by 4%.

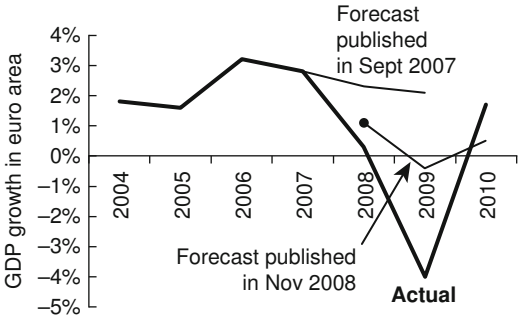

Figure 2.3 The EU forecasting services can hardly deal with turning points
Source: European Commission (DG ECFIN) Macro-economic forecasts.

Under such conditions, crisis forecasting took the form of verbal prophesying and general warnings, for example: "there can be little doubt as to how such a process will end. But that it will end is a certainty, the only question is the exact date of the disaster" (Prasch, 2011).

2.8 Constructive framework proposed

So, the above-mentioned seminal ideas and examples of Ricardo are taken as a starting point evolved into a constructive framework – a practical framework sufficient to catch output and employment declines and other turning points in the economy numerically.

This framework comes down to the following principles:

- A holistic coverage of all technologies in all industries, without missing even the ones not innovative at all (in contrast to the focus on the general purpose and cutting-edge technologies only);
- Direct measurement of progress in terms of explicit parameters of new technologies against old ones (in contrast to the total factor productivity and other indirect measurements);
- Reflection of a worker-workplace coupling (in contrast to an arbitrary combining of labour and capital in Cobb-Douglas);
- Focus on attention both to the first and subsequent steps of transition from the old to the new (in contrast to an artificial separation of the short and long runs considered as autonomous disciplines);

– Taking into account heterogeneity (non-uniformity) of producers (in contrast to the "homogeneous" economic theories dealing with average working conditions);
– Taking into account that physical retirement of fixed capital takes place after the elapse of its lifespan (in contrast to confusing it with financial depreciation, as if capital began to vanish just immediately after its installation); and
– Consideration of balanced growth paths of the whole economy under joint action of all the innovations, and making a choice of, in some sense, the most rational path.

This last step gives an answer to the central question, whether all the paths to the better go through an unavoidable starting recession; that is, whether there is a recession-fraught or recession-free technological leap.

The peculiarity of the current state is that each of the principles of constructive framework already features in various quantifying methods, not being put together yet.

Say, Leontief's (1966) approach does reflect the worker-workplace coupling but measures progress indirectly as a gradual improvement of average characteristics of industries from year to year. Even the further sophistication, that prescribes for changing coefficients to change along an S-shaped trend, still deals with the averages and does not put them altogether aside. This misled to an over-optimistic conclusion that "the economy is able to achieve a smooth transition from the old to new technologies" (Leontief and Duchin, 1986), while we would rewrite this in a more sober way: sometimes the economy is unable to achieve a smooth transition.

On the other hand, Solow (1960) has underlined the importance of direct measurement of progress that evolved into the vintage capital growth theory. But the latter is infected by the Cobb-Douglas technological function incapable of reflecting the worker-workplace coupling.

It is little known, that notwithstanding the term "Solow residual" – the method of indirect measurement of progress – Solow has, in fact, formulated the principle of direct measurement. At that, he also criticised against attaching an exaggerated importance to disembodied innovations:

> The striking assumption is that old and new capital equipment participate equally in technical change. This conflicts with the

> casual observation that many if not most innovations need to be embodied in new kinds of durable equipment before they can be made effective. Improvements in technology affect output only to the extent that they are carried into practice either by net capital formation or by the replacement of old-fashioned equipment by the latest models, with a consequent shift in the distribution of equipment by date of birth.
>
> My objective is … to make allowance for this aspect of reality. (Solow, 1960, p. 91)

An additional just criticism from Boucekkine et al. (2011) is the following:

> Traditional aggregate productions functions are built on the assumption of homogenous capital in the sense that all capital goods constituting the operating stock of capital have the same … contribution to output. In particular, new and old capital goods contribute equally in conveying technical progress within the neoclassical paradigm … Such a view of capital denies de facto any connection between the pace of investment and the rate of technological progress.

But the only fly in the ointment is that the leap-like pattern remains lost: "technological progress operates as a steady improvement in the quality of [new] machines" from year to year (Boucekkine et al., 2011).

Under such an assumption "the economy converges to a unique balanced growth path" (Ibid.), not to a unique upper ceiling. This also misled these theorists to an over-optimistic conclusion about the everlasting new economy and new growth regime.

The Cambridge Multisectoral Dynamic Model (MDM) of the British economy, developed and maintained by Cambridge Econometrics (CE), see Barker and Peterson (1987), also measures progress directly. It deals with a "precise description of capital equipment" where "capital is given an explicit empirical content" (Barker et al., 1995). And even more than that, MDM theorists have outwardly proclaimed that their approach "can handle explicitly technical change" (Barker and Peterson, 1987).

But all this is used for better projecting of the improvement of the ordinary average coefficients and the MDM still projects the changes "following past trends and discussions with industrial experts" (Ibid.). Or more precisely, the projections "are based on the supply and use tables drawn from official sources and incorporate CE's view on expected technical and other changes" (Barker and Foxon, 2006). So it looks like the addiction to tradition has not been altogether overcome thus far.

Thus, "the idea is in the air" and it is proposed to put forth the final touches. The working of the constructive framework is demonstrated in the next chapters.

3
The Innovations-Related Cause of Crises Confirmed by the Prototype Economy

Notwithstanding the simplicity of the example considered, it is a move away from a narrow focus on innovations only to a wider context of their implications for overall functioning of the economy.

3.1 Global fisher folk of the twenty-first century

3.1.1 Statement of the problem

Apart from the examples of Ricardo (1821) mentioned above, Roscher (1854) proposed his example of the starting accumulation hardships and further gains of one clever individual from a nation of fisher folk who had found out an invention. Then Böhm-Bawerk (1884) added some specifications to it and it took the following form.

Suppose a nation of fisher folk dwells naked in caves and lives on fish caught by hand in pools left by the ebbing tide, each man catching and eating three fish per day.

One day, one clever savage has invented a boat and net affording to catch 30 fish a day.

However, making a boat and net requires 50 days of labour, and this boat and net lasts for 100 days.

Roscher, then Böhm-Bawerk, had analysed the variant when the inventor limited his consumption from three to two fish per day for 100 days, keeping a stock of 100 fish, which was made use of during the 50 days in which he made the boat and net.

All this was resorted to for those time disputes about legitimateness of interest on capital. These authors had not traced the further overall diffusion of that innovation throughout the economy; and the simple truth, that the hardships of the starting accumulation of innovation are, as any hardships, a synonym of crisis, remained out of their sight. They judged crisis to be quite a separate issue, and according to Böhm-Bawerk, crises as such "have no other cause than that quantities of products ... cannot find the value expected" (Böhm-Bawerk, 1884).

Now this example will serve well for settling contemporary disputes about impact of real innovations on crises. In order to create an overall context, let us specify further that the total labour force numbers 150 men/workers and this quantity remains constant. Consequently, the total catch under the old technology is 450 fish per day.

For short, the boat and net in the story will be referred to as "net". Then, let us assume a simplicity, not simplifying the results, that nets and people are continuously divisible.

Say, 1 man produces 0.02 (1 / 50) nets per day, and the next day 0.02 men equipped with these nets catch 0.6 (0.02 × 30) fish. If it is talked about the first starting day of the transition, then in this first day the total catch would decrease by three fish, from 450 to 447 fish, because 1 man left fishing for netting.

Or 50 men can produce 1 (50 / 50) net per day, by which 1 man then catches 30 (1 × 30) fish per day. On the first starting day, this would decrease the catch by 150 fish, from 450 to 300, or a contraction of 33%, because 50 men left fishing for netting, and so on.

First of all, let us determine the steady state (stagnation, upper ceiling, stationary state, state of circular flows, fixed state, final stage, rest point, levelling off, cyclical equilibrium, simple reproduction, maturity, saturation, capacity of innovation) of the fisher folk economy after full materialisation of all the potential opened by the productivity leap. Such a unique balanced state is as follows:

– 100 men, each equipped with a net, work in fishing and catch together 3000 fish per day. Previously all the labour force of 150 men caught by hand 450 fish, whereby both structural and productivity changes can be seen;
– overall consumption per head: 20 fish per day (3000 / 150);

– 50 men (33% of labour force) work in production of an investment good, producing 1 net per day that serves 100 days. These men moved to netting from their previous occupation in the by-hand fishing;
– capital stock: 100 nets;
– capital retirement because of wear and tear: 1 net retires each day, being replaced by 1 net produced, so that the investments are a simple supporting of the capital stock;
– labour productivity in the fishing industry: 30 fish per day;
– labour productivity in the netting industry: 0.02 nets per day;
– increase in average nation's welfare: plus 17 fish per head per day. (20–3)

But to attain this new welfare, 100 nets must be accumulated beforehand. At that, in contrast to the uniqueness of the final state, the transition paths to it are not unique at all and depend on the intensity of accumulation (investments). Such spectrum of feasible balanced dynamics is shown on Figures 3.1–3.5, of which Figures 3.2 and 3.3 display the phase of the starting recession from Figure 3.1, in expanded views; and Figures 3.4 and 3.5 provide the possibility of looking beneath the aggregate total fish catch.

3.1.2 Overall slumping S-curve

The most plausible transition is through the *gradual replication* expressed here as an entrance of one replicator per day, that is, an entrance of one man in the netting industry per day (the path numbered "5" on the figures).

The starting period of this path is shown on Figure 3.3. In the first day of the transition, the total fish catch declines due to the loss of three fish previously caught by the person who has now switched to net making. In the next days, the decline proceeds because the catch by the nets already produced is still less than the corresponding loss of by-hand catch. At last, on the seventh day, a turnaround takes place and the phase of growth proceeds ahead.

Apart of these turns into the starting recession and subsequent turnarounds, there are other turning and inflection points of further development.

The inflection point comes when all labour has been drawn out of the old technology and the old production stops altogether. Let us call it a "point of elimination of the old". A round sign on the graph on Figure 3.1 marks it, the other paths being marked likewise. This point

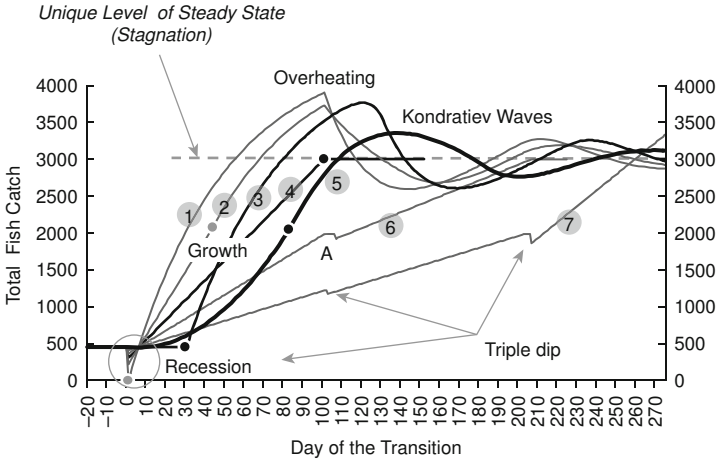

Figure 3.1 Spectrum of the transitions to higher level of welfare

Notes: (1) "Extreme exceeding" path: whole nation switches to the investments in new technology from the very beginning; (2) "Moderate exceeding" path: at the beginning, investments are higher than at the steady state but lower than at the extreme; (3) "Inventor's monopoly" path: only the inventor switches to this and reinvests all his profits; (4) "Steady" path: investments are just equal to their volume at the steady state from the very beginning; (5) "Gradual replication" path: every day, one more replicator switches to the new technology; (6) "Double dip" path: investments are lower than at the steady state; and (7) "Triple dip" path: even further intensification of investments still is lower than at the steady state.

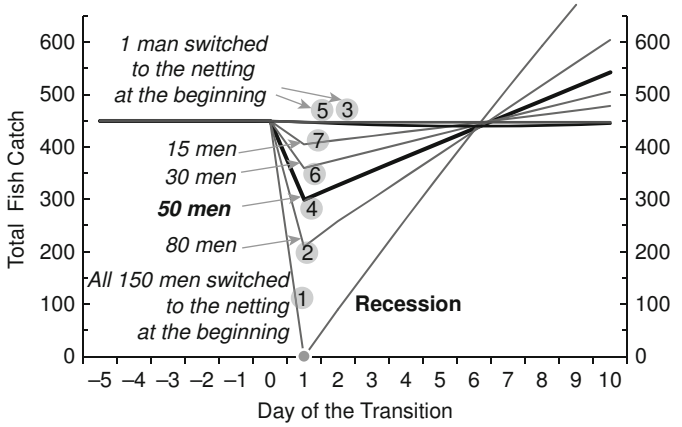

Figure 3.2 The more intensive investments, the deeper starting recession then rewarded with more speedy growth

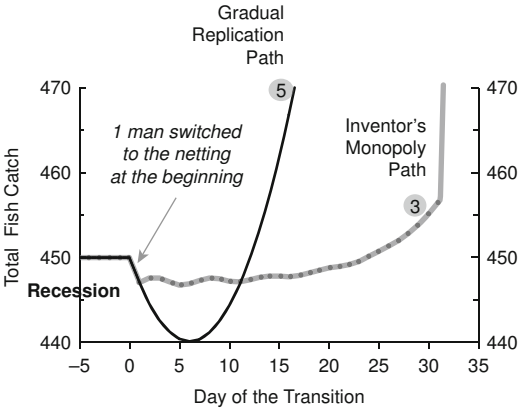

Figure 3.3 Close-up view of the shallow recessions not discerned on Figure 3.2

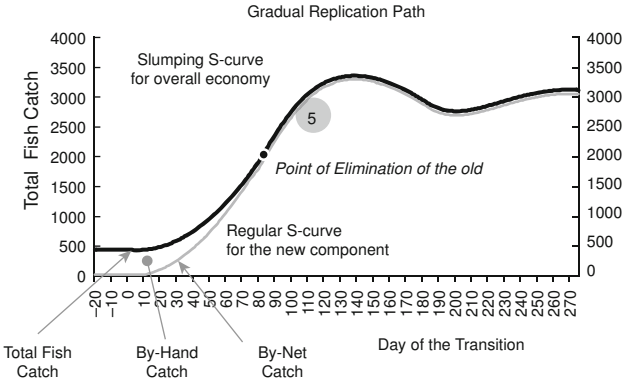

Figure 3.4 The old and new components beneath aggregate total fish catch (for the "gradual replication" path)

of elimination also shown in more detail on Figure 3.4, where the total fish catch is split between by-hand and by-net components.

But the elimination of the old does not obligatorily mean that the emerging modernised industries are already duly coordinated and the required capital stock is already accumulated. Specifically, on this crucial day, the by-net fishing numbers 68 men, equipped with the stock of 68 nets too, of course. The rest of the workers numbered 82

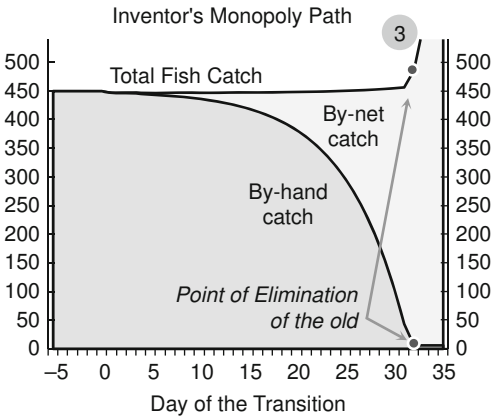

Figure 3.5 The old and new components beneath aggregate total fish catch (for the "inventor's monopoly" path)

(150–68) are engaged in the netting industry. After that, the growth goes on not by virtue of the resources of old economy but by structural adjustments within the new economy, the latter providing less speedy growth.

The point of elimination also signifies the end of exponential growth that began after the turnaround from the starting recession. A common notion of healthy and booming growth is related just to this period of investing in substitution of the old by the new. It suggests that an actual exponential trend is a sequence of such initial fragments of cycles from the sequence of more and more advanced cycles that supplant each other in the middle of their spans.

It could be also added that, if applied to capitalism, a "capitalist accumulation" just means such process of accumulation of new capital, enough to equip all the labour. And a "limit of capitalist accumulation" arises when there is no more labour to run the accumulated capital.

All the following after-elimination period pertains to an asymptotic growth gravitating towards stagnation, thereby containing its own inflection and turning points too.

The "point of elapse of service life" comes when the service lives begin to elapse and the nets begin to retire, that is, it comes after 100 days of operation of first nets produced in the first day of transition. After that, the output of nets begins to outflow for the

replacement (at least partly), whereby causing further deceleration of growth up to contraction. Such "point of contraction" comes when the nets retired exceed the nets produced.

From this can be seen the outstanding feature of the whole previous pre-elapsing period when all the nets completely went for the accumulation without any retirement. This created a possibility of temporary soaring over the level of steady state. Yet such soars cannot hold for a long time, being cut down by the subsequent outset of capital retirements. Then the economy eventually passes to a wave-like convergence to the steady state where the wavelength is approximately equal to the service life of a net.

All this expresses the phases of overheating (overinvestment) and of Kondratiev long waves (see Figures 3.1 and 3.4).

It is important to note that some of the dynamics of by-net catch (of diffusion of the new technology) shown on Figures 3.1 and 3.4 display a very typical S-shaped form. The substitutions of steam for sail, cars for horses, fibre optic for conventional communications followed this pattern, to name a few. In the input-output domain, the dynamics of technological coefficients in farming, manufacturing, energy and service sectors also exhibit this "S" type (Pan and Köhler, 2007).

Walk (2012) even proposes to take this fundamental shape for granted and reduce the forecasting of diffusion of innovation to calibration of the parameters of logistic equation of S-curve. But this dubious proposal looks as if astronomers searched for the best equation of an ellipse instead of the underlying law governing the orbits. Moreover, there are some exceptions , as well. Yet, the S-shape is still exogenously imposed on the changing input-output coefficients, see Pan (2006), Pollitt et al. (2014).

So, in addition to the theory of technological evolution, our analysis has endogenously generated an S-shaped curve of the spread of an innovation without any exogenous imposition of such a shape. This is achieved due to moving away from a narrow focus on the innovations only to a wider context of their implications for overall functioning of the economy.

Consistently, together with a specific S-curve for a specific innovation, it is also generated an overall S-curve for a whole economy, noted for an irregular form, that is, it declines (slumps) at the beginning and fluctuates at the end (see Figures 3.1, 3.3 and 3.4). This is because, although it is a necessary truth that innovative products and

technologies as such should grow from the very beginning, it does not necessarily hold for the non-innovative ones and for an overall total output.

An irregular slumping S-curve achieved here is distinct from the traditional notion of regular overall S-curve known under various names as metamorphoses of industrial evolution by Mensch (1979); or as systemic cycles of accumulation by Arrighi (1994) or as technological surges by Pérez (2002); or as sequence of lead technologies by Stackelberg (2009).

These are intuitive stylised pictures of sequences of the letter "S" depicting the eras of the history of economy, but with no quantification.

Kurzweil (2001), relying on universality of the "S" shape both in nature ("evolution through DNA-guided protein synthesis") and society, proposes a universal Law of Accelerating Returns. His description of the working of this law for technological evolution is the following:

- A specific paradigm ... provides exponential growth until the method exhausts its potential. When this happens, a paradigm shift (a fundamental change in the approach) occurs, which enables exponential growth to continue.
- Each paradigm follows an "S-curve", which consists of slow growth (the early phase of exponential growth), followed by rapid growth (the late, explosive phase of exponential growth), followed by a leveling off as the particular paradigm matures.
- During this third or maturing phase in the life cycle of a paradigm, pressure builds for the next paradigm shift.
- When the paradigm shift occurs, the process begins a new S-curve.
- Thus the acceleration of the overall evolutionary process proceeds as a sequence of S-curves, and the overall exponential growth consists of this cascade of S-curves.
- The resources underlying the exponential growth of an evolutionary process are relatively unbounded. (Kurzweil, 2003)

As for the question, how this technological evolution drives overall economic evolution, including crises, Kurzweil confines himself to a general assertion that "exponential growth in the economy is a far more powerful force than periodic recessions" (Ibid.).

Allowing for the notion of an irregular slumping overall S-curve, derived from the above analysis, now we have an opportunity to come down from the generalities to particulars. Preliminarily, it is worthwhile to notice the curious attempt of Andersen (1999, p. 6) to save a regular S-curve from the "irregular" empirics. In his conceptual framework the "Instances of negative growth [are simply] disregarded from the statistical analysis".

So, an exponential trend of economic evolution driven by innovations is a cascade of initial exponential-like fragments of overall S-curves. Each such curve corresponds to a cycle of innovative development under certain technological paradigm. And such overall curves/cycles can be either slumping or not-slumping (recession-fraught or recession-free) ones.

At that, each overall curve/cycle, as a rule, reaches only part of its span, being supplanted "ahead of time" by the next technological leap (next paradigm shift) from the sequence of leaps.

Figure 3.6 shows an effort to divide actual growth paths into such parts or entireties of overall curves/cycles, together composing the

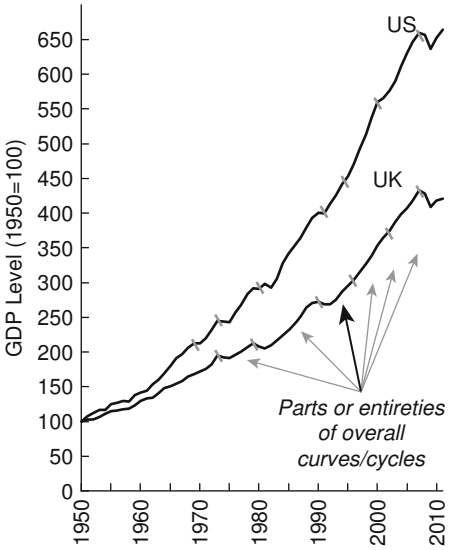

Figure 3.6 Division of the actuality into slumping and not-slumping (recession-fraught and recession-free) initial fragments of overall S-curves

process of eternal development. It should be also noted that the exponentiality of these actual paths is additionally reinforced by the exponentiality of population growth.

To console those who are dubious about the universality of S-shape, for example, Button and Drexler (2005), all the other paths examined in this chapter look like S-shaped ones not so closely.

3.1.3 Multiple paths to a single finish

Now let us consider a less practically plausible but theoretically interesting path number "3" – the *monopoly of inventor* – when all the replicators are kept out and the inventor invests himself only and reinvests all his profit in the new technology.

At the beginning of this path, the total fish catch is bouncing along the bottom of a shallow recession, which is even not as deep as in the previous variant (see Figure 3.3). But beneath this stability of the aggregated total there is an intensive shifting of labour out of obsolete by-hand fishing, so that the emerging by-net fishing hardly compensates the loss of output of old technology. Figure 3.5 displays the details of the vigorous structural change in this initial period. Finally, the novelty takes the lead and the economy skyrockets, then segues into the phases of overheating and Kondratiev waves (see Figures 3.1, 3.3 and 3.5).

In fact, the inventor really can reinvest absolutely all his profit until he has created the new economy; for after that, there is nowhere to invest. This evokes issues of income redistribution and the like.

A joint feature of the two paths analysed above is that the intensity of investment (labour employed in investment-good production) substantially varies from the very beginning. Now we shall consider an exceptional transition path that starts and finishes at a constant intensity of investment.

It is the *steady path* numbered "4" where labour in the netting is equal to that at the unique balanced steady state, namely, to 50 men. This provides a straight linear growth of the stock of nets broken at the point of elapse. Afterwards it passes to the horizontal steady state of the capital stock without any prior fluctuations. For this path, the point of elapse coincides with the point of elimination.

Total fish catch is a broken line, as well, with the difference that it goes through the starting recession of minus 33% (see Figures 3.1 and 3.2).

Notwithstanding that the steady path consists of straight lines and has escaped final fluctuations, this does not necessarily mean that it is the most rational, golden path. Above all, it is a borderline or a threshold, because all the paths exceeding this threshold experience the fluctuations. On the other hand, the paths, in which investments fall behind the threshold, do not attain the steady state at all. For the attainment, they must intensify the investments and go through double, triple or even more dips.

The path numbered "1" (Figures 3.1 and 3.2) is of the *extreme exceeding* over the steady path. It takes place when the whole nation of 150 men switches to netting (to investment in implementation of new technology) from the very beginning. For this path, the point of turnaround to growth coincides with the point of elimination. As to the point of elapse, it puts an end to the overheating, abruptly turning the economy down to the phase of waves. Within this example, it is the path of maximal total consumption.

In the *moderate path* numbered "2" the investments initially are constant, being higher than on the steady path but lower than on the extreme path (specifically, the netting labour is taken equal to 80 men). As distinct from the steady path, such paths are unable to keep up their constant intensity of investment for eternity and after the moment of elimination of the old, they begin to ease up the intensity and converge to the steady state.

On another extreme are the paths numbered "6" and "7" that show the situations of under-investment, when investments fall behind the threshold intensity. Then the development stops on "halfway" or "inferior" steady state where the level of the economy is lower than the upper ceiling; and at such an "equilibrium", if it may be called so, some share of the old technology still remains.

In the *double dip* path 6, the labour in netting initially is constant and equals 30 men. Consequently, the economy stabilises on an inferior steady state (see the flat segment on this path marked "*A*" on Figure 3.1) where the stock of nets amounts to 60 nets equipping 60 men; while the rest of the 60 men (150-30-60) continue to practise an obsolete by-hand fishing.

To proceed with growth, investments are to be intensified, causing one more recession. Figure 3.1 shows such further intensification with the second recession (dip) when the labour in netting jumps from 30 to 50 men, so that in this variant the economy experiences a double dip of 20% and of 3%.

In the *triple dip* path 7, even the intensification after the first inferior steady state is insufficient. The three dips on this path in combination with the subsequent growths correspond to the labour in netting that amounts to 15, 30 and 70 men, respectively, and the depths of the dips are 10%, 4% and 6%, respectively. Note, that the Solowian approach does not distinguish inferior and unique steady states and considers them as multiple steady states of the same kind.

Altogether, Figures 3.2 and 3.3 illustrate the case of innovative development of a whole economy when the starting recession is unavoidable. It is called a "recession-fraught innovative situation" as opposed to a not very happy notion of "negative technological shock". A simple law here is: the more intensive the starting investments/accumulation, the deeper the starting recession then rewarded with faster growth.

Hence, the known trade-off between consumption and investment is further precise here in the trade-off between harder starting accumulation hardships and more plentiful subsequent reward. Say, the gradual replication path (numbered "5" on Figures 3.1 and 3.2), where the starting recession is pretty thin on the ground, takes twice as long to double the pre-crisis welfare than the steady path ("4") where the depth of the starting recession is 33%. And the gradual path takes even three times as long as the path of maximal total consumption ("1") of the deepest starting recession.

Many pungent sarcasms have been lost upon the explanation of personal wealth of the Rothschilds and Vanderbilts by their abstinence and savings hardships. Nevertheless, this is quite right for the wealth of such a "person", like society as a whole.

Since the state has some possibilities to influence the level of savings through "forced savings" and other instruments, the process of development is to some extent manageable – the depth of unavoidable crisis being manageable too. This will be considered later.

Let us also make some other notes.

The gradual replication path and other paths of relatively slow growth are typical for the developed economies, which are the first to introduce innovations and do it cautiously, while the catching-up economies grow more rapidly, relying on already proven innovations. In addition, they have chances to mitigate their starting recessions through foreign investments (advantage of backwardness).

Although the bust-boom vs boom-bust question looks like a chicken-and-egg one, the carried-out analysis of a business cycle driven by innovation has backed up the both of them. The bust-boom sequence is

attributed to the phase of the starting recession, while the boom-bust one is attributed to the downswing from overheating and overinvestment.

The way to distinguish these two is the following. The starting recession takes place under technological leap, that is, at a substantial difference between old and new technologies; while in the case of overheating, there are no such leaps and differences. This is simply because the old is already absent and only structural change, adjustment and coordination within the same technological system take place. The same holds for the downward phases of Kondratiev waves.

So, Juglar (1862) was halfway right, when explaining the boom-bust sequence by overheating and overinvestment; this is indeed, in principle, possible, but it is very unlikely that it actually takes place in the current and previous modern crises.

This example could be further expanded with an invention of a steamboat, which may be either a recession-fraught or recession-free one. For the latter, it is enough to imagine that for making a steamboat, the same efforts are required as for making a net.

Such example could also reflect technological/structural unemployment, if one would further imagine that a steamboat be run, say, by 0.5 men per steamboat, instead of 1 man per boat.

And then, over and above, if the steamboat would be invented somewhere in the middle of the previous cycle driven by the invention of a boat and net (that would be much better for the folk), then the development would contain only an initial fragment of that full cycle, and the phase of stagnation would be avoided, and so on.

It is easy to build many other such examples based on the constructive framework (see Ryaboshlyk, 2000a,b, 2002, 2003, 2004). Analogous examples with separate and explicit new and old technologies, although with a continuous "bookkeeper's" physical retirement of capital and continuous time, are considered by Rainer (2013) and Strohmaier and Rainer (2013).

3.2 Fisher folk economy vs Solow economy: golden path vs golden rate

Crisis analysts would explain the Great Recession in fisher folk country described above in many disparate ways:

– as a decline in aggregate demand, that is, because population massively went off its fish diet, or went on hunger strike;

– as ups and downs of human psychology;
– as a response to uncertainty in technological change;
– as a from-work-to-leisure shift;
– as a consequence of monetary shock;
– because products cannot find the value expected; and so on.

Here is everything but sometimes society is bound to sacrifice current production of consumption goods for the sake of the future. Now this version is adequately quantified through the explicit measurement of technological leap, worker-workplace coupling and other key points of the constructive framework.

And in addition to the explanation of crises, this has integrated together the short and long runs. It was also achieved spontaneously and endogenously as an outcome of innovative development path. Meanwhile, the tradition still considers the simultaneous analysis of fluctuations and trend as a complex and seemingly intractable task. "[T]his decisive problem of combining short-, medium-, and long-run macroeconomics ... still has not yet been solved, and probably will not be solved in the near future", states Hagemann (2009). It seems that this "near future" has already come, at least, regarding short and medium runs.

Now let us examine what the fisher folk economy would look like through the lenses of the Solow (1956, 1957) economy, the main representative of the long-run analysis. Since the labour force of fisher folk is constant (of zero growth rate), it will be an analysis of an essentially intensive growth where the growth of the economy is identical with growth of productivity.

Solow justly criticised his predecessor Harrod (1939) for taking into consideration only the capital, omitting the labour[1] and for fixed proportions:

> the crucial assumption that production takes place under conditions of *fixed proportions*. There is no possibility of substituting labor for capital in production. (Solow, 1956)

[1] The predecessor of Harrod was Marx (1878) with his expanded reproduction schemes infinitely growing by capital accumulation. This implied some infinite source of labour to run that capital.

But Solow rushed into the other extreme of arbitrary proportions. Consequently, the factor of labour was introduced in the way that had decoupled worker from workplace.

For Solow and his disciples, the more nets per fisher, the higher the catch, so that a fisher with a net in each of his hands (and with a boat under each foot) would catch more than when he was equipped with just one net (one boat) as previously.

The steady state (in the sense of stable capital stock when investment equals retirement) for this proportion of two nets per fisher is certainly different from the main variant that has been considered at the beginning, and now it is as follows: capital stock of 150 nets, 75 men in by-net fishing and 75 men in netting producing 1.5 nets a day.

