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Topics in Classical Micro- and Macroeconomics

Elements of a Critique of Neoricardian Theory

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Contents

Preface XIII

Acknowledgements XXI

Part I Labor Values: Theory and Measurement

1	The So-Called ‘Transformation Problem’ Revisited	7
1.1	Introduction and overview	7
1.2	Lipietz’s theorem	8
1.3	Labor value ratios: The systematic component in their price expressions?	9
1.4	Conclusions	11

References 13

2	Baseline Approaches to the Labor Theory of Value	15
2.1	Introduction	15
2.2	Labor value accounting: Some propositions	19
2.3	Four baseline approaches to Marx’ labor theory of value	22
2.3.1	The Temporal Single System Interpretation (TSSI)	23
2.3.2	The Aggregate Single System Interpretation (ASSI)	26
2.3.3	The Conventional Dual System Approach (CDSA)	28
2.3.4	The Marxian Dual System Approach (MDSA)	32
2.4	Conclusions	37

References 41

3	Using Labor Values: Labor Productivity and Technical Change	45
3.1	Introduction	45

3.2	Labor Productivity. A Marxian Critique of its Value-Added Decomposition	46
3.2.1	The measurement of labor productivity	46
3.2.2	Input-output tables and measures of real value added . .	48
3.2.3	Labor values as measures of labor productivity	50
3.2.4	Notes on technological change	54
3.2.5	Disaggregating aggregate measures of labor productivity	57
3.2.6	A summing up	61
3.3	Technical change and the law of decreasing labor content	62
3.3.1	Basic propositions on price-value relationships	63
3.3.2	Notes on the law of decreasing labor content	67
3.3.3	Multiple activities and joint production: Some observations	69
3.3.4	The Okishio theorem and the tendency of the profit rate to fall	70
3.3.5	The law of decreasing labor content: Empirical results . .	72
3.4	Conclusions	78
	References	79
4	Marx after Stone: The Marxian Contribution to the UN's SNA	81
4.1	Introduction	81
4.2	Employment multipliers and labor values in pure joint production systems	83
4.2.1	Employment multipliers	84
4.2.2	Labor values	86
4.2.3	Summary	91
4.3	Measurements of total labor requirements using input–output methodology	92
4.3.1	A physical input-output example	93
4.3.2	Case 1: Industry coefficients	94
4.3.3	Case 2: The output method	96
4.3.4	Case 3: The commodity–technology hypothesis	97
4.3.5	Case 4: The industry–technology hypothesis	99
4.3.6	Concluding remarks	101
4.4	Actual labor values vs. zero–profit prices in Sraffian models of fixed capital	101
4.4.1	Introduction	101
4.4.2	Average and individual labor values in single product systems	103
4.4.3	Individual values in the case of fixed capital: Steedman's example of falling efficiency reconsidered . . .	108
4.4.4	Rising efficiency and rising book values of machinery . . .	111
4.4.5	Final remarks	115

4.5	Conclusions and outlook	116
	Mathematical appendix	118
	References	121
5	Actual Labor Values in a General Model of Production	123
5.1	Introduction	123
5.2	A general equilibrium approach to Marxian economics	126
5.2.1	Reproducible solutions	126
5.2.2	The optimum labor theory of value	128
5.3	A new and measurable definition of labor values for joint production systems	130
5.3.1	Marx's case of multiple activities	131
5.3.2	Joint production	132
5.3.3	The input–output approach to joint production	135
5.4	Values, prices and profits	140
5.5	Conclusions	143
	References	145
6	Employment Multipliers and the Measurement of Labor Productivity	147
6.1	Introduction	147
6.2	The measurement of total factor requirements using input–output tables	148
6.3	Joint production	150
6.4	System indicators of employment and productivity	151
6.5	Some results for an analysis of technical change	155
6.6	The case of a uniform composition of capital	157
6.7	Conclusions	159
	References	161
7	Technology Assumptions and the Energy Requirements of Commodities	163
7.1	An overview on problems and results	163
7.2	Analytical preliminaries	168
7.3	Energy consumption	171
7.4	Energy costs	177
7.5	Comparing energy consumption and energy costs	184
7.6	Summary	191
	References	193