For the proportion of four nets per fisher such Solowian steady state would be: capital stock of 200 nets, 50 men in fishing and 100 men in netting.

In the case of the lower proportion of 0.5 nets per fisher, the steady state would be: capital stock of 60 nets, 120 men in fishing and 30 men in netting.

All this is to show the principal difference between the Solowian arbitrary steady states and the fisher folk unique steady state. In the Solowian version, the intensity of investment determines the level of steady state together with the path to it. While in the fisher folk one, all the paths gravitate to a unique steady state determined by the parameters of new technology(ies).

This is because the fisher folk economics provides the substituting capital for labour within the context of substituting new technology for old. At that, fisher folk has fixed the problem of *fixed proportions* without complete rejection of the proportions as such; namely, by an explicit reflection of the fixed proportions required by old and by new technologies respectively.

Altogether, it was a historical bifurcation from Harrod's line into the fisher folk retention of fixed proportions and Solow's rejection of them; the former being the way of more details and less aggregation.

Another feature of the Solow theory is the diminishing returns to capital accumulation. In relation to the above instances, this means that an insignificant increment of nets added to four nets per fisher would cause lower increase in productivity than when added to two nets per fisher, and so on. Finally, it creates a Solowian slowing growth path.

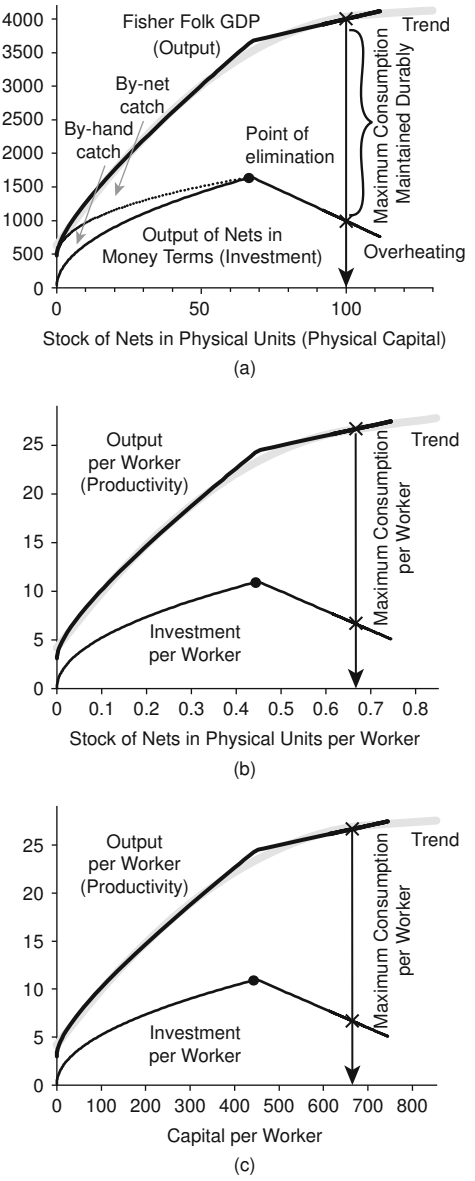

Figure 3.7 Mirage of diminishing returns and arbitrary proportions emanated by aggregation ("gradual replication" path replotted from Figure 3.1)

For a wonder, the fisher folk economy generates slowing growth paths and arbitrary capital-per-worker proportions, notwithstanding that it consists of technologies of constant returns to capital accumulation and of fixed proportions. Such are the metamorphoses worked by an aggregation. Figure 3.7c demonstrates this on the typical Solow "capital per worker – output per worker" panel for the case of gradual replication path.

In order to create Figure 3.7, Figure 3.1 is appropriately replotted (the time picture is replaced by the picture of dependence on capital; output of nets is added to output of fish; and money measurements are incorporated). Figures 3.7a and 3.7b show intermediate steps to the established typicality, of which Figure 3.7a displays gross domestic product (GDP) of fisher folk in constant prices as a variable dependent on the stock of nets.

At that, a fish is accounted as a proxy for money and the price of a net is 1000 fishes, so that, say, in the unique steady state, when the output of nets is one, the value of investment amounts to 1000 fishes, consumption to 3000 fishes and total GDP to 4000 fishes.

The short interval when the stock of nets exceeds 100 and consumption temporarily exceeds the steady level corresponds to the phase of overheating.

As one can see, the fisher folk output curve and its trend might be used as a good Solow's production function with diminishing returns to capital accumulation and with arbitrary capital-per-worker proportions.

But this is only a semblance, a mirage of diminishing returns emanated by aggregation. The point is that, even when old and new technologies are of constant returns and of fixed proportions, their mix (where all aggregated output is credited to all aggregated capital stock, and all capital stock is credited to all labour) exhibits diminishing returns and arbitrary proportions. Such gradual smoothness emerges from the gradualness of the transition, notwithstanding the abruptness of the leap.

Thus, the ignoring of the fact that an intensive growth is underlaid by interplay of new against old has misled to false imagination that capital accumulation per se boosts productivity.

A portion of the blame for this delusion might bear statistical authorities supplying the researches with just such aggregated data.

Meanwhile, economic theory had long ago criticised this dumbed-down perception, because the true generator of intensive growth is innovation and such growth is halted by an exhaustion of opportunities to invest in the implementation of new technologies. "[The] increase of national capital ever does ... proceed, unless in conjunction with some successful effort of the inventive faculty" (Rae, 1834, p. 22, hailed by Brewer, 2010). Another author, Korres (2012, p. 106), likewise writes, "Higher rates of gross investment could raise the rate of growth of productivity by increasing the rate of substitution of the old by new capital." As to the actual, not seemingly, diminishing returns, they are related to an extensive growth with unchanged technology.

This self-evident axiom casts doubt on the very notion of production function. Within this context, Solow took a step backward about the theoretical basis of his framework. Here again, as in the case with S-shaped curve, science tries to formalise a curve visible on the surface, remaining blind to the underlying processes governing it.

Consequently, a logical contradiction has emerged: capital accumulation alone provides an intensive growth of diminishing returns, but the diminishing returns are intrinsic to an extensive type of growth not connected with progress.

This contradiction has been fixed by proclaiming the basic production function to have nothing to do with any progress at all (an incredible growth where there is neither technological change nor growth of population). As for progress as such, it is introduced in the Solowian framework as an additional multiplier to that production function. So, the aggregation has buried the underlying progress, as well, and science theorises how technology shock shifts production function, while this function itself (as shown on Figure 3.7c) is an outcome of a so-called technology shock.

Now let me draw your attention to one more fallacy of Harrod's (1939) approach overlooked by Solow; and not only by him, namely, to the equating of physical retirement of capital with financial depreciation. In spite of the evidence that capital, as a rule, retires entirely in the moment of the end of its service life, the dominant assumption is that capital starts to "melt away" physically already from the moment of the start of its service. That is, retirement equals capital stock divided by service length.

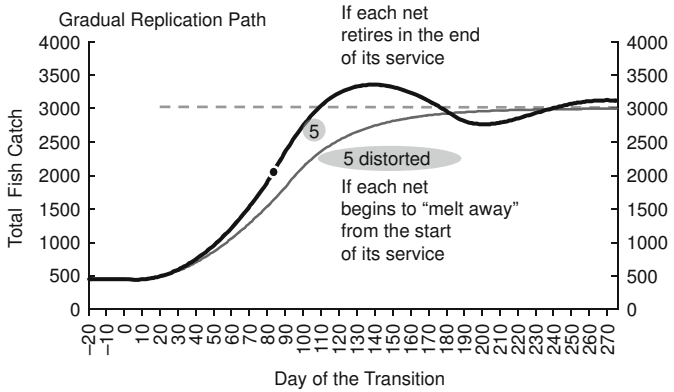

Figure 3.8 Distortions by the false reflection of physical retirement (on the "gradual replication" path from Figure 3.1)

Figure 3.8 shows the distortions caused by such a bookkeeper's view on the physical retirement on an example of the gradual replication path. This path becomes much smoother if the total stock of nets is being deducted by 1/100th each day from the very beginning.

So, this technical minutia has deprived whole economics from a good deal of fluctuations, and the researchers have to resort to various additional shocks to force their artificial economies to fluctuate. Moreover, this minutia immensely understates the level of output, especially the long-term level, and this is when these schemes are intended especially for the long term.

Altogether, we have the case when an aggregation not merely simplifies the truth but distorts it. The mistaken imagination that capital accumulation alone would create intensive growth has in turn accumulated a pile of further erroneous notions. These are as follows:

1. For Solow, the multiplicity of intensities of investment means the multiplicity of possible steady states that calls forth an artificial problem of golden savings rate maximising consumption. While in fact, the maximum of consumption is a trivial one determined by full and balanced implementation of the new technology(ies) (see Figure 3.7). Thus, instead of the golden rate, there is a real problem of golden transition path to the unique steady state (see Figure 3.1).

2. The notion that any constant intensity of investment could keep its constancy all the time. The Solowian theorists attach great importance to constant growth rate and to the existence theorems for a non-existing economy. While, in fact, all the paths to the unique steady state eventually deviate from the constancy (with the exception of the steady path, of course). At that, the substantially different rates of savings required at different phases of cycle reflect on another false belief, the belief that inert private savings would be accordingly quick to supply the technical need in investments automatically.
3. Very smooth development paths generated by the Solow framework lose from their sight the turning points of the starting recession, of turnaround to growth, of elimination, of elapse, and so on. Aggregation has also lost the identity of a steady state and the cycle's phase of stagnation.
4. Arbitrary capital-labour proportions lose the critical situations when there is no labour to run the accumulated capital, or no capital to be run by labour (the latter means technological, structural unemployment). Besides, the arbitrary proportions call forth the notion of constant elasticity of substitution and all the like. While, in fact, the case is about substitution of technologies by other technologies.
5. The imagination that capital accumulation has nothing to do with progress calls forth a too rough measurement of progress by the Solow residual, also called total factor productivity.

It must be acknowledged that the Solow framework already catches a consumption decline caused by an intensification of investment/saving for the sake of the future; but the truth that this already implies a crisis still remains overlooked. For example: "The increase in the saving rate … causes an *immediate drop in consumption* … Over time … [there will be] a higher level of consumption" (Mankiw, 2010; italics added).

Here but one plank divides from the logical deduction, first hinted at by Ricardo: if innovations necessitate an intensification of investment, they necessitate a temporary crisis too.

Before concluding this chapter, it remains to indicate once more that (1) the presented case of a mirage of diminishing returns does not imply that actual diminishing returns do not exist at all; and (2) it

was considered the simplest leap where the old and new technologies are of constant returns to scale; that is, within each of these groups all the producers are homogeneous. More complicated instances of separate heterogeneous continuums corresponding to new and old technologies will be considered later.

4
The Innovations-Related Cause of Crises Confirmed by the Concrete Economy

4.1 Where are the data? (What are the technologies the gross capital formation forms?)

This question sounds the most awkward when posed by those whose faith relies on the "data" not existing at all. In the meantime, each manager knows the parameters of his new and old equipment much better than the marginal product of his last labourer. So, technological leap is open for measurement at micro level and thereupon at industry level too. In other words, an explicit data on what technologies are coming into the economy along with investments (or what technologies the gross capital formation component of national accounts forms) objectively exist and it remains to dig them out.

An important role here belongs to the recently emerging micro-databases whose motto, as it is formulated by McGuckin (1995), is "looking beyond the aggregates". This opens prospects for micro and macro data integration (see, for example, Becker et al., 2004) and for measuring productivity leap (see, for example, Maliranta, 2009).

And more than that, statisticians began to admit an urgent need in improvements to data collection, compatible just with the constructive framework, as far as almost 30 years ago. The related quotations are as follows:

> The existing statistical system makes it extremely difficult to anticipate the potential impact of emerging technologies. Statistics

> document changes in average businesses inputs and outputs but provide little information about the performance of facilities using new technology. The accounts do not distinguish between capital investments that simply replace obsolete or worn equipment from capital investments that represent ... replacement of old technologies with new. These limitations makes analysis designed to show the net impact of new technology on employment ... energy use and other factors difficult to track. (OTA, 1989, p. 8)

"[B]usiness fixed investment ... can be used to assess the penetration of new technology" (NIPA Handbook, 2011, p. 6-1). For these reasons statistics already distinguish "Tech Investment" (investment in technology equipment and software) within "Total Investment" (Dhawan and Vásquez-Ruíz, 2011).

Haltiwanger et al. (2007, p. 65) draw attention to the "situations in which there are limited or no source data underlying an aggregate statistic". One cannot but agree with the thesis that "Improvements to data collection should focus first on areas where policy and research relevance is high but where statistics needed to inform those policies and research are weakest" (Haltiwanger et al. 2007, p. 25). For this, these authors proposed "The Ideal Business Data System" that, inter alia, contains such directions for further development:

- understanding the business cycle (Ibid., p. 66);
- knowledge of the processes underlying the business cycle (Ibid., p. 133);
- the tracking of the response of U.S. businesses to the business cycle (Ibid., p. 14);
- significantly improve the ability ... to detect business cycle turning points (Ibid., p. 22);
- improving the depth of business data (Ibid., p. 92); and
- to gauge which industries are heavy users of advanced technologies (Ibid., p. 66).[1]

[1] It is interesting to note that in 2007, among the hypotheses to be tested, there was "exploring the idea that the financial market deregulations and innovations of the 1980s and 1990s played a fundamental role in the improved U.S. economic performance in the 1990s and in the new century" (Haltiwanger et al., 2007, p. 22).

Needless to say, the researchers support such improvements no less enthusiastically: "growth theories that focus on an aggregate measure of growth, such as GNP per capita, are blind to what is going on beneath the aggregate" (Nelson, 2005).

Thus, now it's time for statistical authorities to practise what they preached.

As yet, we have to content ourselves with estimates and proxies for the data gaps to demonstrate that the constructive framework is already workable even at that.

4.2 The simplest step forward

> Minsky long ago asserted that the true test of the relevance of a macroeconomic theory was its capacity to generate a Depression, since market economies had regularly found themselves in such a state.
>
> Keen (2009)

This statement, in fact, proclaims macroeconomics incapable to generate a depression, whereby justifying the psychology of finances with its "financial instability hypothesis" that "stability is destabilizing", Minsky (1992). Nevertheless, duly improved macroeconomics does stand this Minsky's test.

Below we shall apply the constructive framework to the recession of the early 1990s in the UK to get evidence that the results derived from the prototype economy are still valid for actual economies too. This will be a meaningful outline of the work by Ryaboshlyk (2006).

To catch actual recessions, it is sufficient to implant explicit new and old technologies into the dynamic input-output task. This will be the simplest step forward – comparing with the traditional improvement of average technological coefficients – open for further refinements.

A separate matrix – depicting the technologies coming in together with investments – is already in use, see, for example, Idenburg and Wilting (2000), Nishimura (2003), Pan (2006), Pollitt et al. (2014). But Idenburg and Wilting used it only as a component for better projecting of the traditional average coefficients. Nishimura took the input-output table of Japan as a benchmark of advanced technologies to be transferred to the developing economy of Philippines; his focus was on the structural change and the top-priority sectors. Pan, then Pollitt et al. consider a dynamic I-O task where the pattern of change

of the changing technological coefficients is exogenously prescribed to be of "S" shape. So, although these frameworks deal with two levels of technology, they are incapable to deal with crises, yet. Besides, over the lack of systematic statistics about the height of technological leap, that is, about to what extent the new technologies are better than the old ones, the researchers resort to estimates and proxies.

Giving that an industry is an aggregated unit, a technology invested in industry is also an aggregated outcome of all individual technologies coming in along with the corresponding individual investments. Such a blend may contain both innovative technologies and such ones that are not innovative at all, which could be in various stages of their own life cycles.

Nonetheless, the indicators of a technology invested in an industry measured in this way should differ positively from the corresponding indicators of an existing technology at work. And this difference should manifest itself the most distinctly in times of radical change. Besides, it is, if not the only possible way to encompass all new technologies and analyse their joint implications for all the economy.

In any case, such deepening of growth accounting would right away provide some disclosures about the current phase of the cycle:

– if the technology embodied in investments does not differ from the existing technology at work, then this is a sign of stagnation; and
– if there are at least some industries with substantial technological leaps, then there is a possibility of further growth.

In the latter case, when a techno-leap takes place, it can be forecasted a balanced path of further diffusion of just these new technologies until its full substitution for just these existing technologies at work. In other words, the next question will be: how the economy would develop in subsequent years if all subsequent investments would bring the same new technologies as those observed at present? Of course, volumes of these investments are not deemed to be the same.

More formally, it will be an estimation of the cycle of innovative development of the whole economy under action of a given set of all innovations, and under given initial conditions.

First of all, such analysis will clarify the main concern: whether the techno-leap is of a recession-fraught type. This also will show a new level of the balanced steady state, of stagnation, of the potential upper ceiling that is possible at the new technology.

Indeed, all this sets aside the subsequent, even more advanced innovations. Still, at least the initial fragment of such forecast has a chance to be rather close to the actuality, before being supplanted by the successors.

Now, let us get down to the recession of the early 1990s. The whole economy of the UK has been divided into 13 industries. The new technologies opened a potential for increasing labour productivity and decreasing power intensity and other efficiency parameters in each industry as follows.

Figure 4.1 shows the productivity leap by industries. For example, mining and quarrying productivity increased by 2.5 times (plus 150%) apparently due to North Sea oil and gas.

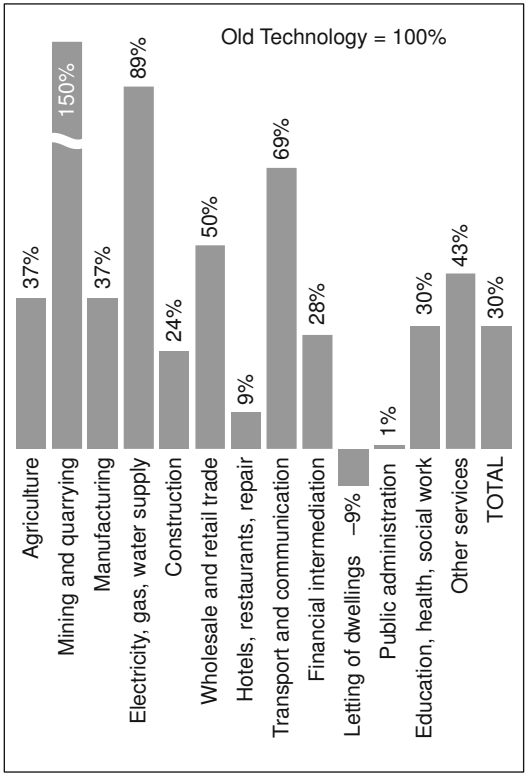

Figure 4.1 Labour productivity leap provided by new technology by industry

Figure 4.2 shows changes in total intermediate inputs needed per unit of output. Under the new technologies, the group of production and construction industries requires less intermediate consumption, which testifies energy and material saving (share of the intermediates in output of Agriculture decreased by a third, in Manufacturing by 18% etc.). And the opposite holds for services and distribution industries. Say, share of intermediate consumption for Public Administration and Education, Health and Social Work roughly doubled and rose by 95% and 124%, respectively. This could be explained by the rise of quality of services due to more advanced medical technology, teaching aids, and so on.

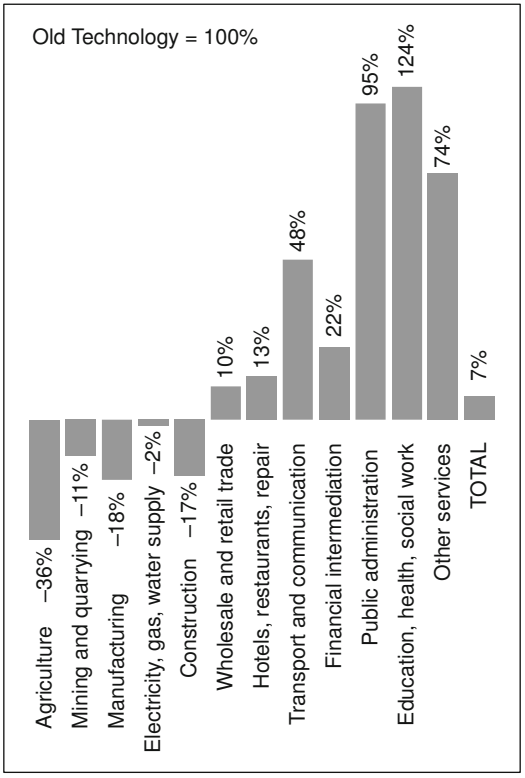

Figure 4.2 Change in total intermediate consumption by industry

However, at the same time such progress must be paid for by investments in new equipment. At that, it was assumed that new equipment could be installed in old buildings as well as in new ones.

Figure 4.3 shows capital-output intensity changes regarding equipment. It exhibits a clear tendency to rising efficiency for new equipment – the capital intensity lowered almost in all industries except for the non-market Public Administration and over-computerised banking (financial intermediation).

The data was also collected on labour force, capital-labour ratio, capital stocks of the existing technologies and their age distribution, inventories, and so on. Capital life-length ranged from 9 to 80 years.

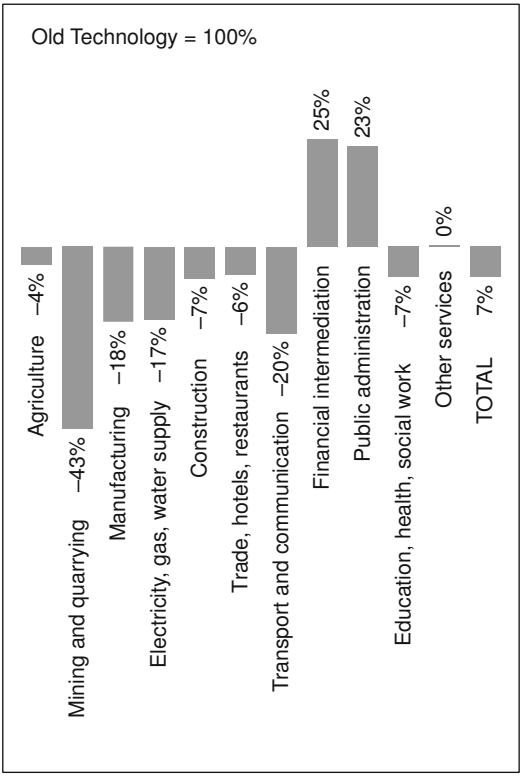

Figure 4.3 Capital-output intensity changes regarding equipment

The set of new technologies uniquely defines the ultimate ceiling of development that could be attained at the end of diffusion (at the stagnation phase). A rule of thumb estimation of this new level is at once provided by the total increase in productivity amounting to 30% (Figure 4.1).

But the path to this prospect is not unique at all. The rise of efficiency of the new capital does not remove the problem of its accumulation, because initially it is absent and some process of gradual substitution of old technologies via new investments is required.

In this connection, a task of search for the optimal transition path maximising consumption was set, specifically: to maximise a discounted sum of levels of personal consumption by years, so that different variants of path for different discount rates were generated.

A remarkable result of these calculations is that at those characteristics of new and old technologies there was no way to the higher level that could escape a temporary starting recession at the start of diffusion of the new technologies. To all the efforts to thread a non-recession path, the computer responded that it "could not find a feasible solution". So that even an absolutely perfect market with the most rational, optimal trajectories sometimes goes through an unavoidable recession.

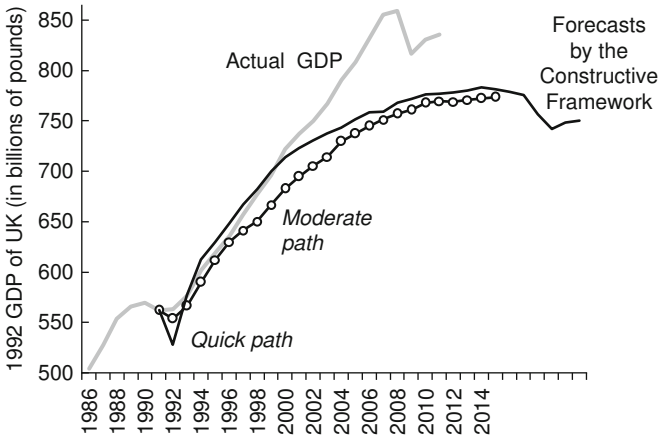

Figure 4.4 Recession in the UK in 1990s and subsequent growth (actual and forecast)

Figure 4.4 shows the forecast of "moderate" transition path the closest to the actual dynamics, and corresponding to discount rates (showing to what degree the present is deemed to be more valuable than the future) in the range from 20% to 30%. It seems that an optimal path is more sensitive to the length of time horizon (in terms of length of human life), than to the discount rate.

The "Quick" over-saved path of deeper starting recession with subsequent quicker growth, overheating and Kondratiev waves was generated under the assumption as if the consumption at present was valued not much higher than in the future (the discount rate was set close to zero). This path is less plausible and provided a less accurate forecast of the actuality.

As it can be seen from Figure 4.4, the constructive framework has generated the whole by-innovations-driven cycle corresponding to the given set of all innovations, and it has reliably predicted the actual recession and the subsequent growth as far as five to six years ahead of horizon, whereby integrating short and middle runs together.

This cycle actually reached about one-third of its span, then being supplanted "ahead of time" by the next technological leap from the succession of leaps constituting an actual process of eternal development. It could be suggested that the leap of 2008 was of recession-fraught type and was at least partly, if not altogether, "guilty" for this "financial" crisis.

So, in more distant years (the right fragment of Figure 4.4), the cycle's forecast parts with the actuality and shows how the economy of UK would develop if the next technological leap came too late and the economy passed into the phase of stagnation (for Japan it was not only a supposing option in the period of "lost decade").

Thus, it has been proven that the recession of the early 1990s was unavoidable and had material, physical roots connected with a recession-fraught technological leap that was the main cause of that crisis, not a complementary one.

This also means that it has been generated a "slumping" S-shaped curve of development of the whole economy under the action of a whole set of all innovations. It quantifies and specifies the tradition of depicting the historical process of technical progress in the form of a sequence of the stylised pictures of a regular letter "S" (as it is already mentioned in the previous chapter).

4.3 Heterogeneity matters: answering the question posed by Professor Pissarides

Technological/structural unemployment was forecast as well, along with the decline in output. This involuntary unemployment arises when the amount of new capital is not yet sufficient to absorb all the labour released from old capital.

Firstly, it was a linear forecast based on an assumption that the labour released from old technologies is directly proportional to the contraction of output. Yet even this simplification had already caught the turning points and a general pattern of the unemployment dynamics (see the linear forecast on Figure 4.5).

None the worse, further refinements were achieved when it was taken into account that output contraction sorts out the worst (marginal) firms; releasing the workers with the lowest productivity in their industries and preserving the most productive ones. That

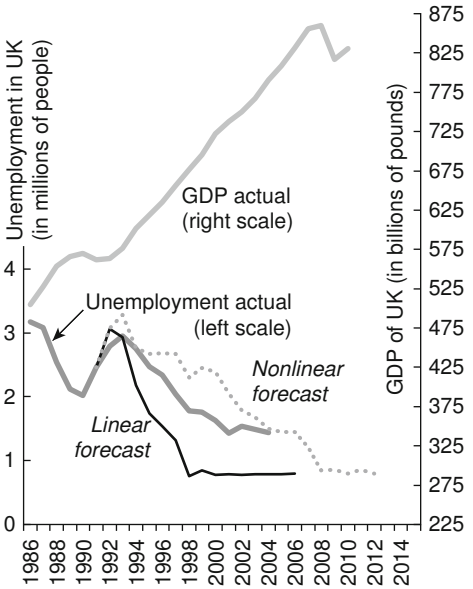

Figure 4.5 Nonlinear forecast of unemployment in 1990s is less optimistic and closer to reality (moderate path)

is, a reduced output requires less labour and causes higher layoffs than could be expected at linear dependence based on average data. Indeed, as Figure 4.5 shows, the nonlinear forecast that accounts for heterogeneity has generated less optimistic, higher unemployment more close to the actual data than the previous one. At that, the timing of the turning point has been also determined more precisely, which afforded to reflect the phenomenon of jobless recovery too (the turn to low unemployment was later than the turn to growth).

It so happened that Nobel Prize-winning Professor Pissarides has analysed the same unemployment time series in terms of short-term fluctuations around the smoothed trend or around the "natural unemployment". And he doubts: "Whether ... the deviation between the smoothed rate [of unemployment] and the actual rate is the cyclical component is open to question" (Pissarides, 2003).

The above analysis had answered this question and showed that it was the cycle itself, directly forecast without being split into the "natural" and "deviation" components.

4.4 Physical retirement of capital vs financial depreciation

In addition to the earlier discussion of the problem of adequate formalisation of physical retirement (scrapping) of capital, Figure 4.6 provides an empirical support for a discrete, non-continuous character of physical retirement on the data about equipment and buildings in the Mining and Quarrying Sector of the UK.

The Office for National Statistics (ONS) estimates gross capital stock with just this self-evident method: "the asset is valued at its new replacement cost until such time as it is retired" (Vaze et al., 2003).

More precisely, the moment of retirement is normally distributed around the life-length:

> Retirements of assets are assumed to be normally distributed around the mean asset life-length. That is, not all of the stock of an asset which lasts five years is assumed to leave ... after five years – rather the retirements are spread around this date. (Ibid.)

Thus, the retirement dynamics follow that of investment with a time lag and with some degree of fuzziness. We assume capital to retire entirely

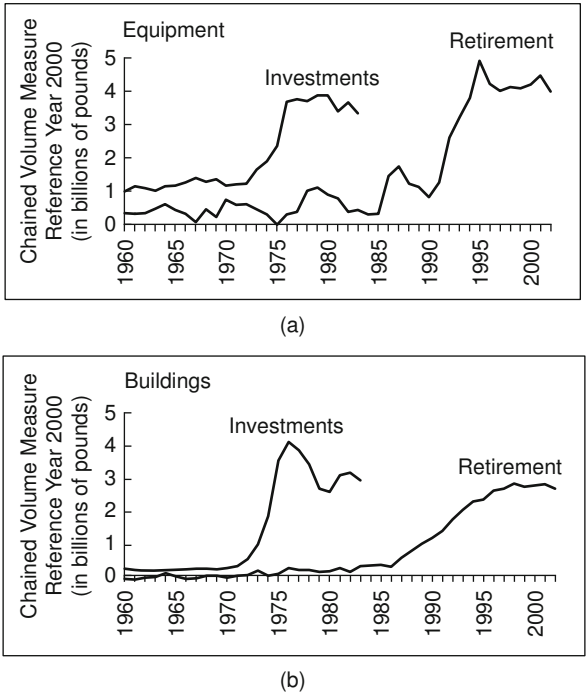

Figure 4.6 Retirement repeats investments in a fuzzy way (mining and quarrying of the UK)

Source: Vaze et al. (2003).

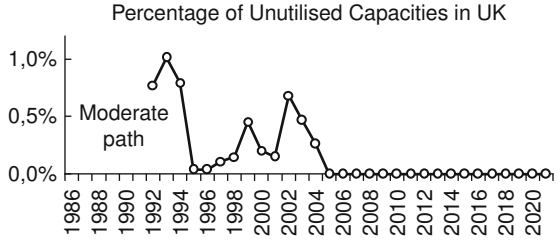

Figure 4.7 Unutilised capacities tend to rise at recession (estimation by the constructive framework)

after its life-length, without any spreading. Although it is not so accurate, it is better than the confusion with financial depreciation.

Besides, the carried out analysis of the UK has also reflected the early retirements due to the advent of more advanced capital. Such retirements are closely related to the unutilised capacities shown on Figure 4.7.

ONS also takes into account that, in times of recession,

> plant and machinery could be prematurely scrapped. Assets were retired from the capital stock early reflecting unforeseen obsolescence. ... it is assumed that the average life-length takes into account the expected level of obsolescence. Premature scrapping will occur in the down swings in the economic cycle. (Vaze et al., 2003)

So, the constructive framework could be also treated as an effort to reconcile the analysis with the statistics.

Over and above, the proposed growth accounting method and the analytical framework might also "generate" another growth rhetoric. Productivity leap should supersede the total factor productivity and all the like. And policy discourses "Are we above or below the potential GDP?" may turn into "Are we above or below the ceiling?" or "How has the ceiling been pushed up by the recent technological advancements?" and finally the main question: "Whether all the paths to the ceiling are fraught with an unavoidable starting recession?"

The content of this chapter is also discussed in publications by Ryaboshlyk (2011a,b, 2012) and partly by Ryaboshlyk (1987).

5

Empirical Support for the Presence of the Innovations-Related Cause in the Current Crisis (Non-financial Roots of the Financial Crisis)

In the preceding chapter, it is considered only one fragment from the sequence of fragments shown on Figure 3.6, together composing the process of eternal development. But notwithstanding its particular nature, it was a rather complicated time-consuming task where more than 5000 variables were considered. And yet it was solved single-handedly using the Solver Engine of Frontline Systems Inc.

That is why there is no opportunity, yet, to provide similar disclosures of all the fragments. Let us hope that this book would spark activities to apply the constructive framework to other crises and cycles, and this will be done on a real-time basis.

So far, it is possible to point to the signs that embodied innovations do figure among the causes of the current crisis. These are: jobless recovery (productivity leap), structural and qualitative changes.

Although this "financial" crisis is considered a unique one, its productivity dynamics is quite typical (see Figure 5.1e). Productivity is the only indicator least damaged even by the most severe crises, because crisis as such is a case of a painful rise of productivity.

As it can be seen from Figure 5.1, all the recessions, from the 1970s and onward, bore the same three consistent distinctive features:

– productivity accelerates from the very beginning, or leads the upward turns in output and employment;

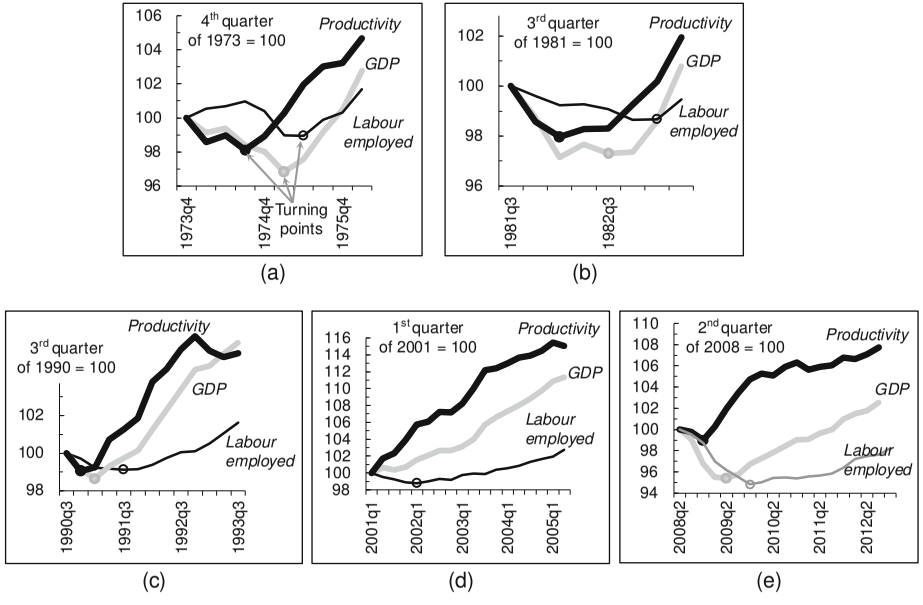

Figure 5.1 Productivity accelerates at crises

Source: Bureau of Labor Statistics of the US.

– the upward turn in output leads the turn in employment, that is, output grows while employment declines; and
– output gets back to the pre-crisis level earlier than employment.

At that, in the three recent recessions, productivity accelerated almost from the beginning, of which the recession of 2001 (Figure 5.1d) was a recession of employment only – at no output decline, and no productivity decline, of course. One would notice these productivity leaps even more clearly, if it were possible to compare new productive units against old ones, that is, if the old and the new were not hidden beneath the traditional indicator of average productivity.

Hall (2010), too, has pointed to "the unprecedented growth of productivity" as a cause of the jobless recovery. Meanwhile, this unprecedentedness sprang up in the heat of crisis, and may be pointed to as a cause of the crisis, as well.

Needless to say, the Great Depression followed just this pattern. At that time, the economy restored its pre-crisis level by 1936, while it took much longer to restore the employment.

Structural change in times of crisis is witnessed by the intensification of labour turnover (of occupational change). One should agree that it makes a great difference in what way total unemployment has increased, say, by 1 million people: either when just 1 million lost their jobs; or when 6 million lost jobs, and 5 million found jobs. The latter would imply structural change, and just this pattern is revealed on Figure 5.2. In recessions, the graph of those who found new jobs steeply rises, and only the temporary advance of those who lost their jobs brings about temporary aggravation of unemployment.

Besides, Groshen and Potter (2003) have found more straightforward evidences that recessions are accompanied by structural change. These are: the relocation of jobs from one industry to another, and the predominance of permanent job losses over temporary lay-offs. Unfortunately, these authors consider structural change not as an integral part of cycle but as a separate phenomenon acting in parallel and independently:

> Recessions mix cyclical and structural adjustments. Cyclical adjustments are reversible responses to lulls in demand, while structural adjustments transform a firm or industry by relocating workers and capital. (Ibid.)

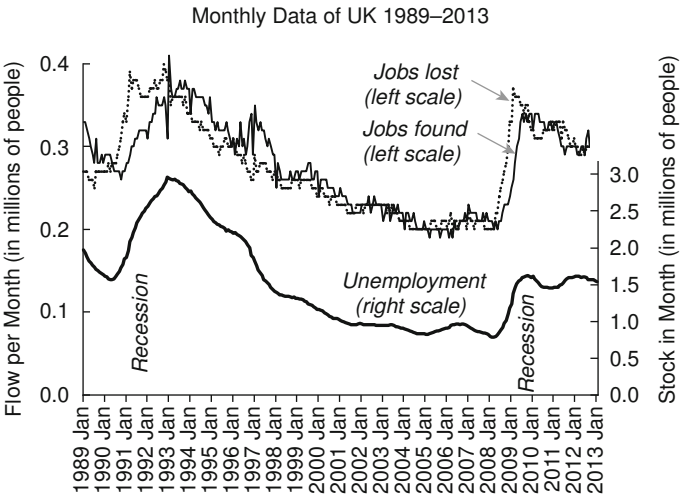

Figure 5.2 Labour turnover intensifies at crises as a sign of structural change

Sources: Statistics.gov.uk; UK claimant count, outflows; UK claimant count, inflows; total claimant count.

Qualitative changes in times of crisis could be seen from the "job polarisation" considered by Jaimovich and Siu (2012). That is, on the background of overall employment decline, the employment in the professional occupations is growing (it includes science, technology and other professionals), see Figure 5.3.

And over and above, the tendency of shortening of the interval between crises is a sign of an acceleration of technical progress.

All these facts are at least not contrary to the hypothesis that new and high-productivity technologies – when they are in some sense "heavy" ones – are able to cause temporary recessions. In such situations, the output declines because the folding of old technologies takes the lead over the unfolding of new ones. The employment declines because job creation at the introduction of new technologies is less than job loss at quitting the old ones, or, in other words, because there are not enough new working places, yet, to absorb all the labour released. At that, at substantial productivity leaps, output grows, while employment does not.

Such is the "easy answer to the no-jobs recovery riddle" posed by Hancock (2004). The gist is that, apart from recovery, the factor

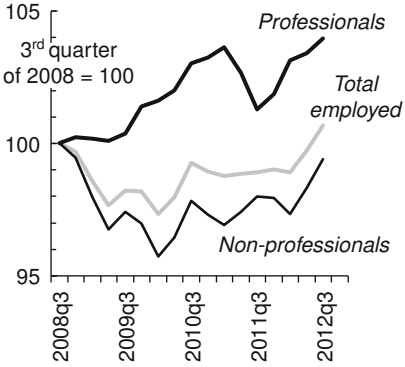

Figure 5.3 Employment by type of occupation
Source: Statistics.gov.uk.

of productivity is in the root of pre-recovery crisis too. So jobless recovery should be managed along with managing the crisis.

As for the financial side of the crisis, this is rather an effect than a cause. The individuals and firms deprived of their solvencies by virtue of the real changes are the first falling dominoes triggering the domino effect of insolvency and bankruptcy.

Part II

Real Cyclical Dynamics in Monetary Environment

This part demonstrates an interplay between prices, interest rates, savings and investments, wages, profits, losses, share prices and monetary policies in all phases of a cycle driven by embodied innovations. It starts from a simple example of heterogeneous economy growing in complexity with the unfolding of the narrative: from natural exchange of products to stock exchange and monetary policy.

6

Theoretical Basis to Embed the Real into the Financial: Production-Consumption Compromise vs Supply-Demand Paradigm

The "criterion of observability" that Kurz and Salvadori (2000) ascribe to Leontief spearheads the argument against the neoclassical theory relying on the non-observable utilities and preferences. We would lessen this strictness in the sense that if there is no way to go on without the non-observables, they should be introduced at least in a logically consistent manner. This will even improve a little their practical applicability.

Our point of departure will include the notions of production possibility frontier (transformation curve), consumption indifference curve and utility mountain (indifference map). These are those common denominators all economists recognise, with the only difference being that half of them do not recognise utility to be observable.

If money is only a medium for exchange of at least two products, then the supply-demand pair of curves pretends to explain the exchange in a situation where there is no genuine exchange at all. Is it correct to state that harvests yield just as much as the volume of demand is? If to determine prices by costs – while costs are determined by prices too – isn't this a tautology to explain prices by prices?

The general equilibrium theory is still unable to explain production and consumption without resorting to price. Paradoxically, a much simpler subsistence economy without exchange looks much too complicated for the explanation of the quantities produced and

consumed. Having endowed price with the supreme power to rule both production and consumption, the neoclassics left subsistence farmers without any clue what to do.

The whole economics has been baptised with the Marshallian Cross in spite of the protests by its father-founder. The Keynesian easy money is a paradoxical example of correct policy implications derived from an incorrect theory…

Such inconsistencies and questions will be discussed and settled hereafter. For that, the proposed interpretation of the financials will heavily rely on real and objective heterogeneity of producers. The public has already heard about the well-known "different plots of land" of the classics and about the agriculture prices determined by the worst marginal plot, but this is just the tip of a much more universal phenomenon.

On the other hand, we shall narrow the exchange between agents endowed with their commodities from nowhere to the exchange of commodities produced. All this will help to show how "the subjective" inside people turns into "the objective" outside them. And besides, the same worker-workplace coupling that helped to uncover the mystery of crises, now will help to uncover that the traditional general equilibrium is a special case of more general concept.

6.1 Heterogeneity vs diminishing returns

The recently emerging micro databases have elicited a huge diversity of individual enterprises concealed beneath the average characteristics of industries. Say, productivity for the best plants in UK manufacturing is up to five times larger than for the worst ones, capital/labour ratio differs up to four times, and so on (Haskel, 2000). "[Wide] asymmetries in productivity across firms" and significant heterogeneity in other aspects are marked by Dosi et al. (2013). Griliches and Mairesse (1999) observed that "…bakeries are just as much different from each others as the steel industry is from the machinery industry" (as quoted by Dosi et al., 2013).

Figure 6.1 shows productivity of each of 6000 grain-growing farms of Ukraine arranged in descending order and employing 700,000 farmers and farmworkers in total. The number of employed in each farm is represented as a segment on the X coordinate, so that the cumulative total of the segments shows the cumulative total of employed

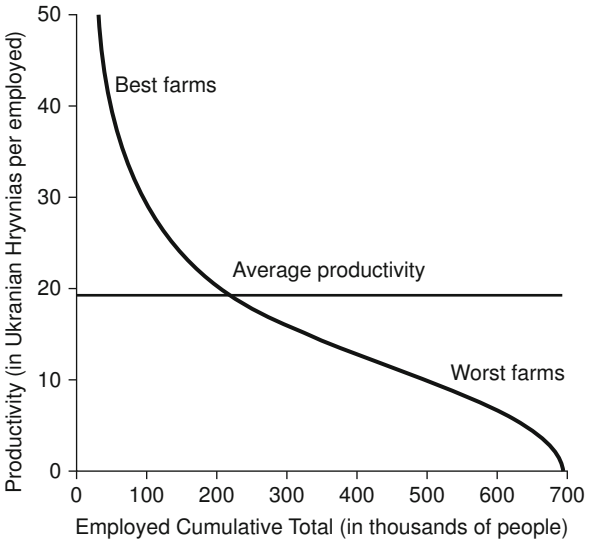

Figure 6.1 Heterogeneity of productivity in grain production in Ukraine

in the industry. The Y coordinate shows an individual productivity of the corresponding farm. All this discrete data flows together into a continuous curve that unites both the micro and macro aspects and reveals the hidden beneath the average. At that, the start and end of the curve reflect the upper-side and bottom-side marginal producers respectively (see Ryaboshlyk, 2005a,b).

Figure 6.2, based on data by Gladysh (2004), shows another graded heterogeneity: the costs of wheat at each of 11,600 farms, which achieved total yield of 18 million tons. The harvest of each farm is represented as a segment on the X coordinate, so that the cumulative total of the segments shows the cumulative total of the harvests. The Y coordinate shows individual costs of the corresponding farm. All this flows together into a continuous curve reflecting the costs of each ton of wheat produced and their heterogeneity. This, inter alia, suggests that price gravitates to the marginal costs, with an important clarification that this concerns marginal costs of the whole industry, not of individual farms.

These data put the end to the view as if heterogeneity were peculiar to agriculture only. Marx (1863) then Lenin (1901) even theorised

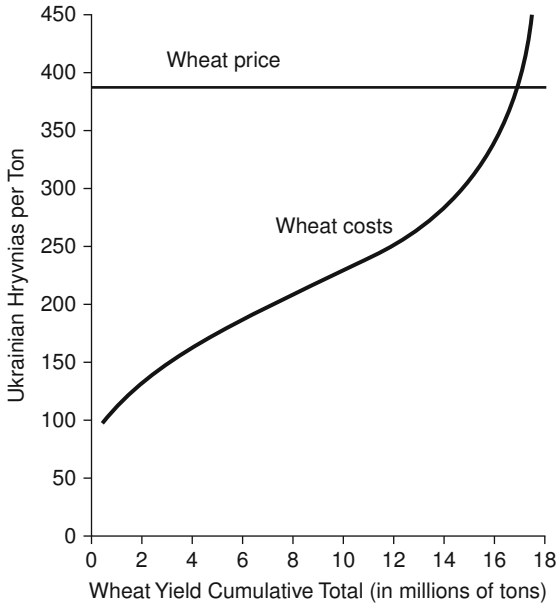

Figure 6.2 Heterogeneity of costs of wheat in Ukraine

what would be if agriculture also were just as homogeneous as all the other industries were assumed to be. Meanwhile, all the others are just as heterogeneous, as it is already conceived regarding agriculture. Moreover, even if all land were of the same quality, the outcomes would still be different because people are different.

All these are the manifestations of heterogeneity of the universe. As Kyiver Berdyaev (1923) brilliantly put it: "The birth of light out of darkness, moving from chaos to cosmos is an emergence of inequality of being out of equality of non-being."

So, the rest of this book will essentially allow for the heterogeneity. We cannot explicitly account for the multitude of different factors that determine the individuality of each individual producer; and yet we appreciate the resulting heterogeneity and try to reflect it, at least in a simple way.

This also means that even in a static state (or steady state) under the same technologies (technological system), the producers are still not the same. This, in turn, requires consideration of the marginal

producers in each industry, as a generalisation of the marginal farmers in agriculture. In dynamics, technical progress does augment productivity and other indicators of producers, but not of the same degree, and not in the way leading to full equalisation. So that the new levels established are still heterogeneous.

It is surprising that modern marginalism – overcrowded with mysterious ghosts of marginal workers haunting each of the firms – does not distinguish the marginal firm as such out of all the firms. Meanwhile, if there are no best and worst firms, there remains no subject matter to theorise about the competitive market.

Now, let us clarify the confusion over heterogeneity and the diminishing returns to scale of an industry as a whole.

Under given fixed technologies, a sequential increase in industry's output means involvement of less and less effective producers. This follows from a simple fact that every moment everything is diverse, something is better and something is worse, and at that, the best is picked up first and foremost; the worst is first and foremost rejected, that is, sorted out by competition. So that the diminishing returns of an economy is a genuine outcome of competition.

It is rather a strange type of diminishing returns that stems from the fact of heterogeneity of producers even within fixed technologies, and from the sorting. Here there is no Malthusian pessimistic flavour that "everything is getting worse" because it is like eating cherries: first the most ripe and biggest ones, then the others.

Thus, the diminishing returns are the principal type of returns to scale at the macro level under fixed technologies due to the heterogeneity and the sorting by competitive market forces. It might be called "the specifically macro returns to scale", meaning the decreasing returns.

As to the micro level, the producers can experience both diminishing returns and increasing returns (economies) of scale. But it is plausible that the majority have already established their rational scales, and that is why, as it is mentioned above, the increase in production of the whole industry requires the increase in producers coming into operation.

Of course, one cannot be prevented from imaging an economy consisting of all producers operating at lowered scales and whereby constituting the increasing returns at macro level, where an increase in the total output would bring about a decrease in the number of

producers. This would be a curious economising of scale on the whole attained at the expense of non-economising initial choices of the particular producers.

6.2 Objective marginalism: generalisation of Ricardo

Unfortunately, it is still believed that, contrary to the agrarian case, there are the increasing returns to scale in other industries; and the tradition still considers the micro and macro aspects of the returns in the same way under the aegis of "the laws of returns" (Sraffa, 1926).

Sraffa especially discussed the possibility of generalisation of diminishing returns in agriculture and of determination of the prices by marginal farmers for other industries. At that, he relied on the prevailing explanation of the agricultural case by the scarcity of land or, more generally, by the scarcity of resources. But there was no meaningful substance in that because all resources are inevitably scarce. This misled Sraffa to a halfway generalisation as follow:

> The law of diminishing returns has long been associated mainly ... with reference to land. ... It had always been perfectly obvious that its operation affected ... the cost of the product; but this was not emphasised as a cause of variation in the relative price of the individual commodities produced ... Very little was necessary as regards the law of diminishing returns ... to be *generalised from the particular case of land* to every case in which there existed a factor of production of which only a constant quantity was available. (Ibid., pp. 536–537; italics added)

So that, the "generalisation" had been confined to "that minute class of commodities in the production of which the whole of a factor of production is employed" (Ibid., p. 539).

But the allowance for universal heterogeneity bears a complete generalisation and Ricardo had laid out such generalisation regarding prices a hundred years before Sraffa's efforts:

> The exchangeable value of all commodities, whether they be manufactured, or the produce of the mines, or the produce of

> land, is always regulated, not by the less quantity of labour that will suffice for their production under circumstances highly favourable, and exclusively enjoyed by those who have peculiar facilities of production; but by the greater quantity of labour necessarily bestowed on their production by those who have no such facilities; by those who continue to produce them under the most unfavourable circumstances; meaning – by the most unfavourable circumstances, the most unfavourable under which the quantity of produce required, renders it necessary to carry on the production ... [so that] the supply afforded ... were equal to all the wants of the community. (Ricardo, 1821, ch. 2, paragraphs 12–13)

Thus, "all commodities, whether they be manufactured, or the produce of the mines, or the produce of land" are priced by those who produce "under the most unfavourable circumstances". Regrettably, Ricardo himself had not attached great importance to his discovery and it remained almost forgotten. That is why one of our tasks is to reveal the fruitfulness of this way.

In more modern parlance, let us call those who produce "under the most unfavourable circumstances": the marginal producers. Do not confuse these real objective marginal producers (farms, firms, plants, enterprises) with abstract marginal workers and marginal units of capital inhabiting the traditional marginalism.

Now, it suggests itself to evolve this idea of Ricardo further and conclude that: prices must be such that the marginal producers of different commodities receive equal reward. Otherwise, the marginal with lower reward would get an incentive to change his occupation and distort the balance.

The reward may be in the form of income, profit or the like, depending on the type of economy involved. At that, it refers to those marginal producers whose product, together with others' products, supplies "the quantity ... required".

Let us call this condition *condition of equality/equilibrium of marginal producers* or the *condition for prices*, and the prices that meet this condition are called *producers' prices*. The reciprocal *condition for quantities* will be discussed later.

Let us call a whole direction *objective marginalism* based on the objective heterogeneity of real producers. It contains an uncommon

equilibrium, an equilibrium of marginal producers, not thoroughly considered yet in spite of its self-evidence. Besides, it separates the determination of prices from the determination of quantities, which contradicts the simultaneous determination strictly adhered to by neoclassical economists. In the latter lies one of the points of discontinuity of economic science to be reconciled further in this book.

All in all, all the industries are heterogeneous and our attention will be focused on their bottom-side marginals. Since the term "marginal" often means specifically the bottom-side one, we shall also stick to this default interpretation unless otherwise mentioned.

These "worst" but necessary producers are the most vulnerable ones. They are the first to go down under structural change, and it is for them any variation of price, interest, wage and exchange rate are of life-and-death importance. Those changes – that for the others mean a tolerable decrease of profitability – for the lower marginals often mean bankruptcy. Paradoxically, but quite logically, such strugglers serve as "a firm spot on which to stand" for revealing the nature not only of price but also of interest and other financials. In this sense, the bottom marginals are the free-market price setters, and all the others are free-market price takers.

At that, the role of the bottom-side marginal producer is moving from "performer" to "performer" along with the movements of total output (either to a less effective "performer" at the increase or to a more effective one at the decrease). This leads to the dependence of prices on total quantities produced, and so on.

Based on this, we shall come to marginalistic generalisations of some classical results. In a simple economy, relative price is determined by marginal labour time spent, instead of average time. And in a complicated economy, there must be an equalisation of profit rates across the marginal producers of industries, instead of the inter-industry equalisation of average profit.

On the opposite extreme are the upper-side marginals that are the backbone of the stock market, and it is just because of the objective heterogeneity that the stock market will be incorporated into the main frame of economics, while in a homogeneous economy there is no place for stocks.

6.3 Commodities produced vs commodities endowed from nowhere

> Natural price ... is ... the lowest price that sellers would take ... rather than leave the industry ... [but] continue their business.
>
> Smith (1776)

Thackeray, then Tolstoy, described the surge in prices of carriages and horses along with the cheapening of furniture in Brussels and Moscow in connection with the Waterloo and Borodino battles respectively. There is no problem for neoclassical economists to quantify all that by shifting supply-demand curves to and fro. We would humbly leave it out, because those transactions were out of the ordinary course of business and of a repetitive production process.

So, we allow for the objective heterogeneity and confine ourselves to the transactions consistent with continuous production. All this will be revealed below, starting from a heterogeneous economy based on manual labour.

6.4 Production possibility frontier in an economy without capital

Imagine a two-product (bread and butter) heterogeneous economy amounting to 100 workers/producers. The available technologies are fixed, but the productivity is heterogeneous across workers/producers as shown on Figure 6.3. This is a simple variant of production function that transforms the inputs into outputs. On this figure, the possible productivities of butter producers are shown on a back axis convenient for reflection of the labour distribution. Figure 6.4 shows an example of such producers' choices between the industries and the corresponding productivity of each producer.

Figure 6.5 on page 81 shows the correspondent total outputs (7938 units of bread and 2646 of butter), so that the proportion of a total "sandwich" produced at this operating point is three units of bread per one unit of butter. Besides, the slopes of lines tangent to this curve at the operating point show the productivities of marginal producers contributing to these totals. Let us also recall that the reciprocal of

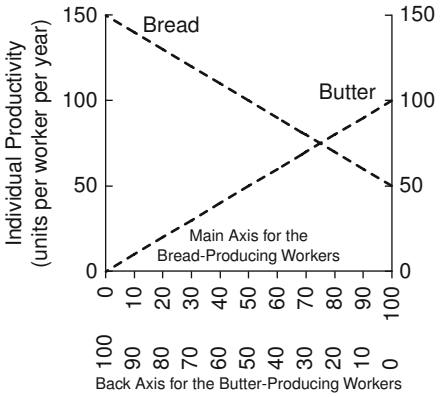

Figure 6.3 Heterogeneity of productivity in the explanatory example (production function)

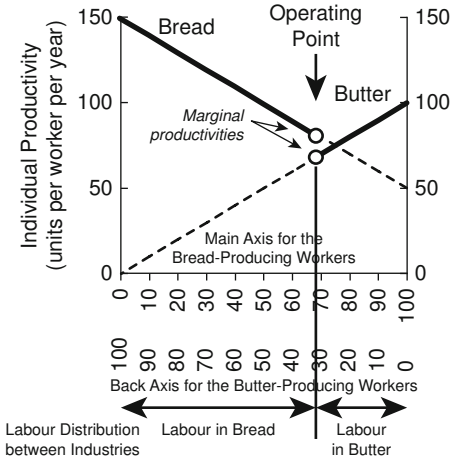

Figure 6.4 A variant of labour force distribution

productivity is labour time spent on a unit of product, hence, the above can be reformulated in terms of labour time if necessary.

Further, Figure 6.6 shows the correspondent production possibility frontier, that is, all the product mixes (output combinations, assortments) that are possible within the resource constraint (within the labour force total). The operating point on this figure corresponds

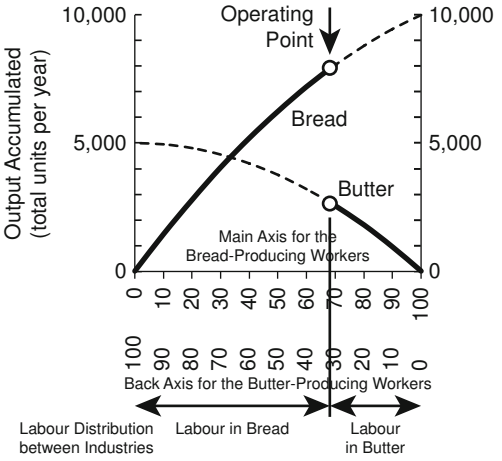

Figure 6.5 The product mix corresponding to the labour distribution

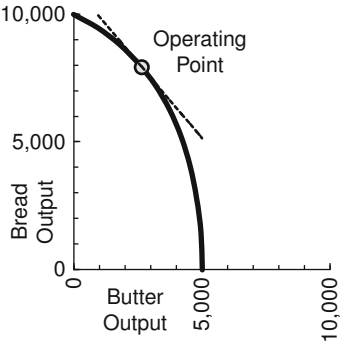

Figure 6.6 Production possibility frontier based on the heterogeneity of producers (constructed out of Figure 6.5)

to the labour distribution and product mix shown on Figure 6.5. Frontier reflects the simple truth that to produce more of one good means producing less of the other.

The tradition of drawing the frontier just in a convex form, in fact, reveals an unconscious intuition of heterogeneity (otherwise it would be a straight line). This convexity is a consequence of the competitiveness of a market economy that sorts in the best producers and sorts out the worst ones. And that is why the middle of the frontier bulges out.

This also means that, under a fixed technology, an economy as a whole has essentially diminishing returns. That is, the more butter already produced, the more bread production must be sacrificed to produce an extra unit of butter. This is because to ensure extra output of butter the next-worst producer "comes into play" and assumes the role of a marginal producer of butter. And at the same time, the previous marginal producer of bread "quits the stage" where still remains the next bread producer with higher productivity, who now assumes the role of a marginal one.

One cannot keep from imagining an economy relying on the worst producers and picking them up in the first place. Only then, the frontier would be concave and an economy, as a whole, of increasing returns. The level of output, of course, would be lower and the society would eat less bread-and-butter sandwiches.

Unfortunately, some scholars view the diminishing returns at macro level as a sign of inefficiency or of incompleteness of analysis and provide the "completeness" by considering the case of increasing returns, as well. This might be of interest for mathematics but of no economic significance (see, for example, Graaff, 1957, p. 67 or Meade, 2013).

The slope coefficient of a line tangent to any point on the frontier (taken with a reversed sign) reflects the marginal rate of transformation in production (transformation of one product into another). It shows how many units of one good the economy must sacrifice in order to produce an extra unit of another good. In short, let us call this *rate of transformation*.

Figure 6.6 depicts such a line tangent to the operating point. Its slope is –1.19, which means that the output of bread must be decreased by 1.19 units per 1 unit of increase in output of butter. So, the steeper the slope of the tangent line, the higher the rate of transformation of bread into one unit of butter.

Within this case, the rate of transformation can also be determined as the productivity of marginal producer of bread divided by the productivity of marginal producer of butter (or as the marginal labour time spent for butter divided by the time spent for bread). Note that we scrutinize the ways of construction of frontier, instead of making it in a hit-or-miss fashion.

Now, it remains unclear why an economy operates just at a certain definite point and produces a definite product mix, not some other technically possible one. There is no other way here but to resort to an invisible explanatory variable and to the calculus of human happiness.

6.5 Utility mountain (field of desires)

> ... the desire for food is limited in every man,
> by the narrow capacity of the human stomach,
> but the desire of the conveniences, and ornaments of building,
> dress, equipage and household furniture,
> seems to have no limit or certain boundary.
>
> Smith (1776) quoted by Ricardo (1821)

The people's aggregate preferences are depicted as a set of consumers' indifference curves, together constituting a utility mountain (see Figure 6.7).

Each curve shows all the mixes of commodities, which consumption would render the same level of society's utility (welfare, pleasure, satisfaction), so that any change in the mix consumed remaining on

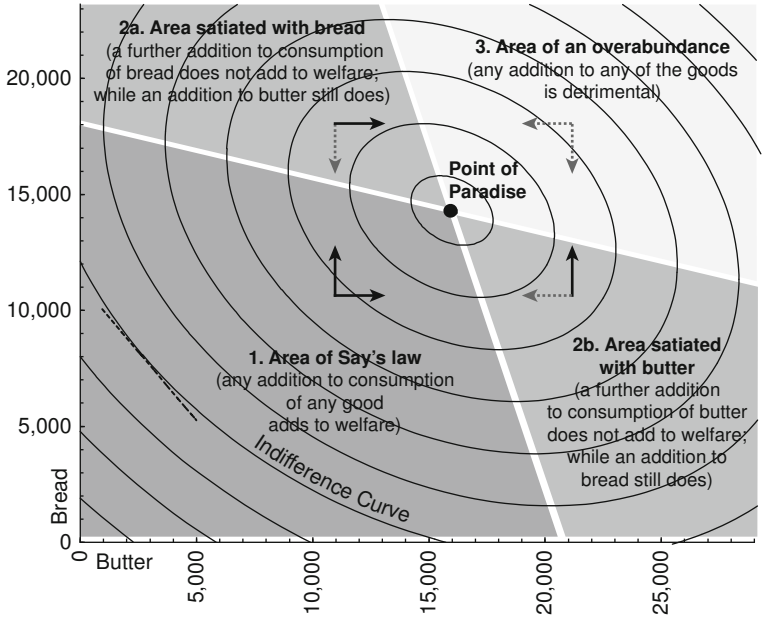

Figure 6.7 Utility mountain
(arrows show the directions of rising society's welfare)

the same curve would not change the utility received, while at passing from one curve to another, the utility increases or decreases.

In contrast to the production possibility frontier determined within production sites, there is neither fixed indifference curve in consumers' minds nor fixed level of desired welfare. It is tantamount to asking how much money is enough for happiness. (Please note that all this way of thinking restores the logical correspondence to the general thesis that human desires have no limit.)

The latter observation is very important, because if a fixed, predetermined consumers' indifference curve (as an effort to create an analogy to the fixed production frontier) does not exist, then all the theorising about shifting of this curve to and fro (analogously to shifts of production frontier) is pointless. What shifts is the whole utility mountain. But first it is worthwhile to leave the mountain where it sits.

Utility mountain, above all, reflects the readiness and openness of consumers to accept and consume any quantities of goods, irrespective of where they came from. Then, the mountain is topped with the point of paradise, the summit of desires.

This whole mountain could be divided into three areas distinguished by whether or not a higher consumption would increase society's welfare.

In the main area numbered "1", an increase in consumption of any good does increase welfare. Geometrically, it means that if the initial point of consumption, lying in this area, moves up or right, it passes to an indifference curve of a higher welfare (see the arrows). This area is called "area of Say's law" (or "nonsatiated area"), in the sense that any production increase will meet a desire to be used.

Areas 2a and 2b are partially satiated, that is, they are satiated with one of the goods. Thus, in area 2a, satiated with bread, an addition to consumption of bread lowers welfare. Consequently, within this area a decrease in bread consumption increases welfare.

Area 3 is an area of overabundance where any addition to any of the goods is detrimental, so that for increasing society's welfare it is sufficient to decrease consumption.

Of practical importance are the area of Say's law (nonsatiated area) and the partially satiated ones. We shall focus our main attention on the former.

The slope coefficient of a line tangent to an indifference curve (taken with a reversed sign) reflects the marginal rate of substitution in consumption. It shows how many of one unit of good the consumers agree to give up in order to consume an extra unit of another good without changing the level of society's welfare (remaining on the same indifference curve). In short, let us call it *rate of substitution*.

An example of such a tangent line is shown in the south-west corner of Figure 6.7. It reflects how many units of bread the consumers agree to give up in order to consume an extra unit of butter.

Within Say's area, the indifference curves are concave which means the more butter is already consumed, the less bread must be given up to consume an extra unit of butter. This is well compatible with an increasing feeling of satiation at increasing consumption of something, so that each next portion is valued less and less, eventually losing its value completely (the tangent line becomes horizontal and the rate of substitution becomes zero).

6.6 Fundamental production-consumption compromise

6.6.1 Quantities without prices

So, on the one hand, the area of Say's law reflects the readiness and openness of consumers to accept and consume any quantities of goods, irrespective of their source (this readiness is the most evident when comparing the years of plenty and years of famine).

On the other hand, the main source of goods is own production. Its limited possibilities are reflected in the form of the frontier superimposed on the utility mountain (see the south-west corner of Figure 6.8).

Naturally, we are interested in quantities produced and consumed where the highest possible society's welfare can be attained.

It is proposed to call this crucial point *fundamental production-consumption compromise* between limited production means and unlimited consumption wants. It could also be called objective-subjective compromise, keeping in mind that the objective production side of society determines all the range of possible combinations of

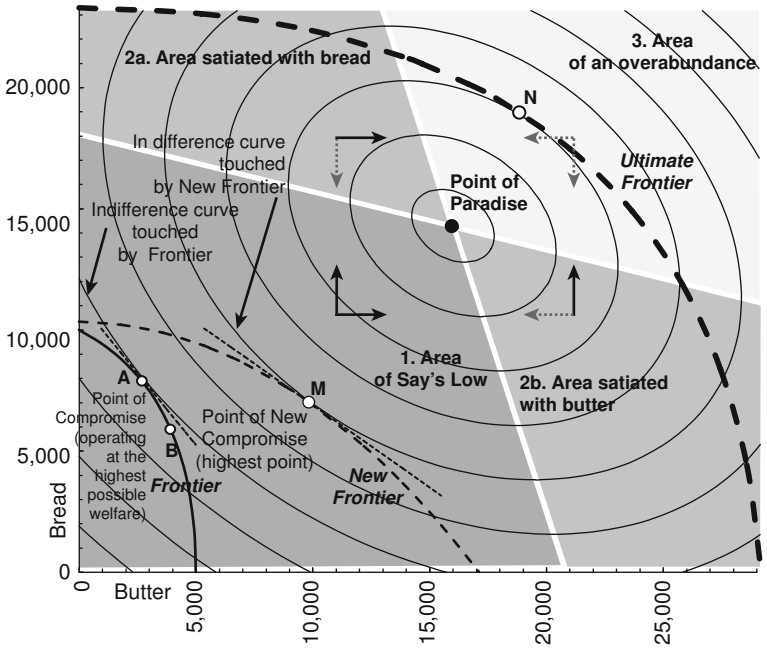

Figure 6.8 Fundamental production-consumption compromise

total output, while the subjective consumption side chooses a specific combination out of this range.

Fundamental compromise implies that the marginal rates of transformation and of substitution are equal to each other. Let us call this *fundamental condition for quantities produced and consumed*. Geometrically, the tangent lines to the frontier and to the indifference curve touched by the frontier must coincide. It is point *A* on Figure 6.8; all the other points, such as point *B* on Figures 6.8 and 6.9, being of a lower level of welfare.

This also determines the lists of producers that in total will provide these *quantities of the compromise*. And these are the competitive lists in the sense that they are summed up from the top producers. Besides, this determines the proportions of consumption. In our example, this is the receipt of sandwich, which is three units of bread per one unit of butter.

Figure 6.8 also provides the proof that in the Say's area indifference curves are concave. Otherwise, our consumption basket would contain just one thing and this thing would deliver the highest utility.

As one may notice, Figures 6.4 and 6.5 disclose the labour force distribution between industries corresponding to the highest point *A*. This is to underline that, unlike the indifference curve, the frontier on its own does not reflect all the production side and a thorough analysis would involve a great deal of additional information.

Technical progress shifts the production frontier outward, then the frontier meets and touches another, higher indifference curve and another fundamental compromise is established (see point *M* on the new frontier on Figure 6.8). Therefore, a moving frontier interacts with the whole mountain, not with some definite indifference curve; and it is the frontier that moves on the mountain, not indifference curves.

For this instance, the new frontier has a less steep tangent line at the point of tangency *M*, which means that the rate of transformation/substitution has decreased and equals 0.68 units of bread per one unit of butter. Besides, at point *M* another structure of the produced and consumed product mix is set.

One can also imagine an ultimate production possibility frontier that covers area of overabundance due to some fantastic technological advances (this is also shown on Figure 6.8). Then there would be no sense to work at maximum output possibilities (to remain on the frontier itself), because in this case, for reaching the point of paradise, it would be sufficient to work less and to be at leisure more. Shorter working hours and longer holidays practiced in the developed countries are the signs of the existence of some degree of such paradise on earth.

The peculiarity of the ultimate case is that then the highest point would find itself inside the frontier. And consequently, in this case, the renowned touch and tangency of the curves – the condition for quantities providing the highest welfare, point N – would lose its significance.

Moreover, if to imagine that frontier went through the point of paradise, then there would be no indifference curve to touch and tangent with, at all because the paradise is something like a pole. This might be interpreted that in a state of happiness no change and substitution could deliver the same happiness.

Analogously, 2a and 2b are the areas of semi-paradise. There is no need to give up, say, bread in area 2a in order to consume extra butter without changing the welfare. Oddly enough, in this area, the decrease in consumption of bread would deliver an increase in welfare; and additionally, the rate of substitution in these areas is negative.

All this is to say that the notion of marginal rate of substitution does not always retain its predominant meaning.

Note that the fundamental production-consumption compromise and fundamental condition are formulated without any reference to exchange and price. They are the concepts of universal validity that explain the quantities produced and consumed in all types of economy. Prices will be introduced later, but first it will be considered an economy without prices.

6.6.2 Achieving fundamental compromise in a non-market subsistence economy

Let the economy operate at a working point with lower welfare than the highest possible one (at point *B* instead of point *A* on Figures 6.8 and 6.9), so that at point *B* the frontier crosses (not touches) the corresponding indifference curve and there is a "fan" of feasible directions of increasing the welfare (Figure 6.9).

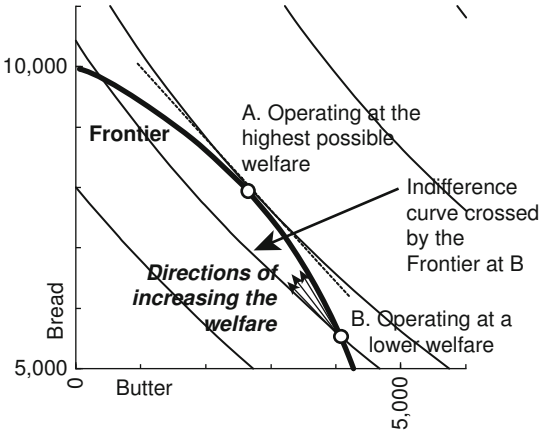

Figure 6.9 Production-consumption compromise (close-up view)

If this is a primitive community, a self-sustained household, a family of 100 persons that directly consumes what it produces, then by what signals can such household find out these directions to a better life? By the signals from inventories.

At the inferior point *B*, the quantity of bread produced is lower than the most pleasant quantity at the highest point *A*. That is why the inventory of bread will be eaten up faster than the inventory of butter; the latter may even be partially left unused. Then the need to redirect the joint efforts in favour of bread will be seen at a glance. So, when the omniscient thrifty eye of the society easily embraces all the economy's expanse, then such structural adjustments proceed quite naturally.

The tradition admits that changes in inventories give signals to production, but in a rather awkward manner:

> According to Keynes, changes in inventories guide firms to increase or decrease output during situations in which prices ... can't serve as signals of what to do. (Antonioni and Flynn, 2010)

It looks like there is a sort of a switch that activates the signals from inventories when the signals from prices stopped.

Meanwhile, inventories were already signalling at those times when there were no prices at all, and this type of signalling never stopped. This is well known by the practitioners but has not received an adequate theoretical comprehension yet. Everybody knows that prices give signals; now it is time to add that the signals to prices themselves are given by inventories.

6.6.3 Achieving fundamental compromise in a market economy

Now assume that there is a division of labour and the 100 producers of our example are 100 individuals, free to choose the industry of activity and to own their individual product. Nevertheless, although each producer is free and independent, he is not self-sufficient, because he possesses bread only or butter only but would like to eat bread-and-butter sandwiches, so that his actual consumption is established through exchange with other producers. And over and above, he cannot embrace the whole economy.

Then society as a whole still consumes just what it produces, but now it does this indirectly, because at the micro level the consumption of an

individual does not contain only that which he has produced himself (in real world, countries also consume not only that which they produce, and yet humanity consumes just what it produces at global level).

Here an issue arises – what the proportion of exchange (relative price) must be that the disparate decisions of free producers would aggregate into total outputs delivering the highest possible society's welfare; that is, into the quantities of production-consumption compromise. Or, to put it another way, that in total it would be a coordinated and balanced economy operating at the highest point.

Straight away, it can be formulated that such relative price must provide equal consumption of the marginal producers. Otherwise, the marginal with lower consumption would be led into temptation to change his or her occupation in aspiration of improving his or her welfare. But this would stop his or her current production required for society and damage the economy's overall inter-industry coordination along with his or her hopes for a better future.

Here we have received an additional condition for market prices (condition of equality of marginal producers) that must be satisfied at the quantities determined from the fundamental condition. It could also be treated as a *rule of invisible hand*.

Figure 6.4 shows that the productivity of such marginal producer of bread is 81.4 units of bread per unit of time; of butter – 68.6 units. Plainly, these marginal producers possess 81.4 and 68.6 units of bread and butter, respectively.

If to consider the relative price of butter to bread (to take bread as *numéraire*, to fix the price of bread at one, to measure price of butter in units of bread), then the relative price providing equal consumption is determined as the productivity of marginal producer of bread divided by the productivity of marginal producer of butter: 81.4 / 68.6 = 1.19.

In the reciprocal terms of labour time, the relative price of two commodities is formulated more strictly: relative price equals the ratio of marginal labour times spent on the commodities.

Indeed, at the price of 1.19, the marginal bread producer can go to a market and exchange 23.1 units of his bread for 19.4 units of butter (23.1 / 1.19), and then consume this butter together with his bread remained in amount of 58.3 units (81.4 – 23.1). And the marginal butter producer can exchange 49.2 units of his butter for 58.3 units of bread (49.2 × 1.19), and then also consume this bread together with his butter in amount of 19.4 units (68.6 – 49.2). At that, the proportion of their consumption is three units of bread per one unit of butter, as it was determined above by the condition for quantities.

Thus, at this price, condition of equality of marginal producers is met and the free market's invisible hand works. Note that this determination of price through marginal producers does not imply an obligatory transaction just between them.

Further, for this simple heterogeneous economy, this producers' price is equal to the marginal rate of transformation. Consequently, marginal rates of transformation and substitution could be simultaneously interpreted as the producers' and consumers' prices, respectively. Geometrically, the producers' price line, the rate-of-transformation line and the rate-of-substitution line collide with each other.

Finally, it means that for this simple market economy, fundamental condition for the quantities and additional condition for prices coincide with each other, so that quantities and prices are determined simultaneously. However, it remains to be established whether or not this holds true for more complicated economies.

Further, if to introduce money into our pre-existing pure barter economy, then a relative price takes the form of a nominal price. At that, the same set of relative prices can be variously reflected in various money units. Say, the nominal price of bread might become 100 money units; of butter – 119 units. Let us simply choose that the relative prices we deal with will turn into the nominal prices as well. Then the money measurement of the total final outputs from Figures 6.5 and 6.6 will show that the national income (national product) amounts to 11,077 money units ($7938 \times 1 + 2646 \times 1.19$).

If, in addition, we assume that the speed of money circulation is such that it makes just one turnover per period, then the total *monetary mass* needed to serve the sale and consumption of national product must be just equal to this product. In actual economies, money makes four turnovers per year and more, so that, in actuality, the need in monetary mass is much less than society's product served by it.

Let us also observe that within our example national income could be interpreted as a *budget constraint of the nation as a whole* and the related budget line coincides with the tangent price line shown on Figures 6.6 and 6.8 (do not mingle it with government budget).

This coincidence might erroneously suggest that just the budget line play the main role in determining the point of compromise. Some authors even define the highest possible welfare just through the budget line, setting aside the frontier entirely, as if this point lay where the national budget constraint touches its indifference curve. Meanwhile, both the quantities and prices for this constraint are found out with the aid of the frontier, which is of primary significance.

This also helps to clarify the confusion over the so-called money-constrained demand (or *solvent demand*) as opposed to the demand of unconstrained desires. In effect, the money-constrained demand does not reflect the demand by its very meaning but reflects the constraints of production. This is the most clearly seen from the fact that one of the main goals of central banks is to expand the monetary mass according to the real dynamics of production. So that, those who theorise about the supply from the production side and specifically moneyed demand, indeed theorise about production and production.

Apart of facilitating natural exchange of goods, the introduction of money affords much easier formulation of the condition of equality of the marginals in terms of income: a price set must be such that the marginals receive equal incomes. That is, for our case, the income of marginal producer of bread is 81.4 (81.4 × 1.0); and the income of marginal producer of butter is 81.4 as well (68.6 × 1.19).

Further, together with being an instrument for equalisation of the bottom-side marginal producers, price also serves as an *instrument of distribution* among all the other producers (upper-side marginals and mid-positioned producers) with the difference that there is no equal distribution between these latter. They receive higher incomes of different degrees, a sort of rent for heterogeneity, for their physical or mental abilities, better natural resources, and so on. Figure 6.10 on the next page shows such distribution of the total national income between the individuals. At that, total national income itself equals the area below the heavy lines.

The equality for the bottom-side marginals might also be interpreted as in some sense fair distribution regarding them and as an economic specification for the political slogan of *égalité*, the most actively supported just by the lower marginals. On the other hand, the top-side marginals are individual ones and receive unequal incomes.

Needless to say, at other variants of the relative price, including the notorious method of average productivities, the condition of equality of the marginals is not met.

Figure 6.11 shows such imbalance for the case when the relative price is determined just through average productivities and equals to 1.37. Then the marginal producer of bread would get an incentive to change his occupational choice and pass to the production of butter.

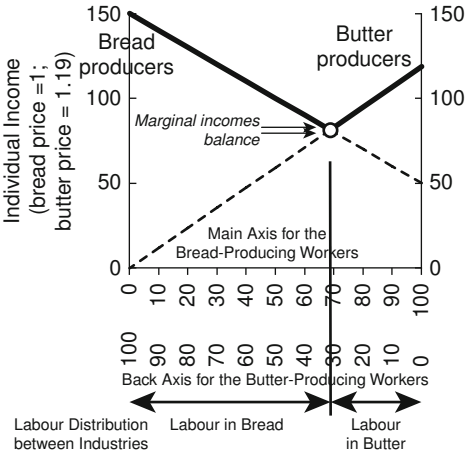

Figure 6.10 National income distribution
(equality of bottom-side marginals and inequality of others)

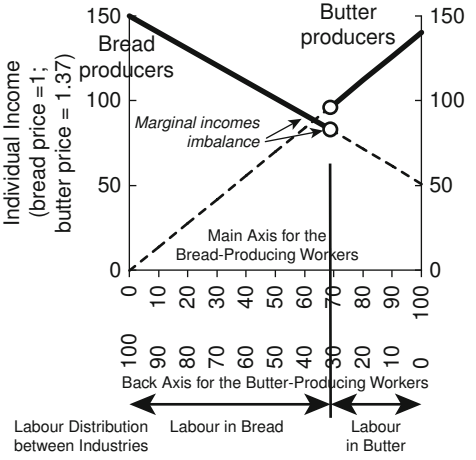

Figure 6.11 National income distribution
at prices determined through average productivities

As can be seen, price change pushes into motion only the bottom-side marginals. This disagrees with the canonical Walrasian (1874) view that any price changes shake up an economy throughout, as if in response to price increase all the producers would increase their intensity up to around-the-clock work in accordance with their individual supply curves.

The following empirics indicate that the former version is more favourable:

– "Rising oil prices makes deepwater oil and gas exploration more economically attractive", Tighe and Bounds (2011);
– due to rising gold prices "gold exploration companies rised interest to the placers of Canada's Yukon territory", Simon (2011), or it became profitable to reactivate some gold mines in South Africa previously suspended due to unprofitability, and so on.

Marshall, relying on the Walrasian shaking up the whole economy, concluded further that "an increase in the aggregate volume of production ... will increase the size, and therefore the internal economies possessed by ... [firms and thus enable them] to manufacture at a less proportionate cost ... than before" (Marshall, 1890, quoted by Hunt, 2002, p. 298). This means an increasing return to scale at the level of economy as a whole. Later, this was repeated by Sraffa (1926). Here again, a simple question suggests itself: what prevented those firms from operating at maximum possible size irrespective of "an increase in the aggregate volume", say, through mergers and acquisitions? After all, is this not an essence of competitive economy: to crowd out the competitors by all the possible increase in own output? That is why the only firm that has a chance to benefit from such an aggregate increase is the marginal firm; provided that it has not yet exploited to the full all its opportunities of the economy of scale.

It should also be underlined that the Walrasian concept of an individual firm's supply curve principally contradicts the concept of the production possibility frontier. Because, then, there is no need to sacrifice production of butter in order to produce additional bread; bread would simply come from nowhere in response to price increase. Consequently, the Walrasian economics do not include the notions of bottom marginal producers and of their equality. All this breaks the millennial classical tradition, in the sense that no special cases or simplifications of the Walrasian version could not be reduced to any type of an economy that had been considered by the classics.

Meanwhile, such reduction is quite possible in objective marginalism. If to consider homogeneous economy as a special case of the heterogeneous one, with uniform productivities within industries, then the frontier turns into a straight line and the producers' prices degenerate into being merely proportional to labour times spent by each of the producers. Such straight-line frontier derived from the classics has been considered by Hagendorf (2009).

In this case, the situations of inequality would be rather peculiar: all the producers of the commodity delivering lower income would be eager to change their occupation. So, the signals from prices would indicate very rough directions to an inter-industry coordination. This serves as a reminder about the eternal presence and importance of the signals from inventories too.

Anyway, our conclusion regarding the producers' price in a homogeneous economy is the same as regarding the fair (just, natural) price of the classics: price equals the labour "crystallised" in a commodity. But we arrived at this in our own way.

The classics considered labour a substance of price, as chemists once considered phlogiston a substance of heat. But this postulate was convincingly proven for a homogeneous economy only. Then, for centuries, they have been making excuses why the prices for other types of an economy do not comply with the labour "substance".

At that, just the next type close to the initial simplest one – a heterogeneous economy – was put in compliance with the "substance" in the most erroneous way: price was proclaimed to be determined by "socially necessary" labour, that is, by the average labour time spent. Figure 6.11 illustrates why this theory is wrong.

This also resolves a great deal of confusion about the baffled relations between price and "value". The latter could be simply dispensed with, allowing for that value is analogous to utility. The thing is that, in the approach proposed here, the problem statement directly refers to relative price as such from the very beginning and does not need any additional notion of "value". It is asked, what set of prices will create incentives for independent producers to provide in total the highest possible society's welfare. And the solution is that such prices must meet condition of equality of marginal producers.

Since the meanings and understandings of equality for the economies of different types are different and sometimes even not unique, the differences in price systems arising wherefrom are not of such a concern anymore.

It is true, that then the rigid classical "time is price" dependence is rejected. But this dependence is preserved as a tendency. This can be seen most clearly in the fact that the champions in productivity growth (in lowering labour time) are also the champions in lowering prices.

It remains to note that condition of equality of marginal producers also serves as a method of rough estimation and prediction of prices, if the quantities of production-consumption compromise are roughly estimated too.

6.7 Production possibility frontier in an economy with capital

Consider another heterogeneous economy of three products (bread, butter and fixed capital) with the same amount of 100 workers/producers. The available heterogeneous technologies are shown on Figure 6.12 (back axes are not used here).

Additionally, the technological requirements include capital-per-head ratios as follows:

25 units of capital per head in the bread industry;
35 units in the butter industry;
50 units in the fixed capital industry that provides capital for all the industries including itself; and
Capital lifetime is ten years.

As can be seen, we continue to observe the principle of worker-workplace coupling for each producer.

Along with the fixed capital, two principal new categories are introduced here – an intermediate product that is not to be consumed directly but is necessary for creation of final products (bread and butter, capital for dwellings is not considered, yet). And besides, fixed capital is the product that stays in the business for a long time, so that some substantial stocks of capital are needed for the production.

An example of one of the possible balanced and coordinated states of this economy is the following:

The labour is distributed between industries as it is shown on Figure 6.12.
Total capital stock is 3140 units (1454 in the bread industry, 949 in butter and 736 in fixed capital).

The products of the industries are: 7033 units of bread, 2344 of butter and 314 of fixed capital.

As one can see, the output of fixed capital is ten times less than total capital stock in accordance with the capital lifetime of ten years. And the distributions of capital stock and of labour between industries are in accord with the capital-per-head ratios required.

The production possibility frontier for all the possible final output mixes is shown on Figures 6.13a and 6.13d on page 99. The utility mountain is assumed to be the same one, but now the frontier touches another indifference curve as on Figure 6.13a.

And besides, the rate of transformation (the tangent to the frontier) cannot be easily determined now through the marginal productivities from Figure 6.12.

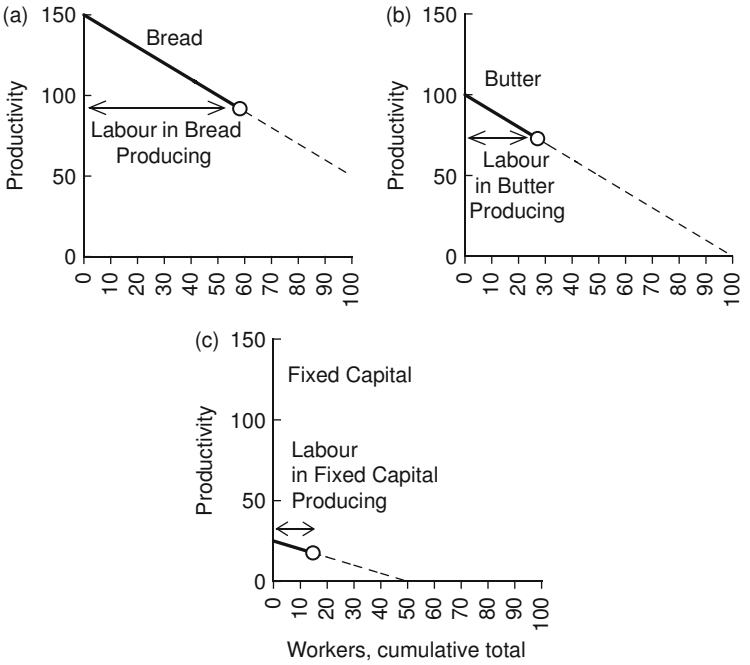

Figure 6.12 Labour distribution between industries and heterogeneity of productivity (physical units per worker)

Figure 6.13d shows the frontier together with the output of fixed capital corresponding to each point on the frontier, whereby reflecting the outputs of all industries. It is clear that fixed capital does not belong to the frontier conceptually because it is not directly used for personal purposes. This capital is only technically needed for providing the final consumption preferred. This also shows that since intermediate products are out of concepts of frontier and indifference curve, these latters are of no use for determination of prices of intermediate products, too.

Figures 6.13b and 6.13c show the corresponding balanced distributions of labour and of capital stock between industries.

So, how much must the producers' prices be? That is, what is the set of prices, which would induce individual producers to operate so that the whole economy operated at the highest point, the point of production-consumption compromise?

For that, condition of equality of marginal producers still must be kept, but the understanding of what this equality means now is not as unambiguous and clear as in the case without capital. The problem is that since there are different capital intensities across industries, the producers have to make different preliminary efforts and sacrifices to accumulate the capital stocks needed. Besides, as opposed to the simple case, where a movement along the frontier (structural change) could be fulfilled without any additional efforts, now such movement does require changes in total capital stock (see Figure 6.13c). All this ought to be taken into account for reasons of equity and some trade-off between the remunerations for current and past efforts is required. In the end it leads to the problem of division of income between labour and capital.

Consequntly, prices now must be determined depending on the understanding of this division. First, let us consider extremes: when all income belongs either to workers, or to owners. More precisely, let us consider such two sets of prices that the bottom marginal producers received (1) equal incomes at zero profits or (2) equal rates of profitability (profit per unit of invested capital) at zero wages. This also means maximum possible wages, or maximum possible profits.

Figure 6.14 shows such extreme ranges of the prices corresponding to the real indicators on Figure 6.13 (to reflect the ranges of bread price, as well, Figure 6.14c shows relative price of bread in terms of butter). At that, the price ranges for the outputs delivering the highest welfare are highlighted by markers.

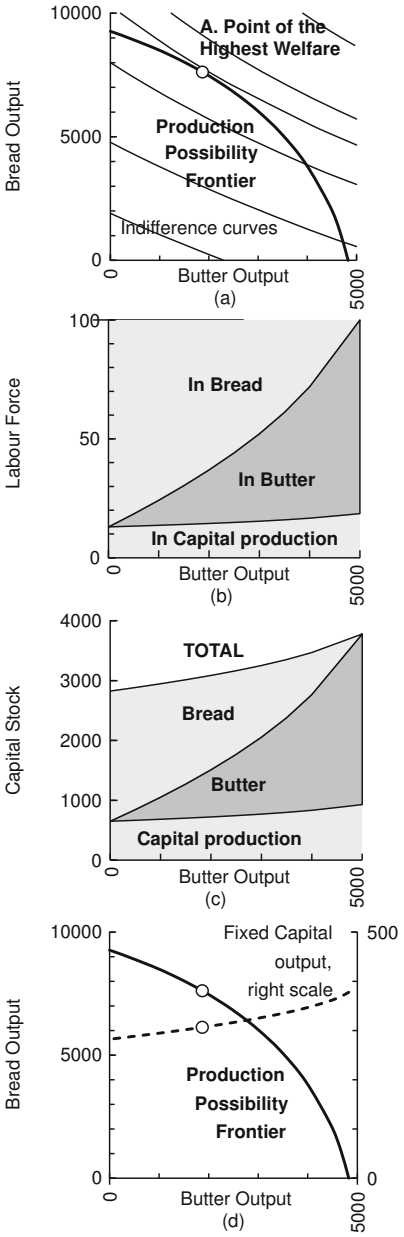

Figure 6.13 Production frontier for the economy with capital and corresponding balanced indicators

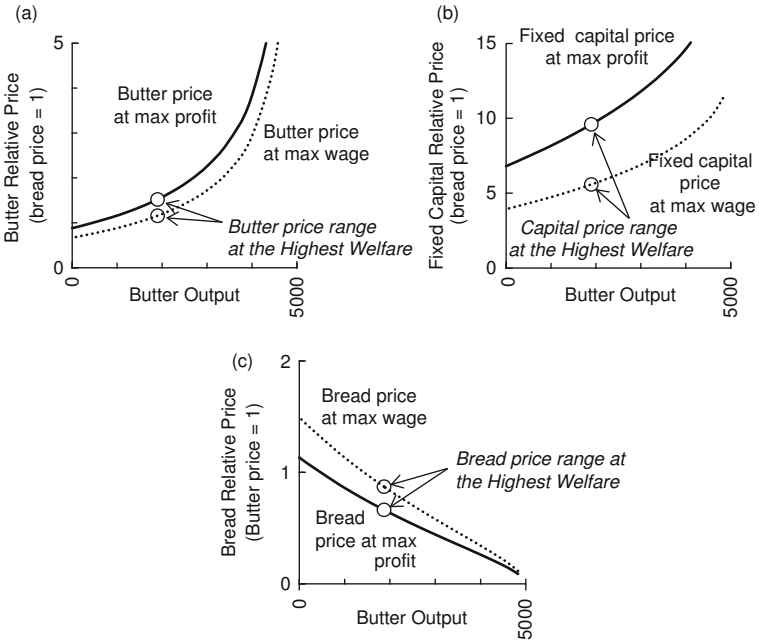

Figure 6.14 Prices depend on wage-profit distribution (for various output mixes)

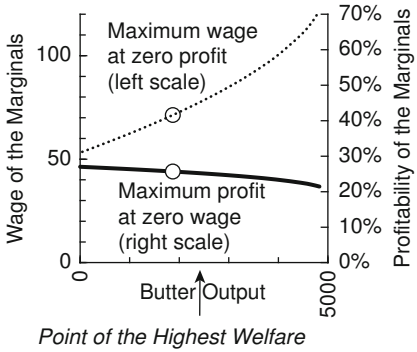

Figure 6.15 Levels of equality of the bottom marginals at extreme wage-profit distributions (for various output mixes)

The meaning of the prices at maximum wage is quite analogous to the economy without capital considered above, yet the derivation of these prices cannot be so easily visualised as in the simplest case. Still, such prices exist and are shown as dotted curves on Figures 6.14a–c. The corresponding equal wages of the marginals are shown as a dotted curve on Figure 6.15.

It looks like in this "only wage" variant the presence of fixed capital is altogether taken into account as depreciation expenses.

But it is not altogether so because there would be the same depreciations, if both capital requirements and capital lifetimes were increased in the same times. Say, if instead of 25, 35 and 50 units of capital per head and lifetime of 10 years, there would be 250, 350 and 500 units and 100 years, respectively, then the depreciations would be still the same. Or in contrast, there could be no fixed capital at all, but instead there would be an intermediate product, the need in which would just coincide with those depreciations.

And all these three substantially distinct economies are to have the same market prices, brushing aside great differences in capital invested? This serves as an additional argument to allow for the capital stock itself too. That is why Proudhon's dream about an uncut labour product had not come true.

So, the other extreme that allows for capital only deserves attention too. The prices providing an equal and maximal rate of profitability

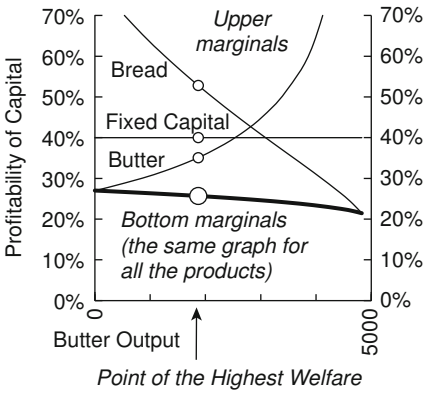

Figure 6.16 Profitability received by upper marginals (thin graphs) and bottom ones (the thick graph)

across the bottom-side marginal producers are shown as firm curves on Figures 6.14a–c. The levels of this equal profitability are shown on Figure 6.15. And in addition, Figure 6.16 discloses unequal and substantially higher profitabilities received by the upper-side marginals. This "potential difference" illustrates the precondition for origin of stock market.

As expected, in this "only profit" variant, the prices of more capital-intensive products (butter and fixed capital) are higher, while those of less capital-intensive (bread) are cheaper.

It is obvious that in a more realistic economy, where there are both wages and profits, the set of prices is somewhere between these extremes. This contradicts the main neoclassical postulate, but altogether agrees with the classical hypothesis that market prices depend on the way of wage-profit distribution.

Figure 6.17 demonstrates this important conclusion more visually on the plane for frontier and indifference curve, whereby adding to the consideration the so-called consumers' price. The attention is focussed on the highest welfare, so that the price range shown as a pair of marked points on Figure 6.14a now is a pair of price lines going through the highest point *A* (see the head-to-head arrows). Recall that prices are reflected through the slopes of these lines, wherefrom

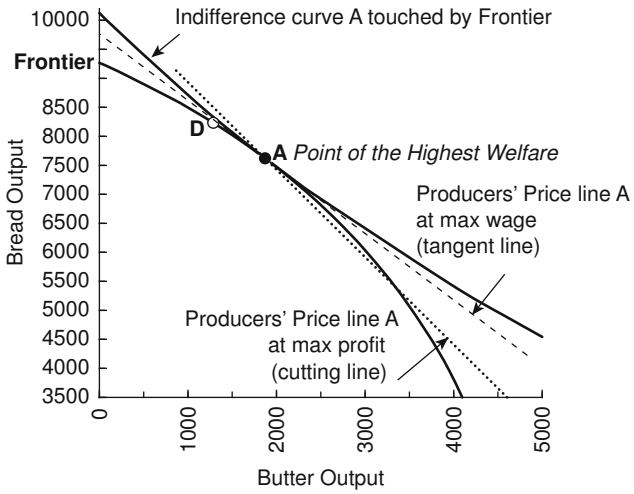

Figure 6.17 Producers' price depends on wage-profit distribution (for relative price of butter)

it follows that the butter price at maximum profit is higher than the one at maximum wage.

As can be seen, the price line, providing maximum wages for marginal producers, holds the predominant view and coincides with the tangent line.

But contrary to the established canons, the price line, providing for the marginals maximum rate of profitability on capital, cuts the frontier together with the indifference curve touched. Consequently, for this "only profit" extreme the producers' price (price of equality of marginal producers) is not identical to marginal rate of transformation anymore. And, which is more important, this remains true for all intermediate cases of both profit and wage.

And more than that, if to hold that marginal rate of substitution is a so-called consumers' price, then at the point of the highest welfare the producers' and consumers' prices are not in a general equilibrium with each other.

Such an equilibrium can exist but at a lower level of welfare (see point *D* on Figure 6.18). Indeed, in this point the producers' price line touches the related indifference curve that means the coincidence with the consumers' price line. But both these coincident lines cut frontier, meaning not the highest welfare at *D*.

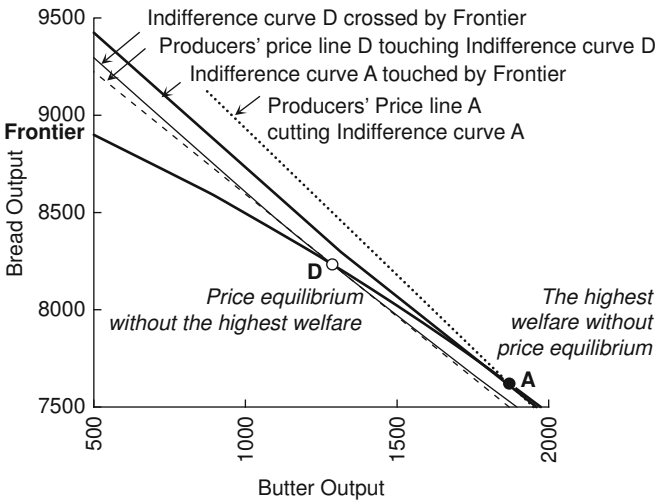

Figure 6.18 Equilibrium between producers' and consumers' price does not provide the highest welfare in an economy with profit

The attainment of both these ends simultaneously (the highest welfare and the price equilibrium) – that would also mean an identity of the producers' price with the marginal rate of transformation – is possible only in simplified abstract economies such as an economy without profit considered earlier.

Thus, it turns out that quite similarly to the classical labour theory the neoclassical general equilibrium is only valid for simplified cases as well. This result is achieved due to construction of the production possibility frontier based on the heterogeneity of producers and with allowance for the capital (we shall return to this later).

Now the comprehension of actual economy is complicated by two possible points of attraction with complementary advantages and disadvantages. To which of them would a market economy spontaneously gravitate?

If all the assumptions regarding consumers are to be trusted, and their heads really hold both the feeling of the level of society's welfare and the mathematical derivative of this level (be it called rate of substitution, opportunity cost, or consumers' price), then the feeling of welfare should be recognised to be more strong, and free economy should choose to operate at the highest point *A*.

In plain English, consumers indicate the most preferable product mix on the production possibility frontier, while producers indicate the prices at which they agree to produce it. And this reconciles the production and consumption sides of society as a whole that combines both these roles simultaneously.

This way of thinking does not mean that we get rid of any subjective sentiments on price. But once the preferable quantities had been somehow established, and if consumers had also a sentiment of comfort from the possibility of consuming these quantities regularly, then whichever the consumers' prices (or "subjective values") might be, the consumers had no choice but to submit to prices dictated by the producers and ensure the repetition of the productive process. That way "the subjective" inside people turns into "the objective" outside them.

To attribute to the consumers' price more importance, we must abandon the realm of repetitive economy. Tons of ink has been wasted here on verbal explanations of how a subjective price works, with only one solid point being quantified at that; namely, at a price equal to zero, the consumers would prefer to "buy up" the whole.

It should be admitted that within this vein it is not so quite clear what type of market adjustment process leads just to the highest welfare, if the starting point were far from it.

The renowned interplay between producers' and consumers' prices leads to the price equilibrium, to point *D*. This sounds very plausible, but for that, then, humanity would be altogether barred from enjoying the highest possible welfare.

To reach the highest welfare (point *A*) there should be a circular search for it and/or adjustment mechanism based on the consumers' feeling of the preferable proportions (bundles) of consumption. If these proportions were rigid, then the adjustment could start as it is outlined on Figure 6.19.

At point *D,* the proportions of output do not comply with the proportions of consumption (with the ray that goes through point *A*). Specifically, the proportions produced at *D* contain a higher share of bread than required. So, if the consumers persisted in their proportions, then some part of bread would remain unused, whereby giving signals to the producers to lower both output and price of bread in favour of butter. This would mean a move toward the highest point *A*, and so on.

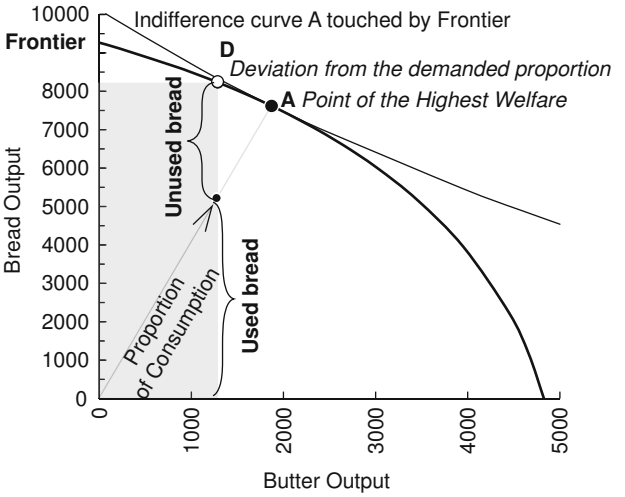

Figure 6.19 Adjustment at rigid proportions of consumption

6.8 Wage-profit compromise

6.8.1 Not yield to formalisation

In this section, we shall scrutinise the middles between the extremes at the highest point and discuss the unsolved problem of how to determine income distribution between wage and profit exactly. The other important problem of the distribution of capital (of wealth) itself in society will not be considered yet.

As it was established above, while the product mix, delivering the highest possible society's welfare, is a unique one, the set of market prices making incentives to produce this mix is not unique at all and depends on the way of wage-profit distribution adopted in the society. This, inter alia, confirms the idea expressed, for example, by Toporowski (2011) that prices are "variables exhibiting particular kinds of distribution".

For the highest point, which is the most important for us, it was determined that equal wages of the bottom marginals may vary from nothing to 71.3 units (bread is accounted as a proxy for money here); at that, the reciprocal profitabilities of the bottom marginals vary from 25.7% to nothing, reciprocally (see Figure 6.15). And the corresponding ranges of prices are shown on Figures 6.14 (for all the products) and 6.17 (specifically for butter).

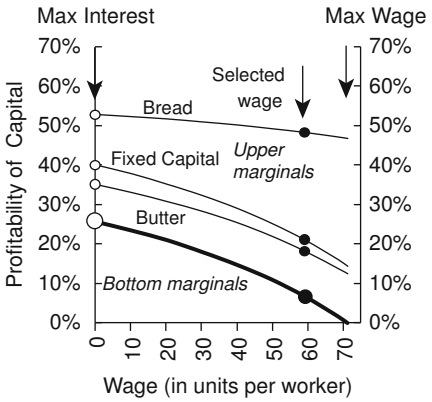

Figure 6.20 Profitability of capital depends on wages (detailing of Point of the Highest Welfare on Figure 6.16)

Now further details are shown on Figure 6.20 (the dependence of profitabilities on wage) and Figure 6.21 (the dependence of producers' prices on wage).

On Figure 6.20, the profitabilities or the upper-side marginals are determined at the same wage as for the bottom marginals. This is the simplification, not simplifying the results. In actuality, wages are also heterogeneous but of a lower degree than the heterogeneity of productivity.

The graphs on this figure agree with common sense that the higher the wages, the lower the profits. But it disagrees with uncommon theories that profits must be equal to zero. Hunt (2002, p. 372) sarcastically observed in relation to this:

> the entrepreneur was motivated entirely by the desire to maximize profits, although in the neoclassical scheme there were never any profits when the economy was at ... equilibrium. The entrepreneur never learned this sad fact, however, and endlessly bought factors and sold commodities in search of these nonexistent profits. At the end ... the entrepreneur found that paying each factor owner the value of what that factor created in the production process exactly exhausted the total value of what had been produced.

Paradoxically, the neoclassical approach relying on entrepreneurs driving for maximum profits ends up with zero profits; while our drive for real

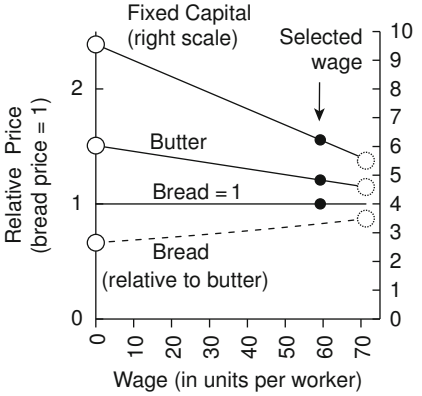

Figure 6.21 Market prices depend on wages
(detailing of the ranges at Point of the Highest Welfare on Figure 6.14)

welfare, specifying what prices should be for that, ends up with a wide range of profits, where even the marginal producers are profitable.

The other disagreements are the following.

Figure 6.21 shows that at a wage rise, market prices of different goods may either also rise or fall. This disagrees that upward wage pressures inescapably contribute to inflation. Analogously, this also disagrees that a wage rise inescapably contributes to unemployment. Rather, it may contribute to more fair distribution of the income jointly earned by labour and capital. The binding impact of wages on unemployment starts from the threshold when the profits of marginal producers turn to losses. But it is only of theoretical importance, as opposed to structural unemployment considered in the first part of this book.

These results also disagree that market prices are formed by equal mark-ups to the costs. The actual variability especially manifests itself in the businesses with quick turnover which operate a small profit and quick return policy. Nonetheless, the rate of profitability on their capital is not small.

The same holds for the idea as if prices were determined by the costs. The thing is that costs are different, while prices are the same for all buyers/sellers. After all, if there were no "high" prices covering "high costs" of the bottom marginals, where would the high profits of the non-bottom ones come from?

Now, the question naturally arises again – how to distribute the income jointly created by labour and capital. Where is the golden mean, the concrete variant out of all the feasible variants of distribution at which the economy should operate? This would, at last, specify the financial sphere in addition to the real one and accomplish the economy altogether.

Alas, even Marshall (1890), the father-founder of the notorious supply-demand cross, had confessed that this question does not yield to formalisation: "there is nothing but bargaining to decide the exact shares … divided between employers and employed. … what point between these limits should be taken … can be decided only by higgling and bargaining".

Further quotations below support this conclusion, as well:

> Smith held essentially a bargaining theory of wages, focusing attention on the relative strengths of the parties, "workmen" and "masters", in the conflict over the distribution of the product. (Kurz and Salvadori, 2003)

> ... unlike his contemporary Malthus and the later marginalist authors, Ricardo did not conceive of the real wage rate (and thus the rate of profits) as determined in terms of demand and supply. (Ibid.)
>
> how the managing director of a large industrial plant could find out the money value of the product of the last laborer. (Oppenheimer, 1943)
>
> a rising labor movement have been associated with shifts toward greater income equality, and periods of labor movement decline have been associated with rising income inequality. (MacEwan and Miller, 2011)

Unfortunately, the Marshallian Cross has baptised the whole economics, including the determination of wages (profits), in spite of the protests of its father-founder.

6.8.2 How Great Plague killed off supply-demand for labour

The main fact in corroboration with the validity of supply-demand curves for labour and wages is the Great Plague, Black Death of 1348, that killed one-third of the population of England and caused the doubling of wages. Edward III issued the Ordinance of Labourers and the Parliament ordered the Statute of Labourers against this.

According to the neoclassical version, the plague had shifted the supply curve of labour to the left. But actually, the plague shifted the labour itself to tilling less land, not the worst land, of course. The productivity of that less labour became higher, creating a precondition for higher wages. This explanation is not an abstract one and can be validated numerically. The comment that the situation was restored when the ratio of labour to land had been restored (Wikipedia, 2012) is also just compatible with this version. In Germany, after the Thirty Years War (1618–1648), wages had even tripled. The policy response then was a strengthening of serfdom.

The neoclassics abstained from an explanation of the price increase that concurrently took place in those times, while their curves, easily shifting to and fro, are apt to hammer home everything. In the meantime, having in mind that money does not undergo to plague, an objectivist explanation is straightforward: prices rose because production fell with an unchanged monetary mass.

Among earlier explanations of wage, let us recall the minimum-level-of-existence theory, which gave birth to the belief as if a fall in

bread price would cause a fall in wages because, they say, the existent minimum determining wages would become cheaper. Such an alleged evil from cheap bread had much confused distant debates over the Corn Laws repeal in Britain.

Another explanation, claiming to provide the exact solution of what wage and profit must be, is the theory of marginal factor productivity authored by Clark (1899). To determine an exact wage's share it is sufficient to add one additional labourer and measure the additional product he contributed (which literally means that the last labourer should be able to buy back his whole product with his wages). To determine an exact capital's share, add one additional unit of capital and measure the additional product it contributed. Hunt (2002) called this "the myth of the measurable productivity of capital".

Here the difficulty is that we cannot add one labourer "bare-skinned", without equipping him with capital, while a coordinated addition of both would re-create the same problem anew. That is, the objectivity of the worker-workplace coupling cannot be rationally rejected.

Unfortunately, over-aggregated production functions like the Cobb-Douglas one do measure the products of labour and capital separately at the expense of rejecting the coupling, together with much of their practical importance.

So, since the idea of marginalism is very vague and has diverse interpretations, our interpretation is based on an understanding of producer as an integral entity where labour and capital are coupled in a synergy, and where it is impossible to formalise the splitting of the joint product in the exact parts ascribed to each partner. To formalise this is the same as to decompose an indicator of birth rate into separate contributions provided by mothers and provided by fathers (yet there is nothing impossible to sophisticated econometrics). Consequently, our marginalism deals with an integral marginal producer, rather than with a marginal labour and marginal capital.

All in all, regarding the wage-profit compromise (or wage-profit dichotomy) there are only some utmost ideas and the empirical facts.

The Marxian view of profit as evil, as labour unpaid due to the exploitation prohibits profit from any right to existence. On the other hand, the so-called market equilibrium gives its blessing to any wage of whatever amount, and to any profit, of course.

The truth is that besides the right for profit to exist, it must also be admitted that instead of the exploitation there is the problem of unfair distribution of wealth jointly created by labour and capital in

favour of the latter. This is because the reigning ideology of social partnership is not always fairly practised. "Capital is a necessary fundamental of economic life, without which labour cannot unfold itself, but it can turn into a self-contained abstract fundamental, and then he falls out of an organic hierarchy" wrote Kyiver Berdyaev (1923).

An unfair distribution is especially highlighted in connection with the recent crisis. "[T]here might be a link ... between radical inequality and financial crisis", asserts Galbraith (2012, p. 3; see also MacEwan and Miller, 2011, or Brancaccio and Fontana, 2011). Still, this is to some extent a separate problem and could hardly be a cause of crises. "[I]f the consumption of the masses is never enough to buy back the product ... why is there no *permanent* depression?" asks Rothbard (1995, p. 429).

Then, for lack of a formalised way to quantify wages and profits, we have nothing to do but rely on facts, which say that the actual share of labour income in total national incomes approximately varies in the range of 50% to 60%. Consequently, to accomplish our economy, it is selected (in some degree at random) the distribution marked by bullet points on Figures 6.20 and 6.21. Besides wages and profits, this has pinpointed the particular set of prices and the rates of profitability of capital at which our economy is functioning.

So, the producers' prices in a heterogeneous economy with fixed capital must ensure equal profit rate across the marginals, at wages determined in an informal and exogenous way. This is a more precise, marginalistic formulation of the classical version that profit rate must be equal across all the producers.

6.9 Burnt bridges to supply-demand paradigm

For many scholars it still goes without saying that "in a phase of expansion ... demand curves shift upward, or in a phase of contraction ... demand curves shift downward" (Schumpeter, 1939a, p. 54). To clarify this, let us derive the standard supply-demand curves (in their standard price-quantity plane and in nominal prices) from the holistic "frontier-mountain" approach considered above. In other words, let us consider the controversies between holistic and atomistic views of an economy. This will require rather complicated manipulations even for fairly simple economy without capital. Still, the consolation is that this will be done for once before pushing the

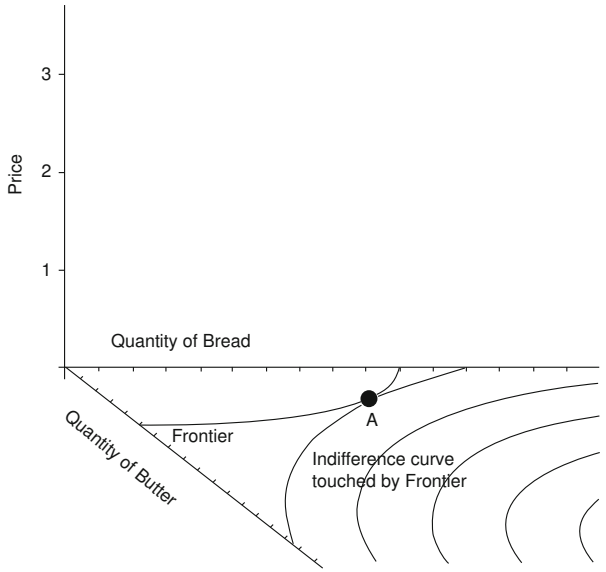

Figure 6.22 Plane graphs of frontier and indifference curves represented in space (for the economy without capital)

supply-demand paradigm back into the history of false economic thoughts.

So, we shall demonstrate the way to supply-demand curves on the diagrams for an economy without capital. Regarding the demonstration on an economy with capital, there will be only descriptions in words of the arguments added by accounting for capital.

As a first intermediate step, let us obtain the curves in relative prices. Generally speaking, relative prices are already well visualised as slopes of price lines in a "quantity of butter-quantity of bread" plane as on Figures 6.6–6.9 and 6.17–6.18. Now we must pass to a three-dimensional space with an explicit axis for price.

Figure 6.22 provides the representation in space of the frontier for an economy without capital from Figure 6.6, and the indifference curves from Figures 6.7 and 6.8 are represented there too. Note that the "price-quantity of bread" and "price-quantity of butter" planes on this Figure are already the same with the neoclassical price-quantity 2D plane.

But such 2D planes lose the dependency of each price on the quantities of two products. That is why the 3D picture is more full (see

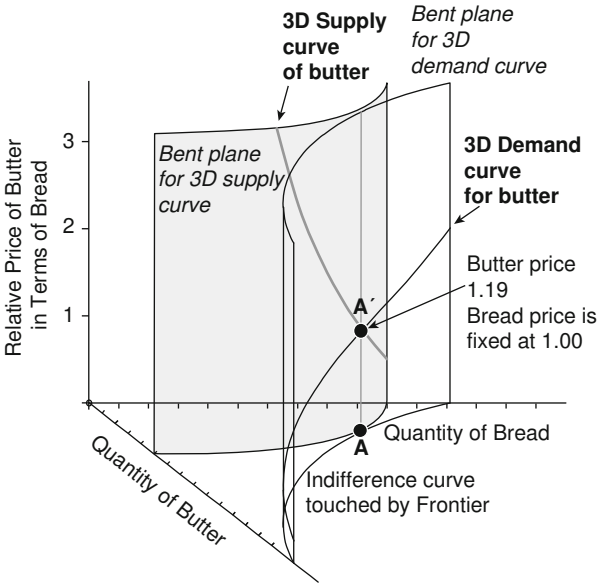

Figure 6.23 3D supply-demand curves for butter (in relative price)

Figure 6.23). Now the producers' and consumers' prices are located on two bent planes set on the frontier and on the indifference curve, and looking like cylinders' walls. On these walls, there are the 3D supply and demand curves for butter in relative prices. These 3D curves do not cross but touch each other in point A' that explicitly shows the relative price of butter of 1.19.

Note that for an economy with capital these 3D curves would not have anything in common at all, because then at the highest point A the producers' price is not equal to the consumers' one.

Thus, it turns out that supply curve closely relates to the frontier and adds to it an explicit representation of the producers' price. While demand curve relates to the indifference curve touched by the frontier and adds the consumers' price.

Now, to come nearer to the neoclassical flat plane, let us project the 3D supply-demand pair on the "price of butter-quantity of butter" plane as on Figure 6.24.

Then the neoclassical 2D curves turn to be shadows of the complete 3D picture, and because of this they have lost all the information

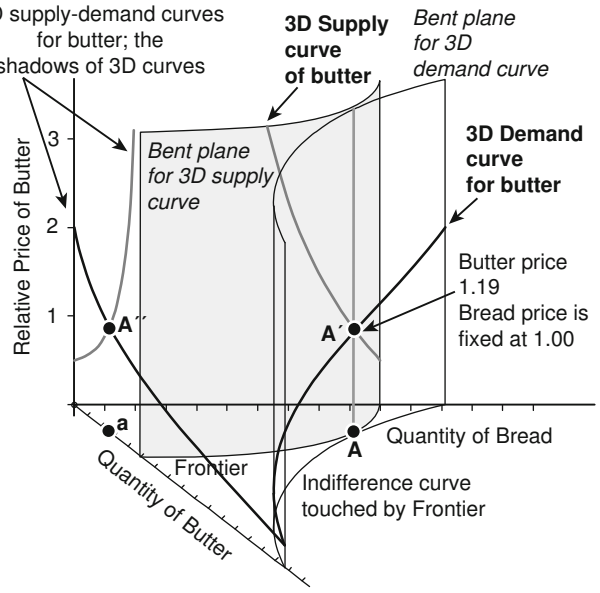

Figure 6.24 2D supply-demand pair for butter as a shadow of the 3D pair (in relative price)

about their relation to the frontier and to the indifference curve touched.

At that, the point of touching A' now appears as the point of intersection of the shadows A'' (see also the illusive intersections on Figures 6.25–6.27). Also, note that for an economy with capital, where the original curves do not even touch each other, the intersection of shadows loses any special meaning at all.

Further turning of relative prices into nominal ones can be made in countless ways. Let us choose that the consumer price index remained the same for all the product mixes, and take the equality prices, determined earlier, as a benchmark (price for bread = 1 and price for butter = 1.19). This passing to nominal prices also introduces non-trivial curves for bread (in relative prices they would be unit curves).

As a result, the overloaded Figure 6.25 shows two pairs of 3D supply-demand curves (for bread and butter) and their projections/shadows

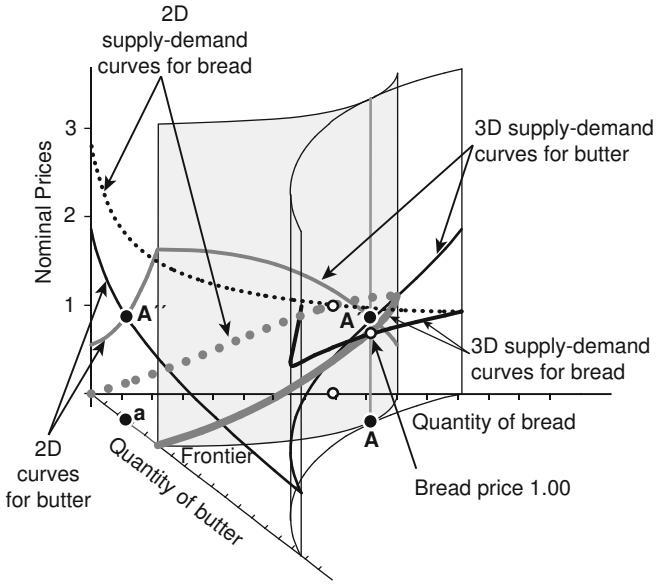

Figure 6.25 2D supply-demand pairs for bread and butter as shadows of the 3D pairs (in nominal prices)

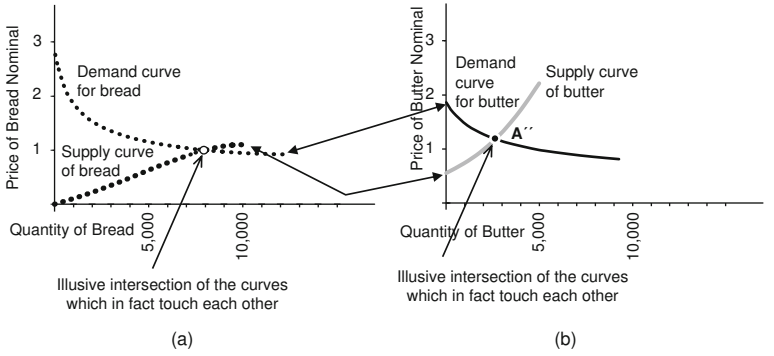

Figure 6.26 Standard neoclassical supply-demand curves (double-edged arrows show some correspondences between two products)

on the respective price-quantity planes (all these – for nominal prices). It is clear, that on this new figure only the benchmark points *A′* and *A′′* from Figure 6.24 "survived".

So, Figure 6.25 already contains standard neoclassical supply and demand curves – represented in space, though. It remains to perform the final step and bring these 2D curves back to their "natural" 2D space as on Figures 6.26a and 6.26b.

As can be seen, the standard curves for bread and butter look like quite independent ones, and the correspondence and interrelation between them is not as clear as in the frontier-mountain analysis. The double-edged arrows on Figure 6.26 show some examples of such correspondences.

Besides, this realm of shadows is not very convenient for reflection of the changes. Figure 6.27 shows the technical progress from Figure 6.8 "in the language" of supply-demand curves.

Allowing for the origin of supply curves from the frontier and of demand curves from the indifference curve touched by the frontier, some deceitful illusions can be uncovered, which the science derived from these shadows. First of all, we may conclude that the free and independent shifts of these curves are impossible.

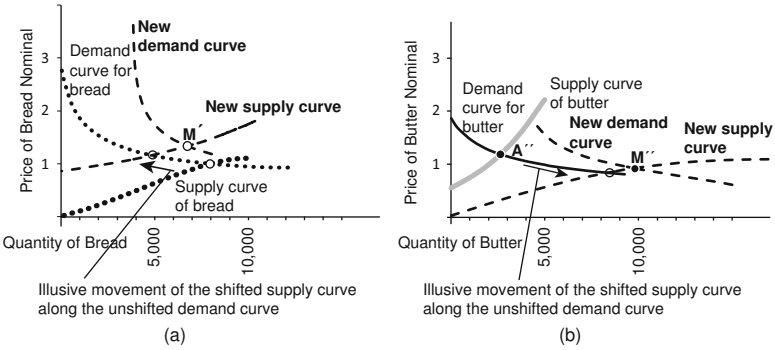

Figure 6.27 Technical progress in terms of supply-demand curves (for the case shown on Figure 6.8)

Figure 6.27 shows that technical progress looks like simultaneous shift of both supply and demand curves. In fact, only the supply curves have shifted (because the frontier shifted); as to the demand curves, they do not shift, but instead there emerge the shadows of another indifference curve touched by the frontier. Meanwhile, it is perceived as an apparent movement of the demand curves too.

Besides, this could be conceived as an illusive movement of the supply curves along the unchanged demand curves; or, reciprocally, of the demand curves along the unchanged supply curves. Such independent shifts are a popular object of baseless theorising. Just this gave birth to a fundamentally false notion of growth driven by demand; that is, to increase output it is sufficient that demand would increase.

A further argument against is that the intermediate products are out of supply-demand paradigm in principle. There cannot be any *demand* for them, only *technical need* derived from the final products determined by fundamental compromise.

Thus, the supply-demand curves (Marshallian Cross) are a very inconvenient tool for reflection of mutual interdependence in the economy, and they lose any meaning if considered beyond general context, as a single pair, especially, due to losing any connection with relative price.

In spite of this, an introduction to economics still starts with these worthless shadows of the actuality. Their resilience and widespread proliferation lie in the superficial plausibility and "universality". Any actual change in quantities and prices could be proclaimed to be "caused" by the movements of this one-size-fits-all pair because the validity of such statements is untestable.

Mathematicians call this too many degrees of freedom; schoolchildren, cooking up a solution, having spied up the answer key.

That is why: these curves are of little help for predicting the future. Balaguer (2010) characterised such predictions as "damned by the ceteris paribus curse".

Allowing for that, next to price, the Marshallian Cross has also baptised whole economics, this flaw of the degrees of freedom is inherent to much more complicated schemes based on the supply-demand paradigm and able to "fit and suit" any data. Small wonder, that such sophisticated but still "too free" curves, such as the IS/LM ones, have easily "explained" the recent crisis, as well (see, for example, Taylor, 2011).

6.10 Connection with and evolution of welfare economics

> ... it is possible to do welfare economics without the use of prices, however this is not always done.
>
> Wikipedia (2009)

> My scientific concept is the opposite to that of Walras. If I wanted, I could have presented my theory of equilibrium in such a way that it would seem to have nothing in common with that of Walras.
>
> Pareto (1911)

Such paragraphs are more appropriate for the beginning, but allowing for the singularity of our one, it is placed here, after the above detailed description of overall ideas expressed below.

The proposed approach can be related to the aggregated general equilibrium theory or to the Paretian general equilibrium or, what is more preferable, to welfare economics. This is because, in fact, welfare economics is economics on its own, where equilibrium is no more than the condition of welfare. Otherwise, there should also be an economics that does not care about welfare.

Despite the widely accepted term "Walrasian-Paretian general equilibrium", the single "Paretian general equilibrium" has its own significance. It suffices to note that Pareto "attempted to introduce some sort of a 'general' theory of general equilibrium" (Cirillo, 1978, p. 99).

In contrast to Walras, Pareto considered the production-consumption compromise in terms of "tastes and obstacles" and "have abandoned demand and supply functions as tools of analysis" (Koopmans, 1957, p. 60, quoted by Fonseca, 2014).

From the very beginning he considered the commodities produced, in a form of production possibility frontier, while the Walrasian approach claimed to cover all the types of commodities, where commodities produced were believed to be a simple modification.

These conceptual dissimilarities afforded to visualise the equilibrium as a tangency of the frontier and indifference curve, and to formulate it as the problem of welfare of society as a whole in terms of society's product transformation curves (production possibility frontiers) and society's indifference curves.

Besides, for Pareto, an equilibrium by itself did not have its own significance but served as a condition of attaining the highest possible

society's welfare. It is meant Marginal Condition that requires that marginal rate of transformation equals marginal rate of substitution. We proposed to call it fundamental condition of equality of marginal rates.

Further, Pareto released the Walrasian invisible hand from the visible crier. Recall that, according to the Walrasian version, market participants had their individual supply and demand curves and individually responded to the prices cried out by the "crier" or "auctioneer". So that a general macroeconomic picture was a sum of such individual reactions and the Walrasian general equilibrium was achieved by an iterative interplay between these cried-out prices and the summed-up responses to them.

And more than that, Pareto altogether released the general production-consumption equilibrium from prices too. This directly follows from the basic concepts, though it is not duly highlighted.

Actually, the assemblage of indifference curves reflect the people's unlimited needs irrespective of where the goods to satisfy these needs would come from – all the more, irrespective of how much those goods would be. And production possibility frontier is also an absolutely real concept representing all the spectrum of assortment of quantities that physically can be produced by an economy. Graaff (1957, p. 14) called this "the engineering level" of welfare economics.

So, the frontier and the utility mountain (utility map) – together with their marginal rates and the equality of these rates – represent a universal welfare economics valid for all historical economic systems (not for an exchange economy only) and explaining the quantities of final products produced and consumed regardless of prices. At that, the technical need in non-final, intermediate products is determined indirectly, through their input-output linkages with final products.

Thus, the core part of welfare economics is genuinely "free from prices", and even in a market economy the most rational quantities produced and consumed exist independently from prices.

As for the case of a market economy, an additional and separate problem arises: how to determine prices which would create incentives for independent producers to provide the total quantities determined in the core part. The solution is in condition of equality of marginal producers (rule of invisible hand) proposed above and in the producers' prices (equality prices) derived from this condition.

Here we arrive to the main difference with the neoclassical line: in market economy with heterogeneous capital, the producers' prices are not identical with marginal rates of transformation in production.

This is simply because, for this type of economy, the closest to actuality, producers' prices depend on wage-profit distribution and are not uniquely defined as the marginal rate of transformation. After all, the fact that the latter shows how one output lowers while another one rises does not imply any relative price between these outputs.

Chance coincidence of the rate with price may occur in three simplified cases:

- in an economy without fixed capital;
- in an economy without profit; or
- in an economy where capital is not a heterogeneous one.

And an additional argument against the determination of prices through production frontier and indifference curves is that intermediate products are out of frontier and of curves, conceptually. It is mistaken to consider a frontier, say, for bread and oil, moreover – a consumers' indifference curve for them (no one wants to drink oil, but wants domestic electric lighting generated with the aid of oil etc.). This is to say that the frontier reveals only a fragment of an extended balanced picture (as on Figures 6.13–6.15) within which intermediate products are considered. Consequently, if to imagine market prices were determined by marginal rates of transformation, then it would remain unclear what determines the prices of the intermediates, while condition of equality of marginal producers encompasses all prices.

This also bears a conclusion that the marginal rate of substitution in consumption could not always be interpreted as the consumers' price. The fundamental role of this rate (together with the rate of transformation) is to serve for determining the quantities produced and consumed, irrespective of prices.

Consequently, there is a sequential determination of quantity and price. Quantities produced and consumed are determined by fundamental compromise and condition of equality of marginal rates, while prices are determined by condition of equality of marginal producers under the quantities taken from the fundamental level.

This overturns the whole neoclassical vision of a market economy – prices do not equilibrate producers and consumers, and prices and quantities are not determined simultaneously.

At the same time, our result fully agrees with the conclusion of classical political economy that "There appears to be a separate determination of quantities and prices in the sense that ... The 'changes' in these quantities are not explained as arising ... due to relative price fluctuations" Bharadwaj (1991, p. 86). So, our result not only approves this overall conclusion but specifies it further in a form of upgrading the Paretian welfare economics.

Altogether, this approach provides the historical continuity of the economy itself because it covers a prehistoric economy without exchange; and it restores the continuity of economic science because the proposed development of neoclassical economics is also a development of the seminal achievements of classical scholars regarding prices, wages, profits, objective heterogeneity and objective marginalism.

Here it is convenient to highlight the following note of Kurz and Salvadori (2003, p. 27; italics added): "many of the early marginalist authors, despite their completely different approach ... [i]ronically, ... were stern advocates of the view that *with regard to reproducible goods the then novel (marginal) utility theory ... amounted to materially the same thing*".

Unfortunately, the tradition simply took for granted the identity of prices with the marginal rates of transformation and substitution. This is valid for simplified economies, such as an economy without profit. Consequently, the traditional general equilibrium claiming to determine quantities and prices simultaneously is valid for "non-general" types of an economy only.

Or, in the proposed terminology, the traditional general equilibrium is defined now as a special simple case, when the producers' prices determined by condition of equality of marginal producers coincide with the marginal rates of transformation in production.

In actual market economies, with heterogeneous capital and wage-profit distribution, such coincidence does not take place and the producers' prices are not the same as the marginal rates. Moreover, these prices are not the unique ones and depend on the division between wages and profits.

The classics were conscious, at least at the very beginning, that their explanations of price by labour time were valid only for a homogeneous economy with manual work. But the neoclassics are still unconscious that, in fact, they have added a correct analysis of a heterogeneous economy with manual work, incorrectly analysed by the classics.

So, both classical and neoclassical economics are right only for their special cases; and both of them are wrong when they claim to

be more general ones. As we see now, they both have turned out to be special cases of the more general concept of fundamental production-consumption compromise that covers them all.

The differences in the understanding of general equilibrium considered above stem mainly from a different understanding of production possibility frontier.

The point is that, although the frontier, as such, is unanimously accepted – and it is also accepted that the frontier combines macro and micro aspects – the understanding of the firms (producers) constituting the frontier, and of the way of their quantitative reflection, is not so unanimous yet.

We construct the frontier based on the heterogeneity of producers, so that society's production frontier reflects a wide range of various output combinations of a whole economy through the wide range of various individual producers. At that, the range of possible output combinations of each producer is much narrower and could hardly be classified as an individual frontier. Consequently, a movement along the frontier is a movement from one producer to another.

In contrast to this, the neoclassics ascribe to firms their private frontiers with private marginal rates and view society's frontier as an aggregate of these mini-frontiers. Then, a movement along such a frontier is a resetting of the production process within firms.

At that, it is deemed to be normal when, in the equilibrium, the society's marginal rate of transformation equals the private rates, that is, the firms should be homogeneous, at least, in the sense of the same marginal rates (see, for example, Graaff, 1957, pp. 22–23 or Cirillo, 1978, p. 49).

It is notable, that a heterogeneity – in a form of possibility of different private rates – is acknowledged but considered as an irregular diversion to be corrected by state interference in a form of "corrective taxes", subsidies and so on. The role of the state, according to this view, is to fight heterogeneity by all means. So, the difference is that one approach highlights homogeneity; another, heterogeneity.

Further, besides these differences regarding the frontier, there are different ways of thinking and different toolkits of notions. In connection with this, let us consider some other disagreements between the rival approaches, starting from one single point of agreement.

The mainstream neoclassical theory does reflect the diminishing returns in the economy, but again, in a quite different manner: the diminishing returns are ascribed to each individual producer together with its individual production frontier.

Analytically, all this is provided by appropriately selected technological production functions, the most popular of which is the Cobb-Douglas one. The neoclassics assume that each producer can operate at arbitrary capital-labour proportions and his task in a market economy is to adjust these proportions to the prices of factors (labour and capital). Such an understanding of technologies looks analogous and symmetrical to the flexible changes of consumers' preferences.

Amazingly, the price "of the factor of capital" or "cost of capital" – which in this scheme is one of the determinants of the technology to be chosen – is understood here not as a price of produced capital good but as a "rental price of capital" closely related to interest rates for credits. This means that in addition to the prime problem of distribution of income between wage and profit, this theory at once tackles the subsequent problem of distribution of the total profit between active borrowers (the producers) and passive lenders. This going into the details of financials also helps to set up the details of technologies, as well.

At the same time, this attention to detail has not prevented the neoclassics from a fictitious assumption that the producers possess nothing and run their businesses wholly at the expense of others.

The financiers call this an over-leveraged business fully financed by debt. Recall that total capital is divided into two broad categories: own capital and one financed by debt; and the financial leverage or gearing is the proportion between this debt capital and own capital, or debt-to-equity ratio. Since the own capital is assumed absent, the neoclassical view is based on a fantastic leverage ratio equal to infinity.

Nevertheless, apart of the reflection of diminishing returns, the defenders of this approach put forward two additional arguments: it is a finished, mathematically symmetrical theory, and it is capable measuring marginal contributions of factors (of labour and of capital) separately, that pave the way for the dubious idea that wages and profits could be exactly formalised without any participation of "bosses and workers".

For the sake of all this, they unconsciously sacrificed the heterogeneity and the dependence of price on wage; and quite consciously sacrificed the engineering essence of the production, so that, in addition to fantastic finances, fantastic over-flexible technologies described above are proposed.

Of course, it could be afforded a certain variation in technological proportions. But to afford the degree of variation up to an arbitrary combining of the "factors" is really too much. This altogether deprives

this approach of the ability to deal with technological unemployment, not to mention the other shortcomings.

Could you fancy a plant manager for whom it would be open equally possible ways to step up production: either by hiring additional workers only, or by installing additional equipment only; the engineering and technological requirements being of no significance? All of significance is the factor prices (wage and rental price of capital) that completely define the actual capital-to-labour ratio. Say, if workers would work for free, then they would dig by shovels only, power shovels becoming unnecessary; while at high wages, firms would look to substitute capital for labour. According to such reasoning, poor countries have low capital-labour intensity due to cheap labour force; and it is the rise in wages that leads to the adoption of more capital-intensive technologies (see, for example, Broadberry et al., 2008). Meanwhile, the actual causality points in the opposite direction.

So, the neoclassical belief, that a market economy is anxious about the capital-labour mix adjustment to factor prices sounds more and more ridiculous. We hold another reasoning – new technologies are introduced simply because they are better in non-financial terms of productivity and quality, the "factor prices" being instruments of distribution of the enhanced wealth.

In spite of many such critiques (see, for example, Hunt, 2002), those "pluses" outweigh and this method, although irrelevant to practice, still widely remains in use.

6.11 To be constructive

> No law can be laid down respecting quantity,
> but a tolerably correct one can be laid down respecting proportions.
> Every day I am more satisfied that the former enquiry is vain and delusive,
> and the latter only the true objects of the science.
>
> Ricardo (1820b)

Although half of economists believe that utilities are observable and measurable, nobody had not measured yet but one point on the whole utility mountain, namely, the actual quantities consumed. Besides, the actual price gives a rough estimate of the slope of the indifference curve touched by the frontier (this estimate is rough because we have

found that in a heterogeneous economy with capital price does not coincide with the slope).

As for production frontier, it is quite visible, being constructed out of visible producers. So, only these hard data are at our disposal for forecasting the macroeconomic impact of technical progress. Consequently, if a new possibility frontier has been foreseen, knowing the parameters of new technologies, the old question arises again: at what actual point, out of this broad range of possibilities, will the economy operate? What changes in the structure of final consumption will take place?

Here we encounter the difficulty that, although we have a clear theory explaining the quantities and the prices, the constructive method derived therefrom relates to the prices only. That is, prices can be determined by condition of equality of marginal producers once the quantities are somehow given. But those quantities remain blurred in the mist of the invisibles.

One of the ways out is to set it aside. "Ricardo had no theory of how the level of output is determined… But then neither did any other premodern economist", concluded Blaug (1999, p. 223, as quoted by Kurz and Salvadori, 2003). Analogously, Park (2012) observed that Sraffa (1960) simply "takes the quantities of output as 'given' when considering the determination of prices. He gives little hint at how the quantities of output have come to be what they are".

Still, we can try to obtain at least rough estimates of the quantities. Ricardo's (1820b) idea suggests an assumption that in the new economy there would be the same proportions of consumption as previously (this, on no account, means that the structure of the economy itself would remain the same). Let us call this estimation of the point of compromise on new frontier an estimation "by old proportions of consumption".

Besides, taking into account that we also have a rough estimate of the slope of the old indifference curve touched by the old frontier, we may also assume that the new slope would not change substantially; and then find such another point on new frontier where the slope is equal to the old one. More simply, this is the point where the relative prices would roughly remain the same as previously. Let us call this other estimation one "by old slope of tangency".

Then, it may be further expected that the actual point of compromise (point of the highest welfare) lies somewhere between these two estimates.

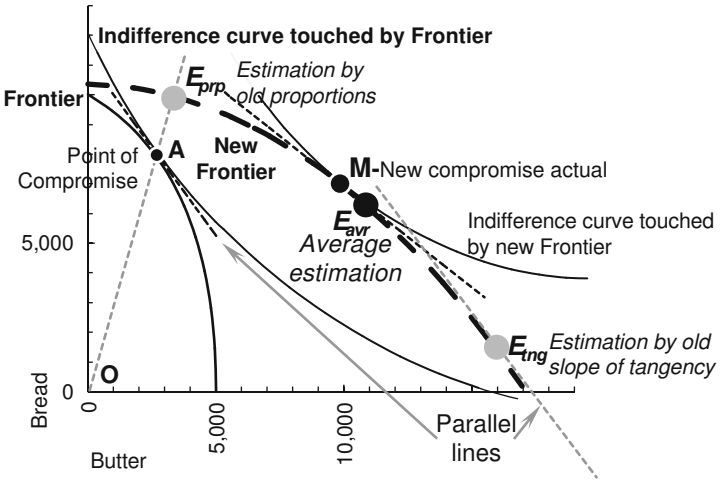

Figure 6.28 Estimation of new point of compromise (of the highest welfare) at progress, fragment from Figure 6.8

All this is illustrated on Figure 6.28, which is a fragment of Figure 6.8. The new point of compromise (point *M*) is unknown, because the new indifference curve touched by new frontier is invisible just as the old curve was invisible too.

Point E_{prp} shows the estimation by proportions. It is the point, where the ray *OA* that passes through the point of old actual output *A* (point of compromise) crosses the new frontier.

Point E_{tng} shows the estimation by tangency. The tangent line to this point is parallel to the tangent line to the point of old actual output *A*.

Point E_{avr} shows the average of these two extreme estimates. As can be seen, for our example, this average finds itself not very far from the actual point *M*.

The content of this chapter is also discussed in publications by Ryaboshlyk (2007a, b, 2008a). It remains to recall, that we have considered the real and financial aspects of steady states, while the dramatic passage between such states is the theme of next chapter.

7
Dynamics of Prices

7.1 Dynamics without inflation

Suppose that new technologies are invented in the heterogeneous economy with capital from Sections 6.7 and 6.8. These technologies offer a leap-like increase in productivity, as it is shown on Figure 7.1. However, at the same time, such progress must be paid for by investments in new equipment, which new capital-per-head ratios are the following:

- 45 units of capital per head in the bread industry instead of 25;
- 70 units in the butter industry instead of 35;
- 90 units, instead of 50, in the fixed capital industry that provides capital for all the industries including itself. At that, the first units of new capital are produced by old, existing capital; and
- Capital lifetime is seven years instead of ten.

It is assumed that the proportions of final consumption (the receipt of sandwich) at old and new technologies are the same and contain three units of bread per one unit of butter. Then the steady state of the new economy is the following:

- The labour is distributed between industries as on Figure 7.1.
- Total capital stock is 6146 units (2238 in the bread industry, 2158 in the butter one, 1750 in the fixed capital one).
- The products of the industries are 14,931 units of bread; 4977 units of butter; and 878 units of fixed capital. So, the new technologies can increase the level of consumption more than two times.

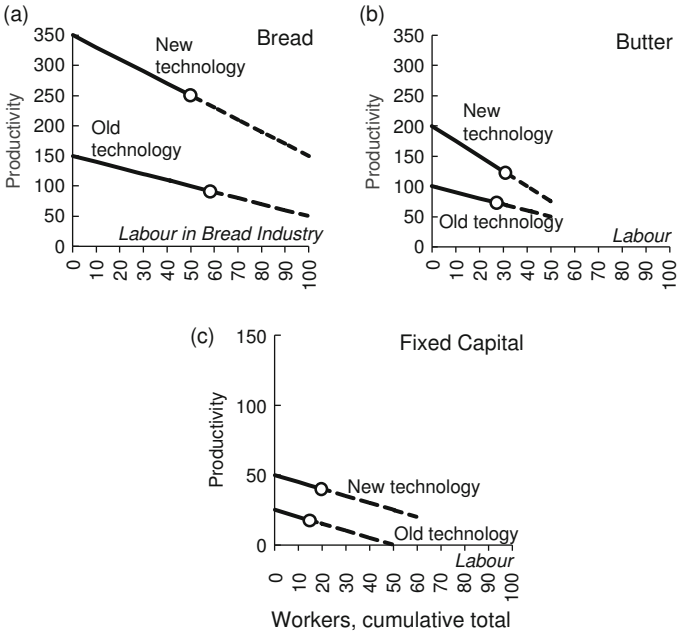

Figure 7.1 Heterogeneity of productivity and labour distribution between industries at old and new technologies

In order to fix the idea regarding the financial indicators that are not yielded to a complete formalisation, it is assumed that the share of wages (of payroll) in total national income is constant and equals 60%, and that the wages are the same throughout the whole economy. Note, that the shares for individual producers are not the same, of course.

Then the sets of prices of equality of marginal producers at these two levels of balanced state are as on Figure 7.2. At that, the nominal prices are determined so that the consumer price index remained unchanged. Besides, wages increase from 61 to 130 units; profitability of the capital invested by marginal producers rises from 7.2% to 8.8%. But to attain this new welfare the new capital stock must be accumulated beforehand and some process of gradual substitution of old technologies via new investments is required.

The real part of the transition is shown on Figures 7.3 and 7.4 as a process providing maximum consumption summed up by years. As

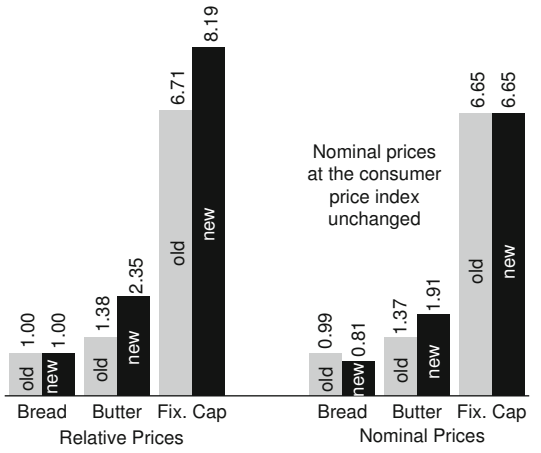

Figure 7.2 Prices at the initial and final states

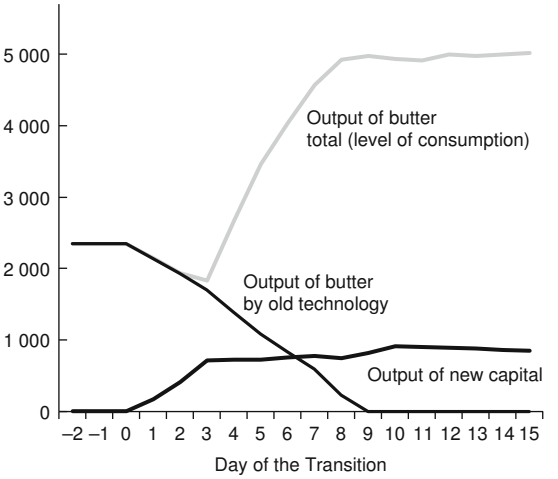

Figure 7.3 Coordinated transition path to new technologies, the outputs

it was already underlined in Part I of this book, even optimal paths of development in some cases contain a starting temporary recession, and this example illustrates this once more: the starting acceleration of investments runs at the expense of consumption. Moreover, in

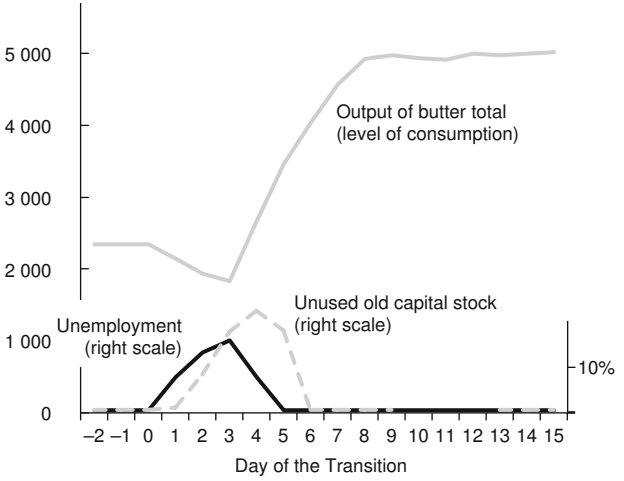

Figure 7.4 Coordinated transition path to new technologies, unemployment and unused old capital

addition to the recession, this optimal path also contains the structural unemployment and capacity underutilisation – early retirement of old capital due to the advent of a more advanced one (see Figure 7.4). Since the proportions of consumption, of the bundles, are fixed, the level of consumption is reflected here through one of the consumer goods, namely, butter.

Now, let us discuss how to determine the *price dynamics in the transition* to new technologies when only the endpoint prices at the beginning and at the end are already estimated. Allowing for the principle of single price for the whole economy, no price system could concurrently equilibrate both old and new groups of the marginals.

Therefore, let us put forward the hypothesis that the transition prices should at least minimise the difference between the rates of profitability of all the marginals. At that, the weights of the outputs by old and new technologies in the total outputs must be taken into account too. Hence, the case is about the weighted differences. This is important, because it guarantees the natural dominance of the old prices at the beginning and of the new ones at the end.

Figures 7.5 and 7.6 show such transition prices and Figures 7.7 and 7.8 show the sequential profitabilities of old and new marginals.

Figure 7.5 Transition prices of bread and butter

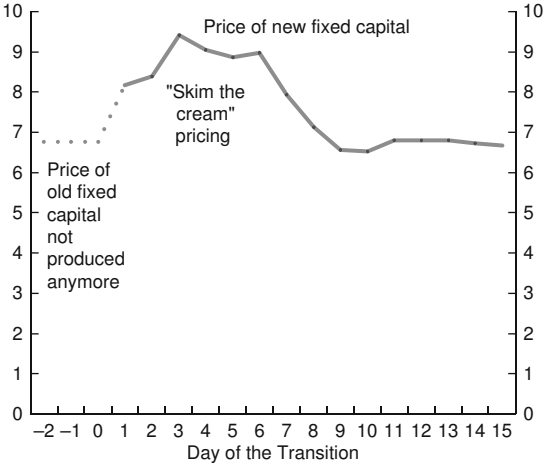

Figure 7.6 Transition prices of fixed capital

As seen on Figures 7.5 and 7.6, the price dynamics of the fixed capital are not so smooth as of bread and butter. This is because of the peculiarity of establishing prices for principally new products. Since it is physically impossible to equip all the users at once with new capital,

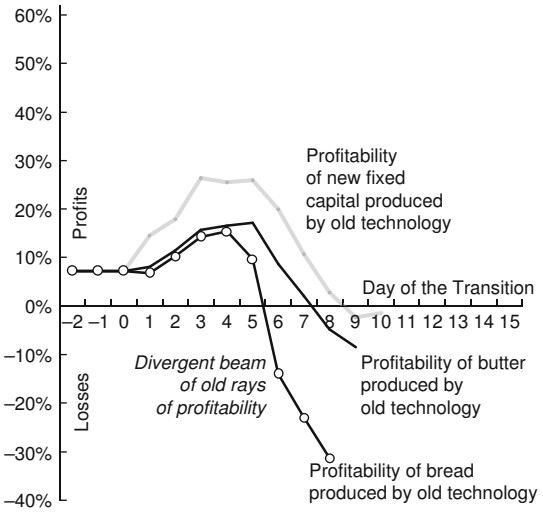

Figure 7.7 Profitabilities of products produced by old technologies at the transition prices

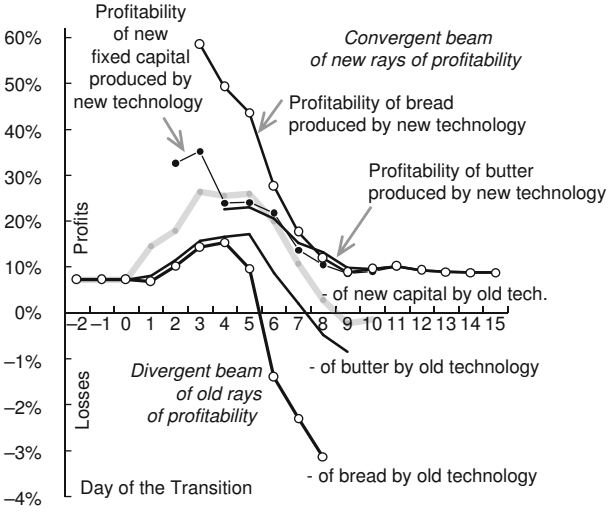

Figure 7.8 Profitabilities of products produced by new technologies added to old technologies on Figure 7.7

the buyers of the first units will be the upper-marginal producers, that is, the rich ones. The next units will be sold to less wealthy ones, and so on. That is why within a dynamic process there must also be a dynamic equality between the selling and buying producers of new restricted products. This starts from the "equality with the rich", that is, from a high initial price, which then gradually lowers. This phenomenon heavily relies on the heterogeneity and is named "price skimming".

Returning to all the prices, the dynamics of the profitabilities provided by them form a pair of Beams of Rays of Profitability: a divergent beam for the products produced by old technologies and a convergent beam for new technologies, as one can see from Figures 7.7 and 7.8. Each old ray ends with the end of output of its product (when the last producer using backward technology becomes unnecessary); and each new ray begins with the beginning of the output. At that, the roles of marginal producers are dynamic ones, too, ceaselessly moving from one to another.

Pérez while describing "some chaotic" phases of the cycle, has word-painted the price chaos caused by progress:

> ... during the period of installation ... The change in the relative price structure is radical and centrifugal. ... Rates of inflation or deflation ... are chaotic and all statistical efforts to construct constant money series ... are doubtful ... People ... experience great uncertainty as to the "right" price of things. (Pérez, 2002: 62–63)

Now we may specify a regularity of this chaos as the divergent and convergent beams of old and new marginal profitabilities. As one can see, the end part of the old beam is in the red that leads to a sequence of important conclusions. This being in the red means that over and above the unavoidable output and employment decline, and capacity underutilisation, even an optimal development may also be fraught with unavoidable financial non-profitability. That is, the old producers still needed for coordinated and smooth functioning of real economy may face premature loss of profitability, and consequently, they would lose an incentive to stay in production also very prematurely. This in turn causes small distortions in the real rational development shown on Figures 7.3 and 7.4.

This is a thus far unknown type of market failure, namely, a failure of market prices – the transition prices are temporarily incapable to give the right signals for producers.

7.2 Dynamics with inflation: non-Keynesian substantiation of the Keynesian easy money

Another impediment for the altogether rational real development is the problem of high savings needed for that. The share of gross investments in GDP in our economy in the transition to new technology is twice as much as in the steady states. Figure 7.9 shows that even when measured in different variants of prices, the general picture remains the same, because in fact this reflect the "physical strain" put on a society in this period.

The supply-demand theorists simply proclaim that this high "demand" for savings will be automatically satisfied by the correspondingly high private "supply". While the non-theorists have to deal with an eternal imbalance of investments with savings.

The objective ground for this imbalance lays in substantially various rates of savings technically required at various phases of cycle, which are too quick for more inert private savings. In times of recession, the latter may even drop.

The southern part of Figure 7.10 shows such typical dynamics of the level of private savings. This means that at such a "supply", the

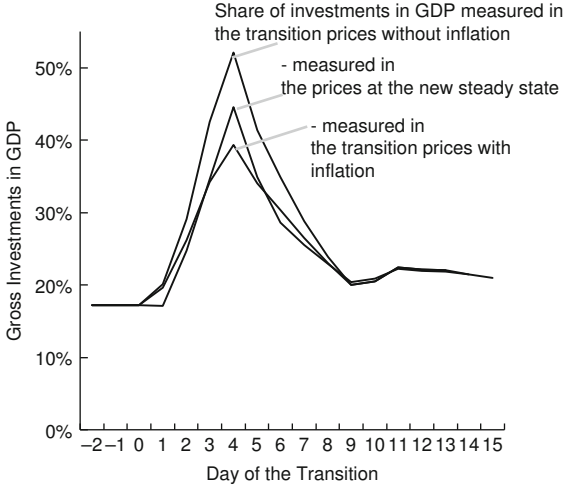

Figure 7.9 Share of gross investments in GDP
measured in different variants of prices (for real dynamics on Figure 7.3)

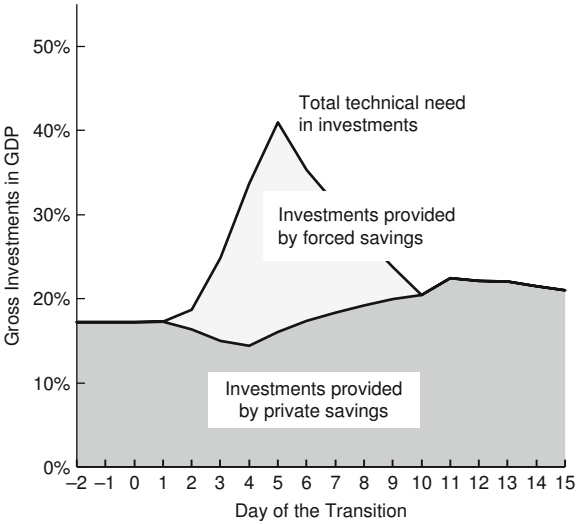

Figure 7.10 The sources of financing the technical need in investments

real development would be much slower than engineeringly feasible and provide a lower welfare, than as on Figure 7.3.

One of the outcomes is to impose a cheap state-set price for fixed capital. But this would not be a market economy anymore, and it is unlikely that the expected result would be actually achieved. The quasi-market solution is that the state resorts to "forced savings" and finances the balance by monetary emission. This is shown also on Figure 7.10.

The obvious side effect of this is inflation (Figure 7.11). The proliferation of such practice is testified by many facts, say, that half of the inflation in Turkey was caused by the construction of hydraulic facilities or that "With stubbornly high inflation ... Beijing is expected ... supporting growth" (FT, 2012), and so on.

Now, let us consider further, a less obvious side effect of inflation itself. Figure 7.12 shows the profitabilities of old marginal producers at the variants of prices with inflation and without inflation. Here the inflation does not merely change the scale but leads to much more substantial effects. As can be seen, under inflation, the beam of old profitabilities is much less dipped in the red zone of losses; say, on this figure, two industries with old technologies now work to the

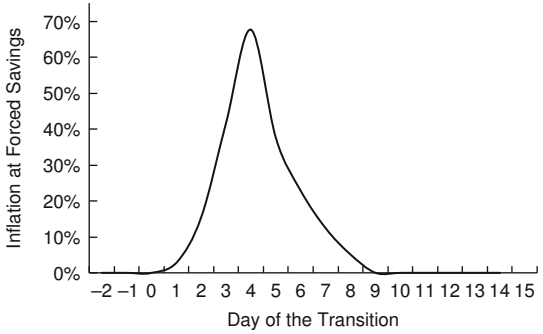

Figure 7.11 Inflation when the investment gap is financed by monetary emission

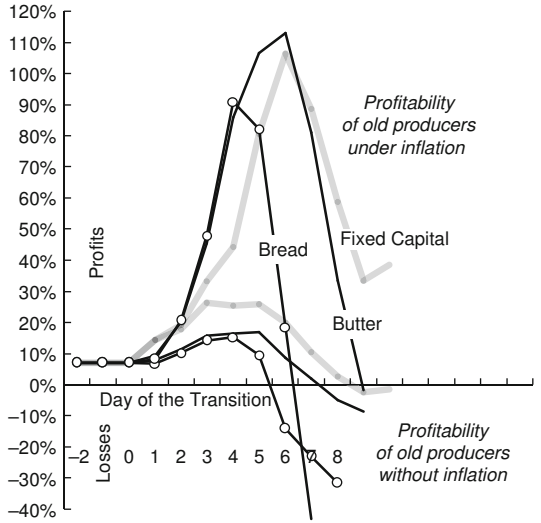

Figure 7.12 More money – less bankruptcies (the beam of old profitabilities with and without inflation)

end, remaining profitable. This means that such money injections cut down the number of bankruptcies and alleviate recessions, because inflation cheapens the debts and makes the repayments easier.

So, this policy of easy money kills two birds with one stone: it facilitates investments in the development, and cuts down bankruptcies

by cheapening the debts; all this being achieved at the expense of lenders repaid in depreciated money. There are proposals that the repayments were obligatorily indexed for inflation, especially highlighted by Soto (1998), with insignificant practical implications, yet, and the former policy remains in use as the lesser evil.

Needless to say, conversely, an exaggeratedly difficult money and deflation artificially increase bankruptcies and just this took place at the Great Depression. In other words, it was the case when the manageable depth had been unwittingly "managed" in the wrong direction, profoundly worsening the situation.

The reader might have already concluded that, in fact, it is achieved a non-Keynesian substantiation of the Keynesian easy monetary policy at crises. This is a paradoxical example of correct policy implications derived from an incorrect theory, of doing the right thing for the wrong reason.

Keynes's logic derived from the need to compensate the lack of so-called effective demand by government spending, financing it especially by monetary emission. While the latter seemingly inferior point turned out to be the crucial one. And all the volumes of Keynesianism have boiled down to a practical advice to conduct monetary policy opposite to that in the time of the Great Depression.

As to the "boosting demand by government spending", it is of additional importance due to the danger of crowding out effective market by an ineffective government.

Thus, the proposed approach backs up this type of anti-crisis policy with a more plausible theory and opens the possibility to apply it more consciously. Keynes had said how to cure crises, but not when crises would spring up – and now this gap has been filled.

Besides, now we may specify the bounds of validity of the Phillips Curve that is incorporated in many computational schemes as a strict functional relationship: "lower inflation – higher unemployment". Meanwhile, it works only in cases like the one considered above, and as a prevailing tendency. While in the phase of stagnation, the efforts to spur the economy on by spurring monetary emission and inflation bring in no more than *stagflation*.

It remains to note that all this proves once more the non-neutrality of money – the money supply does affect real development. The content of this chapter is also discussed in the publication by Ryaboshlyk (2008b).

8
From Interest Rate to Stocks

> The interest of money is...
> regulated by the rate... of profit
> which can be made by the employment of capital.
>
> Ricardo (1821)

8.1 Interest rate for credit: savings and investment

An interest rate for credit is set the same for all the borrowers and its height is especially crucial for the last marginal borrower.

That is why the maximum height of interest rate is limited by the profitability of utilising the credit by this marginal borrower, because there is no sense in paying more for a credit than it yields.

The less volume of credit resources of the whole economy, the higher the interest, because the volume goes to a more and more narrow circle of borrowers with more and more effective marginals within the circle; and reciprocally: the more the volume, the lower the interest.

Besides, allowing for interest on invested capital in turn depends on the wage-profit distribution; it follows that interest rate for credit inversely depends on the level of wages too.

Such dependence of the interest rate on these two factors in application to our example is shown on Figure 8.1. Let us call it "constructive demand curve for credit". It determines interest, once the volume of credits and the level of wages are known.

This concept originates from Ricardo (1821) who connected the interest with the "profit which can be made by the employment of

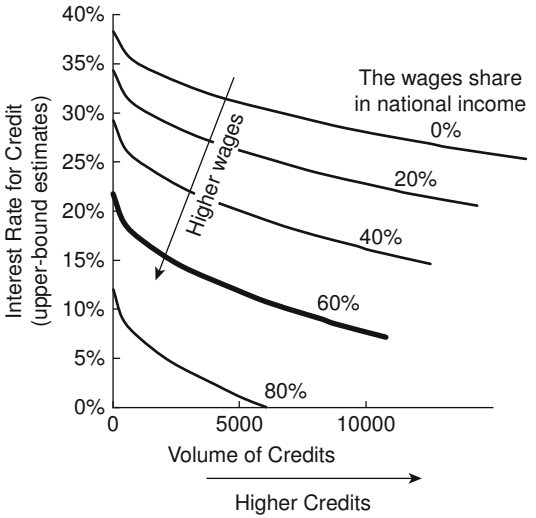

Figure 8.1 Interest rate dependent on volume of credits and level of wages

capital". However, here Ricardo did not take into account heterogeneity and marginalism as he did for price.

This was done by Keynes (1936) who introduced the investment demand-schedule, or the schedule of the marginal efficiency of capital, which determined the rate of interest. So that the constructive demand curve for credit is very close to the Keynesian schedule, the difference lying in the direction of causality. In Keynes, it is the volume of investment that is established in accordance with the rate of interest, not vice versa.

As for the supply curve of credit resources or savings, there are doubts about its existence along with the related equilibrium. "Saving does not depend on the interest rate", admits Mankiw (1994, pp. 402–403), but this has not prevented him from teaching the saving supply curve.

Bortis (2009, p. 18) states the same in a more stern way: "no regular, well-behaved associations between 'rates of interest' and 'quantities of capital', in general between factor prices and factor quantities, exist in principle."

Keynes (1936) criticised the Marshallian cross for savings rather contradictorily:

> ... the rate of interest [depends] on the interaction of the schedule of the marginal efficiency of capital with the psychological propensity to save. But the notion that the rate of interest is the balancing factor which brings the demand for saving in the shape of new investment forthcoming at a given rate of interest into equality with the supply of saving which results at that rate of interest from the community's psychological propensity to save, breaks down as soon as we perceive that it is impossible to deduce the rate of interest merely from a knowledge of these two factors.

Finally, having rejected the supply-demand for savings, Keynes substituted it with a more sophisticated, but not more constructive, supply-demand for money; as if one is really able to indicate a definite sum that would fully satisfy him.

The possible outcome from the evidence against the saving-investment equilibrium is to make the imbalanced situations themselves become a subject matter of science.

As it was considered in the previous chapter, savings could lag behind the technical need for investments causing a slower pace of growth than technically possible. Then the authorities often fill the gap by "forced savings" in a form of monetary emission.

In this case of lagging, the interest is determined by the actual volume of savings through the constructive demand curve for credit.

On the other hand, savings could also exceed the technical need for investments, and then the problem of excess savings emerges (i.e. you can lead a horse to water, but you can't make it drink). Such excess savings are often absorbed by the state.

Wolf (2010) made such an example: "Japan's private non-residential fixed investment was 20 per cent of GDP in 1990, close to double the US share. This has fallen to 13 per cent ... But no comparable decline has occurred in" savings. Bank crediting "stops growing, not because banks do not wish to lend, but because companies and households do not want to borrow" because of "diminished investment opportunities, once catch-up growth was over" (Wolf, 2010).

All that time the government was obliged to absorb these surpluses and run fiscal deficits, whereby accumulating huge government debt

amounted to 227% of GDP in 2010. "Without them, the country would have fallen into a depression" (Ibid.) and deflation.

Taking into account that in Japan most of the savings are made by corporations, the alternative policy for Japan might lie in absorption of the surplus by wage increase, that is, in passing from production catch-up with the developed countries to the wage catch-up. The latter still lags behind. In its day, it were the relatively low wages that had provided Japanese corporations with profits for the after-war investments, while now it is quite possible to increase wages at the expense of profits without any harm for real production and inflation. The corresponding real increase of personal consumption can be provided by passing from the ongoing foreign trade surplus to balanced trade; or, speaking figuratively, by passing from "feeding" other nations by excessive exports to "feeding" itself by a balanced exchange.

Thus, the discrepancy between the technical need for investments and the savings is a normal situation, not an intermediate moment in adjustment process governed by interest and gravitating to some final stage. Savings could simply be either used or not used in full, essentially different instruments being needed to deal with these two cases.

8.2 Leverage or gearing: stock market

The existence of credits naturally implies two concurrent matters.

First, total capital is divided into own capital and capital financed by debt (by credits of various sorts); this being measured by an indicator of leverage: the ratio of debt to own capital.

Second, this debt-equity division is more important for the upper-side marginals and mid-positioned producers, than for the bottom-side ones, since the latters get either no benefits from credits or the lowest benefits.

The case is, that above giving the possibility to expand business, credit affords to raise the profitability of own capital (return on own capital). For that the business must be effective, that is, the profitability of all the capitals invested must be higher than the rate of interest for credits. Then, the more credits are taken to finance the business, the higher the profit per unit of own capital.

Here is the essence of the leverage or gearing effect: to gear up profitability by the use of somebody else's money in addition to own money.

Shortly, the effect can be formulated as: the higher the leverage, the higher the return on own capital. Ultimately, if an owner possessed nothing and ran his or her businesses wholly at the expense of others, the leverage is infinite along with an infinite profitability. But on the other hand, there is a damping rule too: the higher the leverage, the greater the risk. That is why the acceptable leverage ratio should be prudent. Heterogeneity of leverage ratios is widely admitted, for example by Kim and Stone (1999).

Let us also note that from the dependency chain: the higher the wages, the lower the interest rates – while the lower the interest rates, the higher the leverage effect; we can also come to a counter-intuitive dependency: the higher the wages, the higher the leverage effect.

Some points of the previously mentioned are illustrated below. The horizontal line on Figure 8.2 shows the profitability of all capital of the upper-marginal producers of bread. This is the rate that can be achieved without resorting to credits, without leverage. The slope line shows the possibilities to increase the profitability of own capital proportionally to the leverage ratio. Figure 8.3 shows the same in relative terms – by how many times the leveraged profitability is higher than the non-leveraged one. In addition, the family of curves show the dependence of the leverage effect from the level of wages.

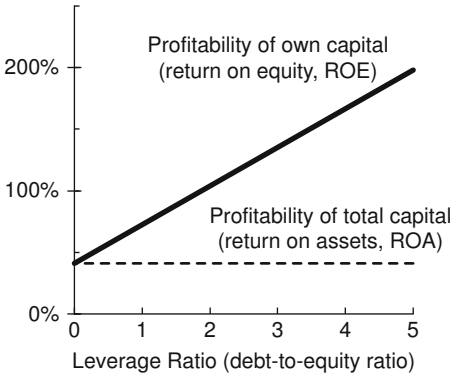

Figure 8.2 Profitabilities of own and total capital
(for the best producers of bread, under the wages share equal to 60%)

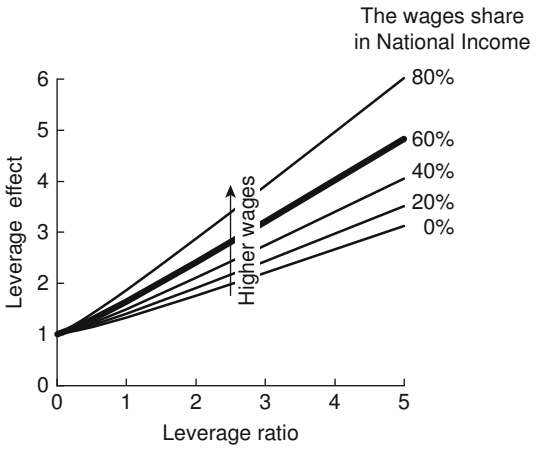

Figure 8.3 Leverage effect dependent on two indicators (for the best producers of bread)

Now, the considered difference between two returns – the return on own capital of the upper marginals and the return on credits (interest rates) – can be evolved into a theory of *stock market* which is coherent, at least, within all this framework.

Assume that the own capital is a tradable one and its nominal price is divided in stocks with a nominal price of one monetary unit.

Then the ceiling or upper limit of market prices of these stocks equals the ratio of the return on own capital and of the interest rate. Or, to put it another way, the upper limit is determined by how this individual profit rate outperforms interest rate of banks.

This follows from the reasoning that the difference between the two returns summons up the motivation to pay for the stocks at an even higher price than the nominal one and still receive higher payoffs than from credits. But this excess of the market price cannot be such that the return from the bought stocks would become even lower than from credits. Then they say: he would be better off depositing his money in a bank.

On the one hand, this is trivial, because interest rates traditionally serve as a benchmark for pricing stocks, property markets, and so on. Still, it remains unclear whence these interest rates came from, and they have been considered as state variables or exogenous ones.

As opposed to this, the proposed method opens up the possibility to deal with both interest and profit rates as endogenous variables and to deepen the insight into the interplay between them. This will give an estimate of an upper limit of stock market fluctuations at different phases of the cycle. Especially, this will afford to follow the approaching to the upper limit and forecast the events of stock market corrections. As it was underlined, at the heart of all these estimations lays a contraposition of the higher and lower marginals.

Further, the connection of stock prices with interest and profit rates, and the connections of these two with the levels of leverage and wage, means that the stock prices are also connected with leverage and wage.

Figure 8.4 shows such estimates of the upper limit of stock prices as the dependency on these two indicators on an example of the best producers of bread. Figure 8.5 displays a 3D image of this, resembling a sail, so that the stock price must be under this sail.

Figure 8.6 on the next page turns to the dynamic aspect and shows an upper limit of stock market fluctuations at different phases of the real cycle earlier shown on Figure 7.3 and at commodity prices from Figures 7.5–7.6. This is an aggregated "Index of the Three" – the weighted index of the stocks of three industries of our prototype economy (bread, butter and fixed capital industries).

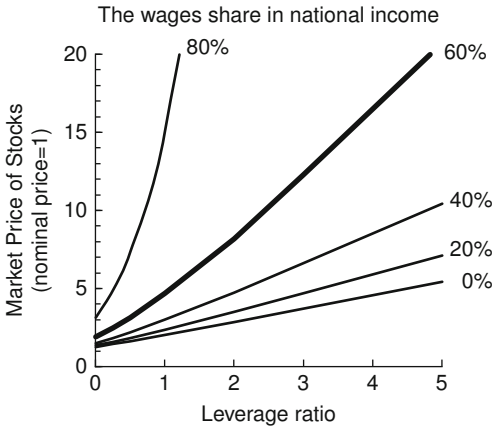

Figure 8.4 Upper limit of stock prices (of best producers of bread)

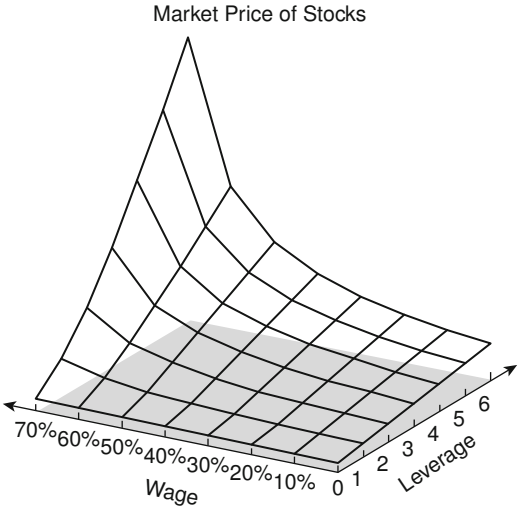

Figure 8.5 Stock price "sail": 3D picture of Figure 8.4 (for best producers of bread)

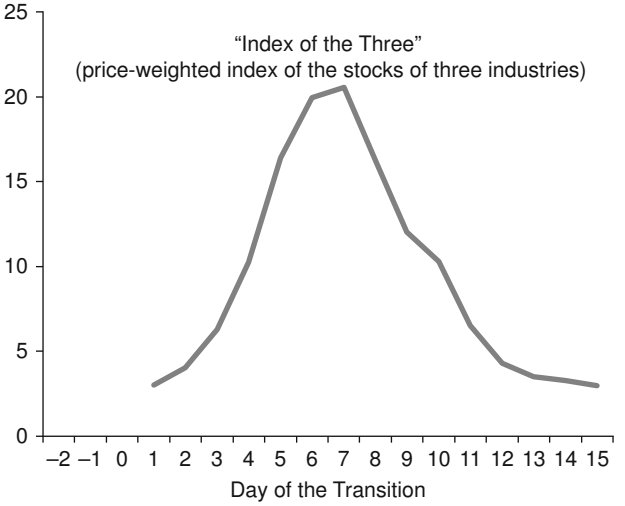

Figure 8.6 Upper limit of dynamics of stock market fluctuations (of the "Index of the Three")

Empirical supports for this explanation of stock market are the following:

- average return on stocks outperforms return on credits roughly by three times;
- the leverage effect is actively used for stock price managing;
- the recognition of the inverse dependence from interest rates. Say, rising interest rates is considered to be a "bad news for stock markets"; and
- one of the causes of the after-war tendency of an outpaced growth of stock prices is the growth of wages.

Part III
Precursors and Competitors

This part is less systematic and contains in-depth discussion around some theoretical fundamentals and other issues of the previous parts.

9
Concept of Price: Aristotle vs Marshall

9.1 Tail wags the dog

The understanding of the role of price as an instrument of fair distribution goes back to Aristotle (350 BCE), who in his *Nicomachean Ethics* considered price in the context of attaining reciprocity and justice.

Thomas Aquinas (1273) analogously thought that *justum pretium*, a just price, was "a price that suitably supported the seller in his social rank" (Canterbery, 2011).

The labour-is-price thinking also originates with Aristotle, who on the ground of those considerations of justice expressed this as follows: "... the terms have been equated so that as farmer is to shoemaker, the amount of the shoemaker's work is to that of the farmer's work for which it exchanges" and that "The builder ... must get from the shoemaker the latter's work, and must himself give him in return his own" (Aristotle, 350 BCE).

It took two thousand years until Smith (1776) upgraded those examples with figures: "if it usually costs twice the labour to kill a beaver which it does to kill a deer, one beaver should naturally exchange for or be worth two deer. It is natural that what is usually the produce of two days or two hours labour, should be worth double of what is usually the produce of one day's or one hour's labour."[1] At that he made a proviso that this refers only to "the rude state of society

[1] Then it took 233 years until Hagendorf (2009, p. 9) added the total labour time amounted to six days and constructed the production possibility frontier for beaver and deer.

which precedes both the accumulation of stock and the appropriate land…" (Smith, 1776).

But Ricardo specified that even in modern society, labour remains to be not the least determining factor of price: "…my proposition 'that…the quantity of labour employed in commodities determines the rate at which they will exchange for each other'…is not rigidly true, but I say that it is the nearest approximation to truth" (Ricardo, 1820b, quoted by Bortis, 2010).

Besides, Smith made no steps to the further specifications regarding heterogeneity and marginal producers, and defined prices through average "usually costs".

This insight had been fulfilled by Ricardo (1821, ch. 2, paragraphs 12–13) in his already mentioned generalisation:

> The exchangeable value of all commodities, whether they be manufactured, or the produce of the mines, or the produce of land, is always regulated, not by the less quantity of labour that will suffice for their production under circumstances highly favourable, and exclusively enjoyed by those who have peculiar facilities of production; but by the greater quantity of labour necessarily bestowed on their production by those who have no such facilities; by those who continue to produce them under the most unfavourable circumstances; meaning – by the most unfavourable circumstances, the most unfavourable under which the quantity of produce required, renders it necessary to carry on the production.…the supply afforded…were equal to all the wants of the community.

Ricardo himself had not attached great importance to this discovery and highlighted only a specific case for agriculture, in terms of diminishing returns, whereby initiating a notorious tradition living until now.

Nevertheless, a great merit of Ricardo is that he had underlined that "exchange value" (relative price) of "all commodities" is determined by those who produce "under the most unfavourable circumstances"; and he added an important clause that it meant those most unfavourable "who carry on the production" because their produce, being summed up with the others, provides "all the wants of the community". The latter means that the case is about those bottom marginals whose produce is still needed to society.

Paradoxically, this explanation of the nature of price through marginal producers looks like "the tail wags the dog" (Dunn and Levy, 2005), the worst determines prices for all the economy. But there is a substantial clause that this refers only to those worst whose products are still needed by the community. They have the lowest level of profit, equal among all industries, while the upper marginals and mid-positioned producers have their higher levels of different degrees.

Taking into account the principle of single price for the whole economy, "the dog" should be much pleased with obeying "the tail", because the longer the tail, the higher the dog's income. After all, if there were no "high" prices covering "high costs" of the lower marginals, whence high profits of the non-lower ones would come from?

As regards those worst whose products are not needed: they are sorted out by competition. So, prices considered here are essentially competitive ones because they are the lowest prices at which the marginals, whose products are still needed, would not leave their industries. It also reveals how it is mistaken to understand competitive "low" prices based on low costs of the best producers.

In this book, Ricardo's generalisation has been developed and reformulated in terms of prices of equality of marginal producers at quantities of production-consumption compromise. The latter specifies how "all the wants of the community" should be interpreted, and so on.

All this has been almost entirely overlooked until now. Kurz and Salvadori (2003) have also quoted this important passage of Ricardo, but in the context of discussion around technical knowledge, profit and output only.

It is symptomatic that in an explanation of why the "quantity of labour embodied in a commodity" cannot be determined independently of the level of output, which is one of the consequences of heterogeneity, Kurz and Salvadori resort to just an agricultural example:

> amount of labor needed in the production of one quarter of corn ... on the marginal land, which, however, cannot be ascertained independently of the total amount of corn to be produced and the quantities of the different qualities of land available in an economy. (Kurz and Salvadori, 2003)

Here it might be worthwhile to emphasise that this still holds true if instead of corn stands any manufactured product and instead of marginal land, a marginal industrial plant.

Heterogeneity is still confused with diminishing returns and cannot free itself from comprehension as an agrarian specificity, to become a property of the universe.

Sraffa (1926) explained macro-diminishing returns not by heterogeneity, but by existence of limiting factors of production "of which only a constant quantity was available". All this misled him to a halfway generalisation of agricultural "diminishing returns" to some other "specific" industries only:

> The law of diminishing returns has long been associated mainly with the problem of rent, and ... with reference to land. ... It had always been perfectly obvious that its operation affected ... also the cost of the product; but this was not emphasised as a cause of variation in the relative price of the individual commodities produced, because the operation of diminishing returns increased in a like measure the cost of all. ... Very little was necessary as regards the law of *diminishing returns ... to be generalised from the particular case of land* to every case in which there existed a factor of production of which only a constant quantity was available. (Sraffa, 1926, pp. 536–537; italics added)

So that, a "generalisation" had been confined to "that minute class of commodities in the production of which the whole of a factor of production is employed" (Ibid., p. 539).

Following this halfway approach, Sraffa also left a hint on the condition of equality of marginal producers:

> If diminishing returns ... are taken into consideration, it becomes necessary ... to examine the *conditions of simultaneous equilibrium in numerous industries*: a well-known conception, whose complexity, however, prevents it from bearing fruit, at least in the present state of our knowledge. (Ibid., p. 541; italics added)

All this looks like wondering about Ricardo's generalisation without making the final step to set all that straight and pass to universal heterogeneity and universal "diminishing returns".

For the present, Ricardo's generalisation is more welcomed, in fact, by business than by theorists and policymakers. This is because it helps the former defend itself against government attempts to impose cheap prices.

This is well illustrated by the related minutes of hearings in the US Senate, highlighted and commented by Senator Kefauver.

Preliminarily, the senator asked a contradictory question:

> ... if the products are identical, how can their prices be different? It is an elementary principle in economics that the product selling at a *lower price* will capture the market; other sellers must reduce their prices to meet the competition if they wish to make sales. (Kefauver, 1965; italics added)

In response, a businessperson Mr Bethlehem presented the standardized approach to this problem: "*Differences in costs* among producers *have little …effect on the prices* at which products are sold." (Ibid.)

This was supported by another businessperson, Mr. Homer:

> Differences in costs [are] the same as *differences in … efficiencies* …
>
> I believe that … the market price of a product reaches a level slightly above the *cost of the marginal producer*. … I do not think that all the producers who are *more efficient than the marginal* one *make the same amount of profit*. … if [we] showed a little bit better performance than anybody else, that may be because the results show we have been a little more successful than anybody else …
>
> [Thus,] *price level is … established by the marginal producer* …
>
> If you do not operate on that basis [namely] if you keep the most efficient producer cutting prices every time that he has a little margin in there or makes a little money, he *drives out of business* the rest of the producers. … [And in this way] you are going to gradually get down to the point where no one is able to stay in the business. (Ibid.)

Then Senator Kefauver, in fact repeated Ricardo's theory, but still questioned it:

> the high-cost marginal producer – whose output is needed to meet the public demand for the product – will establish the price at almost zero level profit on his operations. Then if demand drops off, *a still lower-cost producer will become the marginal operator, and prices will fall* to reflect the lower costs. On the other hand, if demand

> increases, prices will rise to *bring into operation the high-cost producers who previously could not have functioned in the industry*. (Ibid.)

Below is another discussion about "high" oil and gas prices:

> For some reason people seem to think that competition should result in lower prices [but] the market price is set by whomever is producing at high costs. Why should Exxon or Shell or Aramco accept less than this for their product? The more efficient should be entitled to make larger profits over and above the marginal producers without lowering their prices for the benefit of the public. Otherwise the marginal producer will go out of business, depriving the public of the quantity they still need ... By the same token, if the public need more, higher cost producers move in and all the producers sell near that price. (Saunders, 2007)

These examples show once more that the prevailing idea that *each* producer sets his lowest possible price must be further specified that this relates to the *bottom-marginal* ones only.

9.2 "Time is price" supported by facts

> ... a seah of flour will sell for a shekel
> and two seahs of barley for a shekel
> at the gate of Samaria.
>
> 2 Kings 7:1

Although there is no rigid dependence of price from labour time, this time will always be one of the determining factors of price, and flour will always be more expensive than grain, due to labour added for grinding. One of the evident manifestations of time-price dependence is the existence of the time-wage system, so that this dependence is valid at least as a tendency.

"... my proposition 'that ... the quantity of labour employed in commodities determines the rate at which they will exchange for each other' ... is not rigidly true, but I say that it is the nearest approximation to truth", stated Ricardo (1820b, quoted by Bortis, 2010).

Statistically, the tendency of labour-price dependence can be most clearly revealed by deviation analysis, that is, by comparing changes in productivity in different industries with price changes. In fact, this

would be a comparison of labour-time changes and price changes (for productivity is the inverse of labour time). If the labour determinant is valid, then difference in productivity speeds should cause difference in nominal price speeds, which is nothing but relative price change.

When productivity growth regarding some commodity takes the lead over another one, then relative price of the former should become cheaper (and the latter, more expensive). Even if in some industry productivity remained unchanged, its relative price should increase due to productivity growth in other industries. Here the time-is-price dependence works as a sort of mechanism through which the achievements of the one group flow to other groups as well, and this narrows the income gap that follows from a widening productivity gap.

Just this actually takes place in the service sector, becoming relatively more and more expensive due to lagging productivity growth. Because, say, a chambermaid would not be content with a widening of her income gap with a producer of computers, the widening productivity gap being not her business.

"Technological innovation put downward pressure on prices" (Boettke and Luther, 2011). "Businesses have actually achieved higher productivity at lower prices" Gordon (1990). Such statements already hint at more precise formulation: the champions in productivity growth (in lowering labour time per unit of output) are also the champions in lowering prices. That is why the growth of the champions' monetary turnover always lags behind growth of real output achieved thanks to productivity.

Below are some other evidences supporting the existence of the time-is-price dependence.

"Interestingly enough, how the three sectors with large falls in inflation are also sectors which have seen significant increases in average annual labour productivity growth" observed Nickell (2005, p. 9). Recall that the inter-industry differences in inflation rates mean the changes in relative prices.

Even the semi-market Ukrainian economy shows this tendency: the more intensive productivity growth, the less intensive price rising. Figure 9.1 demonstrates this on the data of 16 industries of Ukraine (Ryaboshlyk, 2007b).

Equipment is becoming cheaper and cheaper relative to consumption products in the post-war period in the USA. This is another

approval of the dependence, because this cheapening is backed by keeping a lead in productivity growth, that is, in reducing the labour time spent.

This phenomenon has been discovered by Gordon (1990) and has fuelled a diverse variety of non-labour explanations and further theoretical implications, for example, by Gordon himself or Fisher (1999), or Greenwood et al. (2000).

The explanation of Greenwood et al. is based on the notorious one-size-fits-all supply-demand paradigm. According to this version, the negative co-movement between growing output of equipment and its declining relative price is interpreted "as shifts of the supply schedule of equipment along the equipment demand curve" (Ibid., p. 93).

But – allowing that in consumption industries both output and relative price were growing – these authors could just as easily interpret this parallel *positive* co-movement as shifts of the demand curve along the supply curve of consumption products. Indeed, these curves can interpret anything.

Besides, as the real business cycle (RBC) theorists, these authors conclude that "the fall in the relative price of new equipment is a direct, micro-based measure of investment-specific technological change" (Ibid.). Still, if there was not the fall, but the rise in the relative price of equipment, then this on no account would mean an

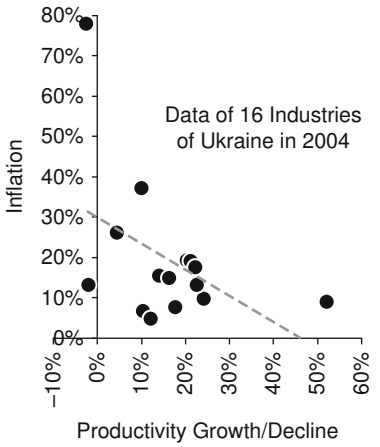

Figure 9.1 The higher productivity growth, the lower price rising

absence of investment-specific technological change. It would simply mean that the productivity in consumption industries equipped with equipment take the lead over equipment industries themselves. This would overturn the relation between prices only, not the conclusion regarding techno-changes. That is why this point of the RBC's theory is logically inconsistent.

Fisher (1999) connects the cheapening with "an improvement in the technology that produces capital equipment". But this sounds as if any progress has not been taking place in other industries for half a century. So, it is not enough just to mention an improvement in the technology, the equipment industry's technological leadership must be emphasised.

Thus, it is sufficient to conjoin price changes with productivity changes to obtain a more plausible time-is-price explanation of the phenomenon of relative cheapening of equipment.

Another example refers to the nineteenth century. "Glass, which was formerly worth £11 per crate, is now worth only £2 since the improvements which have taken place in manufactures ... but the rate for carriage is the same as it was formerly ... " (Royal Commission on Railways, L., 1867, p. 31, No. 630, quoted in Marx, 1878).

Marx brought it over as an evidence for the self-will of the railway tycoons, while it was sufficient to make use of exactly that labour theory he supported: the price of transportation had risen relatively to glass because productivity growth of transport fell behind glass. Thus the political partiality interferes with the impartiality of science.

9.3 Sales tax vs cumulative effect

The concept of price based on equality of marginal producers, in conjunction with the holistic view of an economy, affords, inter alia, to dispel the fears of alleged "disastrous" consequences of the general sales tax (turnover tax, gross receipts tax). These consequences – referred to as the cumulative effect (cascade effect, pyramiding effect) – rest on the assumption that each producer of the production chain would simply raise his price according to the sales tax rate, whereby triggering an endless chain of price raising. But such theorising implies a likewise endless money supply to make that price raising possible. This fault is similar to the Marxian expanded reproduction schemes, in which endless growth tacitly implied an endless inflow of labour.

Meanwhile, if monetary authorities retained control over the monetary mass, then the sales tax, actually, would lead to some changes in relative prices, but this would include both increases and decreases in prices of particular products.

Let us illustrate this on an example of an economy with capital from Section 6.7. To make the production chain longer, let us additionally assume that bread is used for production of butter in a ratio of one unit of bread per one unit of butter. So that, further to final consumption, bread will be also used for the intermediate one.

And let us pose a question: At what rate would the general sales tax be equivalent to the value-added tax (VAT), in the sense that the former would bring the same budget receipts as the latter? If the VAT rate is, say, 15%, then it can be shown for this example that the same receipts could be received at the sales tax rate of 10.8%.

The simultaneous price distortions are shown on Figure 9.2. The middle part discloses new prices that provide the equality of marginal producers under the sales tax and at an unchanged monetary mass and unchanged consumer price index. The initial nominal prices are taken as 100, then the new levels of prices are: butter 103.5; fixed capital 99.2; bread 98.2.

On the other hand, if to assume that each producer exactly compensates the input price increases by the increase of his or her own price,

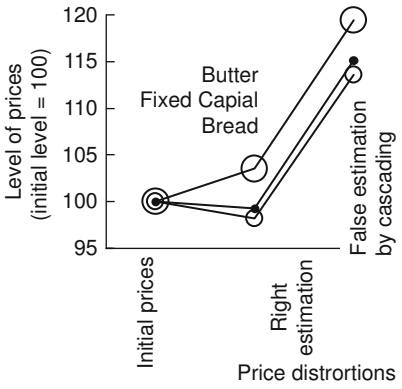

Figure 9.2 Price distortions by the sales tax are not so severe as it is generally assumed

then (at such so-called cumulative or cascading estimation) the consequences of sales tax would look much more "disastrous" (see the right part of Figure 9.2). As one can see, this too straightforward simplification has guessed neither new levels of prices nor their new proportions.

Thus, in each country, there might be some room where the advantage of the simplicity of the general sales tax outweighs its disadvantages. Singapore apparently has found such a room, successfully practicing the general sales tax of 7%.

Note, that in this example bread is a dual-use good that can be used both for intermediate and final purposes; so that here the butter-bread production possibility frontier and utility mountain are related only to that part of bread which is eaten by consumers.

10
Starting Accumulation vs Primitive Accumulation

Marx handed over the tradition of understanding primitive accumulation as a single act of creation of capitalism; not as the first technological leap, which was industrialisation, out of the sequence of further leaps. Consequently, scholars, studying joint features of initial industrialisation in different countries, do not always notice that those features had many similarities with modern technological revolutions, too, and that it is the key to better understanding modern crises. While considering all this, we should clearly distinguish the two sides of accumulation: physical accumulation of physical capital and accumulation of money to finance this.

Gerschenkron (1957, p. 109) justly criticised Marx for the overlong primitive accumulation and asked: "why should a long period of capital accumulation *precede* the period of rapid industrialization?" Then McCloskey (2009, p. 2) added, "Saving and investment must be used when they are made…They cannot accumulate from an age of piracy to an age of industry."

At that, Gerschenkron (1957, p. 111) remarked that "the concept of original accumulation, if properly restated, has a rather modern touch". Still, he had outlined the inter-country regularities of initial industrialisation within the vein of an initial act of creation.

The "key phrases" related to these regularities are:

- what makes preindustrial accumulation of capital potentially meaningful is the *discontinuity of industrial development*;
- the industrial development, after *a certain period of preparation*, assumed the form of a big spurt;

- industrialization everywhere means increase in the volume of fixed capital ... *changes in technology* [etc.];
- it must demand considerable capital and ... these accumulations appear essentially as claims on current output and render possible a deflection of resources *from consumption to investment*. (Ibid., pp. 110–117; italics added)

Besides this general pattern of industrial development, Gerschenkron noticed the peculiarity that countries that came to industrialisation later – though they suffered from "the difficulties, the strains, and the cost" imposed upon them by accumulation – have a sort of "advantage of backwardness" which the advanced countries did not have. That is, the underdeveloped countries have an opportunity to receive various forms of assistance from advanced countries:

> that capital can be imported from abroad ... implies the possibility to invest without *lowering the rate of current consumption*; similarly, the opportunities for imports of capital goods from abroad, if they are financed by ... previous accumulations of bullion and plate ... in the backward country, also *avoid reduction in levels of consumption*. (Ibid., p. 119; italics added)

Now, we may suggest a further "proper restatement" that the general pattern of industrial revolution described is also general for next technological revolutions, as well. Indeed, the latter are also characterised by discontinuity (technological leap); by existence of advanced countries and countries lagging behind progress, the latter having an "advantage of backwardness" in the terms of the catching up (it is a pity that Ukraine is a catching up economy that does not catch up, yet); and – this is the most substantial – by the process of accumulation of physical stock of new fixed capital that replaces the old one.

Then, we may name these processes as "starting accumulation of new capital" and rename primitive accumulation as the "the most first starting accumulation of new capital", the only distinction being that in those times there hardly was any old fixed capital to replace.

Besides, we may add a further joint feature of the starting accumulations, namely, that sometimes they are "loaded" with starting recessions if new technologies are in some sense heavy enough. In other

words, the old-fashioned hardships of accumulation of old capital are still valid for the accumulations of new capital, too, albeit not so much for the latter.

This item is not fully recognised, yet, so let us enlarge upon it. In the above quotations, it was mentioned three times that capital accumulation implies lowering of output of consumption goods; for example, "deflection of resources *from consumption to investment*". But it had not been concluded, yet, that this is the same crisis or recession. Analogously, "the difficulties, the strains, and the cost" are also synonyms of crisis.

This interpretation is approved quantitatively in Part I of this book where the constructive framework capable to catch starting recessions is proposed and where the notion of recession-fraught technological leap was introduced.

Under this type of recession, the society consumes less simply because it produces less consumption goods, sacrificing current consumption for the sake of the future. Many pungent sarcasms have been lost upon the explanation of personal wealth of the Rothschilds and Vanderbilts by their personal abstinence and sacrifice. Nevertheless, this is quite right for the wealth of such a "person" like society as a whole. That's another matter – that these sacrifices and hardships are distributed very unevenly.

This explains why the developed countries are in the epicentres of crises. Because, as the pioneers of technological revolutions, they could not alleviate their relative hardships by foreign investments or other support from some even more developed countries, by definition.

Unfortunately, the critique of Marxian primitive accumulation sometimes is exaggerated up to rejection of the problem of accumulation itself. "Accumulation has not been the heart of modern economic growth ... It has been a necessary medium, but easily supplied, like Shakespeare's alphabet", proclaimed McCloskey (2009; 2011: 166–167). One might object that it is not so easily supplied, especially physical capital, and just because of that, there are temporary recessions.

The growing importance of innovations, of accumulation of human capital and so on does not annihilate the old-fashioned starting accumulation of new-fashioned physical capital. Unfortunately, the latter is often simply forgotten, if not deliberately ignored.

"Why is adoption not instantaneous?" asked Dosi (1991), who gave many correct answers, such as diffusion of information, choice process, rationality of behaviour, and so on. But the main version – that there is no physical possibility to provide all the adopters with new equipment instantaneously – remains omitted.

Hirooka (2006: 28) connected the time span needed for full diffusion of an innovation with "the capability of the human brain to process the information."

And along with this, this author dropped not a few hints that the diffusion process does also include the old aspect of investments in – and accumulation of – fixed capital. It can be seen from the following key phrases:

> "rapid development of the economy brought huge investment demand ... " (Hirooka, 2006, p. 81)
>
> "a heavy investment required ... In the case of synthetic dyestuffs ... " (Ibid., p. 187)
>
> "the amount of investment required to adopt the innovation ... " (Ibid., p. 292)

It looks like in this case, the fixed capital is half-forgotten.

Now let us consider once more the mass blindness to the possible connection between accumulation of physical capital and crisis.

On the one hand, the fact that accumulation runs at the expense of consumption is almost universally recognised when considered in general; but not recognised in particular, regarding accumulation for productivity and other innovation purposes. And even if the latter is recognised, too, it is still not apprehended that this in itself is at least one of the causes of crises.

Malthus, the contemporary of Ricardo, was on the verge of Ricardo's discovery. He considered " ... recessions as a result of excess saving relative to investment" (Rymes, 1988, quoted by Kates, 2010: 41). Meanwhile, it was sufficient to overcome the view that recession was an abnormal phenomenon and to reformulate these words as recession is a normal result of saving for investment (and of the specificity of the situation).

Below are some other variations around this.

Marx (1878) admitted a very important point that the object of accumulation is productivity increase that was compatible with

Ricardo's "accumulation which facilitates future production" (1820a, ch. I, sec. II). But, being politically *engagé*, Marx objected "that the aim and compelling motive of capitalist production is consumption" and accordingly stated the following: "That accumulation should take place at the expense of consumption is … an illusion contradicting the nature of capitalist production."

Marshall (1890) left a hint at the starting accumulation in terms of efforts spent a good while before: "new processes and new machinery … economize human effort on condition that some of the effort is spent a good while before the attainment of the ultimate ends".

Bouniatian (1928) wrote that in society as a whole "the process of accumulation of capital which accompanies the evolution of economic life" can proceed only in such a way that "productive force of labor and of existing capital … allotted to the increase of new means of production at the expense of consumption goods".

Aftalion (1927) wrote, "As a matter of fact, for the community taken as a whole … accumulation means, indeed, only the application of economic factors to the production of capital goods at the expense of consumption goods."

At that, Aftalion explained the real, natural aspect of accumulation as follows:

> An individual can … invest his purchasing power … in … securities or real property, or lending to the banks or private persons … [But these] are merely modes of transference of free purchasing power to other persons. The latter must immediately invest it in goods or services, in order to complete the act of exchange from which it emanated. With respect to individual holders, money is an intermediary form of capital, but with respect to the community as a whole, it is not. (Aftalion, 1927)

Yet, these two latter authors remained blind that the development "at the expense of consumption goods" is in itself an explanation of crisis: a sacrifice of the present for the sake of the future. Aftalion had noticed nothing but that "At the origin of nearly all the periods of rise one can find the trace of a discovery or invention" (Ibid.). Unfortunately, that "one" had failed to follow that trace as far as to find the origin of the periods of recession too.

Consequently, these and other authors put forward other explanations of recession, but for the starting accumulation one.

Aftalion (1927) thought that the cause of crises lay in the long period required for the production of fixed capital, forecasts of demand becoming too optimistic then.

Bouniatian (1928) thought, "the increase of demand for consumption goods has a tendency to grow slower than the accumulation of social capital and the production of these goods resulting from that accumulation". In the terminology of Part II, this means that the indifference curve touched should move fast enough to keep in step with the moving frontier, while in fact the frontier simply touches another curve. But this is quite another way of thinking.

11
Demando-Mania: Keynes and Demand-Deficient Versions of Crisis

> It is absurd to explain the current recession by deficient aggregate demand.
>
> Kates (2011)

The enigma of economic crises can be reduced to the fundamental question: Why do people buy less? Because their desire to buy grows less or because there is less to buy? The former version dominates not only today but during all the history of economic science.

Keynes (1936) was not original in explaining crises by insufficient demand. He additionally stressed that an aggregate demand not only grows slower but also decreases absolutely. At that, any traces of inventions and discoveries had clearly evaporated, whereby marking the complete degeneracy of demand thinking.

This book does not challenge this version; it only adds that embodied innovations sometimes would command the starting recession even under no demand problems. Be the "demand" even unlimited, recessions would still occur.

These demand-deficiency versions of crisis have a long-standing history where real investments also appear along with savings.

Malthus, in addition to his version mentioned above, "attributed the insufficiency of demand to extreme inequalities of wealth where those with high incomes did not spend all they had received" (Kates, 2010, p. 47). He "held that business might be depressed, either by a voluntary failure of demand on the part of those who had the power

but not the will, or by an involuntary failure of demand by those who had the will but not the power" (McCracken, 1933, pp. v–vi, quoted by Kates, 2010, p. 44).

"Aftalion has succeeded in establishing the possibility of a voluntary failure of demand by those who have purchasing power but insufficient keenness of desire" (McCracken, 1933, p. 149, quoted by Kates, 2010, p. 47).

Foster and Catchings thought that "the critical relationship was not between saving and consumption ... but between saving and investment ... they stressed the independence of decisions to save and invest. They recognized that cyclical instability could result from *failure of decisions to invest to offset decisions to save*" (Gleason, 1959, pp. 160–161, quoted by Kates, 2010, pp. 57–58; italics added).

Based on all of this, Kates (2010, p. 36) concluded that "[regarding an aggregate] demand deficiency ... Keynes was by no means the first to come upon this idea, but until then no one had been able to convince the mainstream of the profession that it was a valid operational concept".

To explain how the demand could become deficient and cause crisis, Keynes contrived the following scheme:

- not all savings are channelled into investments; and
- the excessive savings (unused money) are excluded from active circulation.

However, this is not yet sufficient for output to decline and might lead to deflation only. To close the door to this option, Keynes added price rigidity in conjunction with production flexibility (as if it were easier to revise production than to rewrite price tags). Then the next steps of the scheme were as follows:

- decline in active money under rigid/constant prices would cause the decline in real purchases;
- producers instantly react to this decline in aggregate effective demand by decline in output;
- crisis is erupted and the scheme is completed; then
- rigid prices eventually loosen and adjust, and output restores.

But the starting point of this chain of argument still remained unexplained: how could it be that the supply of savings exceeded the

demand for investments? This sharply contradicted the views that were in fashion then. In order to overcome all this, Keynes had to revive the older views – that the decisions to save and invest are independent ones – yet wrap them into the supply-demand rhetoric. Interest rate did not equilibrate savings and investments anymore, but it equilibrated "the demand for liquidity [money] ... with the amount of liquidity [money] available" (Keynes, 1935, quoted by Kates, 2010). The latter notions became even more invisible and untestable, but it afforded to return to the right conclusion that " ... there is no automatic mechanism to ensure all savings end up channelled into investment" (Kates, 2010, p. 56).

The flaws of this far-fetched scheme are as follows.

Excessive savings – the keystone for this version of crisis – is most typical for the phase of stagnation only, but the consideration of the sequence of phases was out of the scope of that reasoning. Consequently, it is an essentially static scheme that has brought about an artificial separation of the short and long runs.

For practical application of this so-called "valid operational concept", it should be taken into account that in actuality there is at least mild inflation. Then, the exclusion of some portion of money from active circulation would create a tendency to slower inflation rather than to deflation. Then, to make this scheme work there should be even more fantastic concepts of rigid inflation and of stopping the production due to an incorrect inflation.

And last but not least, the main message of this book is that even when all the savings are soaked up by investments, crises still may occur. There is no need to focus narrowly on the abnormal non-invested savings, because even the normal invested savings sometimes are fraught with normal recession.

Overall, Keynes stuck to the line of abnormality of crises, as Marx did to surplus value, and they both had to resort to dubious logics. Or, speaking less generally, Keynes, like his Ukrainian predecessor Tugan-Baranovsky, stayed within the demand-for-investment thinking and never turned to the terms of technical and engineering need in investments.

12
Wage-Profit Distortions in Ireland and Ukraine

These weird cases of wage-profit distribution are given in addition to Section 6.8 in Chapter 6.

As asserts Kelly (2008a, b), in Ireland "wage growth lags far behind" and "profits are extraordinarily high". This is supported with the data of 2005 that the profit per employee in Ireland is the second highest in the EU, twice as much as in the UK, and half as much again as the EU-15 average. At the same time, the actual situation might be disclosed more profoundly if described in terms of distribution.

In 2005, the profit per employee per year in Ireland amounted to 45,800 euros, average wage for private sector was 29,000 euros. So that the income jointly created by labour and capital is 74,800 euros and the labour's share out of it is 39%. The analogous share in neighbouring UK is 66%.

Consequently, under the proportions of distribution as in the UK, wage in Ireland would amount up to 49,400 euros, becoming the highest in the European Union; and profit per employee would squeeze to 25,400 euros, still remaining higher than in the UK and becoming lower than the EU-15 average of 29,500 euros.

Thus, the indicator of share of labour in total income reflects the situation more objectively.

In Ukraine the situation is much worse. While in Ireland profit exceeds payroll 1.6 times, at some Ukrainian enterprises the exceedance amounts to more than seven times; at that, even the sum of dividends paid exceeds the payroll. This refers to the North Ore Mining and Processing Plant, PLC, in the Dnipropetrivsk region (the North Plant), 2008 data.

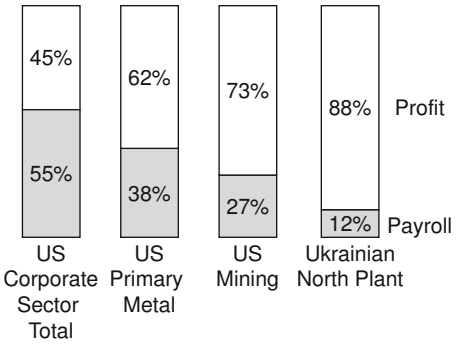

Figure 12.1 Distribution of joint income between labour and capital, 2008

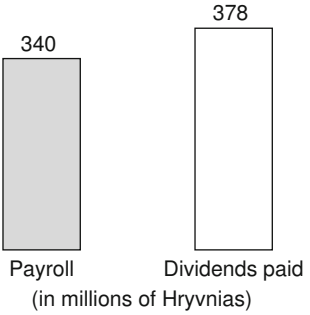

Figure 12.2 Dividends exceed payroll at the North Plant, Ukraine, 2008

Figures 12.1 and 12.2 show this in comparison with the corporate enterprises operating with profit in the US, the data for total economy, for Primary metal manufacturing and for Mining.[1]

If the Ukrainian employees would at least approach the proportions of distribution of their counterparts in the US, then their wages might rise twofold. This testifies to the weakness of the Ukrainian trade

[1] The sources are: the Securities and Stock Market State Commission of Ukraine; and the US Department of the Treasury, Internal Revenue Service (Returns with Net Income, Balance Sheet, Income Statement, Tax, and Selected Other Items).

unions, which remain as powerless as in the Communist era. Such non-conflict relations between employees and employers distinctly contrast with acute political protest actions Ukraine's democracy often resort to.

It would be suitable here to recall a historical anecdote: Churchill complained that the Soviet newspaper *Trud* (Labour) published against Great Britain. Stalin replied that *Trud* was an organ of free trade unions – he didn't have any power over them.

Altogether, it should be admitted, that the wage problem is a problem of distribution; but this key word is often pulled from arguments of the practitioners at their debates over wages. Meanwhile, the distributive thinking is more compatible with the reigning ideology of social partnership than treating labour as the same "factor of production" as machine.

That is why it is high time to introduce the indicators of distribution in the practice of financial accounting. In the meantime, although no accounting department calculates the income jointly generated by labour and capital, payroll and profit items presented in income statements allow for simple calculations to derive at conclusions as to the actual state of distribution.

The specific items used for determining joint income in this analysis are:

- Profit before tax;
- Salaries and wages;
- Compensation of officers;
- Pension, profit-sharing, stock, annuity; and
- Employee-benefit programs.

In conclusion, it is interesting to note that the self-evident assertion of Ricardo – a rise in wage involves a fall in profit and *vice versa* – had not been evident for Marx (1894), who deemed that "Nothing is more absurd ... than to explain the fall in the rate of profit by a rise in the rate of wages" (quotation and commentary of Kurz and Salvadori 2003).

13
Bridges to the Cambridge Multisectoral Dynamic Model of the British Economy

The constructive framework discovers the degree of disaggregation (of drilling into the reality) sufficient to catch turning points of the economy, while many other approaches lose fluctuation because of aggregation, catching trends only.

One such example is the product of the Cambridge Econometrics (CE): the most detailed Cambridge Multisectoral Dynamic Model (MDM) of the British economy, as set forth by Barker and Peterson (1987), which might be detailed further yet. Besides the UK, the MDM is also a base for many of the EU and global models, being both widespread and typical one (see Barker, 2009; Barker et al., 2012; Pollitt and Barker, 2009). The following analysis contains some proposals for mutual improvement.

Figure 13.1 shows the main distinctions. The MDM starts from FORECASTING average technological coefficients through watching R&D expenses.

First, it still considers progress as enhancing of average technologies, not of new technologies, as such, whereby depriving itself from dealing with recessions.

Second, although it is clear that the higher R&D expenditure, the better new technologies, the results of creative work could not be forecasted very precisely. In fact, the MDM at once skips to long-run forecasting and sets the rather complicated task of providing too rough outcomes.

As opposed to this, the constructive framework WATCHES the beginning of the actual introduction of new technologies and

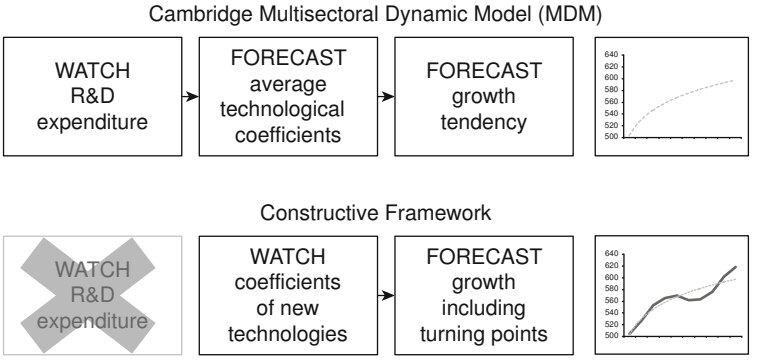

Figure 13.1 Comparison of the MDM and the constructive framework

forecasts its consequences. The initial data is not forecasted, but directly collected, and, in conjunction with rejecting the averages, this provides more accurate final forecasts, catching recessions and integrating short- and middle-run forecasting.

A combined approach should add a long-run span, relying on the R&D analyses. This would upgrade both methods to reflect a continuous technological relay not of the new and the old only, but also of the new and the newer.

Apart of the distinctions, the MDM and the constructive framework have many joint points, making such a synergy quite possible.

The Multisectoral Model is "an integrated top-down, bottom-up" one, Pollitt et al. (2014, p. 120), which could be also interpreted as an engineering-based microdetailing of macroaggregates. The critiques expressed in our book coincide almost verbatim with the critiques put forward by the MDM theorists: "In the past, technological progress has often been represented as exogenous in macroeconomic models (e.g. via a time trend) or as a residual in a neoclassical production function." (Ibid., p. 24). Instead of treating capital "as a homogeneous input" (Ibid., p. 121) MDM practices "Precise description of capital equipment" (Ibid.). And at that "At best, the technological options can be presented in chronological form (commercially available, in development stages, technologically feasible), coming on line progressively" (Ibid., p. 122).

A dynamic input-output task is also an integral part of the Multisectoral Model. But the coefficients[1] are a priori supposed to change over time along a logistic trended path (Ibid. p. 32). From here is but one step to the consideration of the underlying laws generating S-shaped logistic pattern endogenously.

So, the MDM should be finally "disaveraged," that is, average coefficients should be split in old and new ones. The "commercially available" new technologies at hand should be not forecast but directly watched; while the "soon-to-be available" technologies that are in "development stages" and "technologically feasible" should be forecast basing on the R&D data. This is one of the ways to enhance the perpetual forecasting process.

Altogether, on the one hand, it is important that the MDM already deals explicitly with the new technologies connected with investment, with their productivity and so on. But unfortunately on the next stages these separate characteristics are sunken in the projections of average ones.

Even if these projections were very accurate, under such degree of aggregation, economic fluctuations would still be out of catch. Besides, the long chain from R&D expenditure to growth, containing two consequent forecasts, has little chances of being very accurate and, as it has been mentioned, is more appropriate for a long-run forecasting (see the upper part on Figure 13.1).

The constructive framework sets both an easier and more complicated task. It starts not from forecasting but from directly watching the characteristics of new technologies, and forecasting their further diffusion. Thus, constructive framework brings about only small touches to the MDM's scheme. These are: direct watching the "commercially available" technologies and refusal from the averaging.

Figure 13.2 illustrates some problems with forecasting ability in the UK and shows the variants of the forecast for 2009 published at different time distances from the moment when the actuality revealed itself. The MDM team participates in this collective opinion forecasting, as well. The earliest forecasts promised for 2009 2.5%

[1] Fundacion (1997), who, inter alia, considered substitution of plastic for rubber in the automobile sector, had fulfilled analogous projections of the EU coefficients change under technological change.

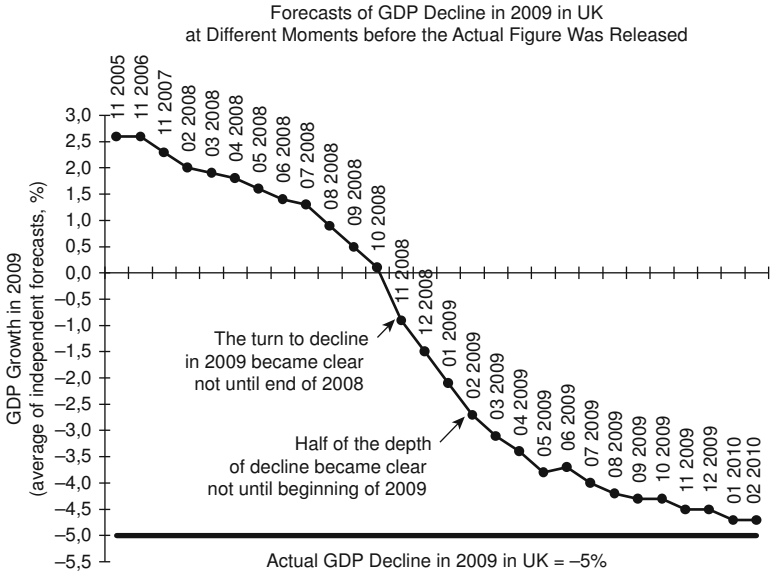

Figure 13.2 The UK forecasting services have problems with turning points

growth; the decline, as such, had been predicted not earlier than in November 2008; the depth of decline had been guessed half right in February 2009; actual decline in 2009 was –5%.

14
Conclusion

> I have always remarked that
> business men and men of the world,
> who have many things laid before them extempore,
> ...are much easier to talk to even on scientific matters than other men,
> because they keep their minds free, and listen to the person speaking
> without any other interest than a desire to get information;
> learned people generally will not listen to anything
> except what they have themselves learnt and taught,
> and about which they have become agreed with those of their own set.
> The subject is usurped by some word-credo, by which it is as well to abide as any other.
>
> Goethe (1822)

The only defence from the critiques of the neoclassical orthodoxy is the "So's your old man" argument. That is, the critics themselves rarely propose theories of their own.

This book is an effort to go beyond criticism to the elaboration of comprehensive and coherent alternatives. It could be also treated as an effort to converge and reconcile classical and neoclassical theories. Both turned out to be special cases of the more general concept of fundamental production-consumption compromise. At that, we heavily relied on the fact of generic heterogeneity of real producers, which was crucial for the achievement of these findings. As a result,

the classical theory has become more marginalistic; the neoclassical – less abstract and more close to the reality. Besides, the book tries to liberate economic science from a vague category of *value*.

As for the enigma of crises, the book has brought back an old idea – that investments in innovations may command temporary recessions – and endowed it with an adequate quantification. The crucial points here are an explicit reflection of new technologies and the worker-workplace coupling. Speaking more technically, an endogenous generation of S-shaped pattern of the diffusion must come instead of the exogenous one.

Speaking more generally, the book has provided in-depth elaborations of the ideas and hypotheses already expressed before, including old ideas, especially by Ricardo and Pareto, and the new ones inspired by the recent crisis.

Thus, the reproach that an incrementalistic view of technical progress adopted in the Solowian growth theory does not sit easily with the actual quantum-leap-like pattern of progress is fixed in the form of constructive framework where technological leaps are reflected explicitly.

The set of hypotheses that money and finance are part of this story and that cycles may have real drivers such as innovations are answered in the form of starting recession at introduction of embodied innovations.

The hypotheses that technological advancement requires unavoidable sacrifices and that cyclical activity may be impossible to avoid are answered in the form of an unavoidable but predictable and manageable recession.

The hypothesis that the Keynesian-type policy interventions succeed only within tightly defined limits has turned into non-Keynesian substantiation of the Keynesian easy money and quantitative detail of those tightly defined limits.

The hypothesis that it is absurd to explain the current recession by deficient aggregate demand is proven in the form of crises that still occur under an absence of any problems from the demand side.

The "*anathema*" pronounced against the general equilibrium approach has turned into fundamental compromise where the traditional general equilibrium is a special case.

The hypothesis that prices exhibit particular kinds of distribution has turned into concept of prices providing equality of marginal producers, dependent on wage-profit distribution.

The hypothesis – that dealing with nebulous terms "confidence"', "euphoria" or "panic" means a perception rather than an explantion – is specified so, that it is possible to deal with consumers' indifference curves but impossible to deal with people's propensity to save.

At the same time, not all and everything is approved, say, regarding the hypothesis that growth is a cyclical process driven by the very nature of capitalist development, it is shown that one of the main types of cycle is of a universal nature and does not belong to some specific social organisation (be it capitalism or any other ism).

Altogether, the book has consolidated such ideas into a concise and constructive theory, called objective marginalism: how an innovative and heterogeneous economy works in general and fluctuates in particular. And the tool for practical application, constructive framework, capable of catching the turning points of the economy, is proposed as well.

It allowed to reflect the historical continuity of the economy itself and to restore the continuity of economic science, because many results of both classical and neoclassical theories are aligned and integrated as special cases of the proposed approach.

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