**Part II Production Prices and the Standard Commodity. A
Critical Reassessment**

8	In Search of Foundations for a Classical Theory of Competition	201
8.1	Classical ruthless competition	201
8.2	Two-sector economies	202
8.2.1	The crude state of the society	202
8.2.2	Production of commodities by means of commodities	206
8.3	Sraffian multisectoral economies	213
8.3.1	Economic properties	214
8.3.2	Mathematical foundations	216
8.4	A streetcar named desire: The von Neumann production price model	220
8.5	Differentiated sectoral wage and profit rates	227
8.6	Capital stock matrices and sectoral profit rates	239
8.6.1	Capital consumed and capital advanced	239
8.6.2	Makeshift construction of empirical depreciation and capital stock matrices	242
8.7	Conclusions and outlook	249
	References	251
9	Two Concepts of Basic Commodities for Joint Production Systems	253
9.1	Introduction	253
9.2	Basic Leontief-commodities	254
9.3	L -basics: Further discussion	258
9.4	Basic Sraffa-commodities	265
9.5	Conclusion	270
	References	271
10	Some Continuity Properties of a Reformulated Sraffa Model	273
10.1	Introduction	273
10.2	Limit cases of Sraffian models of production prices	273
10.3	Some propositions	276
10.4	Conclusions	280
	References	283

11 The Standard Commodity and the Theory of Income	
Distribution	285
11.1 Introduction	285
11.2 The Sraffian approach to income distribution	286
11.3 The Standard Commodity	287
11.4 Hiding nonlinearities: The role of the Standard Commodity ...	287
11.5 Conclusions	291
References	293
12 Sraffa's Standard Commodity: No Fulfillment of Ricardo's	
Dream of an 'Invariable Measure of Value'	295
12.1 Introduction	295
12.2 Flaws in the interpretation of the Standard Commodity	296
12.3 Flaws in the construction of Sraffa's Standard of Value	299
12.4 On the non-existence of an 'invariable measure of value'	304
12.5 Conclusions	307
References	309
<hr/>	
Part III Gravitation or Convergence in Classical Micro-Dynamics	
<hr/>	
13 Dressing the Emperor in a New Dynamic Outfit	317
13.1 Introduction	317
13.2 An extension of the Walrasian tâtonnement process	320
13.3 Global stability by derivative control	323
13.4 Examples	328
13.5 Conclusions	332
References	333
14 Stability - Independent of Economic Structure? A	
Prototype Analysis	335
14.1 Introduction	335
14.2 Cross-dual dynamics in Walrasian production economies	337
14.3 Universal stability	342
14.4 Newton-methods: Old and new	348
14.5 Ignorable components?	354
14.6 Conclusions	359
References	361

15 Classical and Neoclassical Competitive Adjustment Processes	363
15.1 Introduction	363
15.2 Neoclassical stability analysis in the short and in the long run .	364
15.3 Classical competition: Notes on the literature	367
15.4 A new approach to the stability of market economies	372
15.4.1 Square joint production systems	372
15.4.2 Process extinction	378
15.4.3 Product extinction	381
15.5 Conclusions	383
References	385
16 Composite Classical and Keynesian Adjustment Processes .	387
16.1 Introduction	387
16.2 Notes on the literature	388
16.3 Dual dynamics	391
16.4 The composite system	393
16.5 Some preliminaries	395
16.5.1 Stability of the Keynesian case and the composite system	395
16.5.2 Stability of the Classical case and the composite system .	398
16.6 A new approach to the stability of composite systems	401
16.7 An alternative investigation of the stability of composite systems	408
16.8 Some simulations studies	410
16.9 Conclusions	413
Mathematical Appendix	416
References	425
<hr/>	
Part IV Gravitation or Convergence in Classical Macro-Dynamics	
<hr/>	
17 Some Stability Properties of Goodwin's Growth Cycle Model	431
17.1 Introduction	431
17.2 An extended Goodwin cycle	431
17.3 The Goodwin case reconsidered	435
References	437
18 Endogenous Aspirations in a Model of Cyclical Growth . . .	439
18.1 Introduction	439
18.2 A model of cyclical growth	440
18.3 Discussion of the model	443

18.3.1	The implied dynamics	443
18.3.2	Properties of the steady state	444
18.3.3	The phase portrait of the model	445
18.3.4	Local stability	445
18.3.5	Asymptotic stability in the large	447
18.4	Conclusions	449
	Mathematical appendix	450
References	451
19	Partial Cooperation with Capital vs. Solidarity in a Model of Classical Growth	453
19.1	Introduction	453
19.2	Solidarity among workers	457
19.3	Partial cooperation between labor and capital	459
19.4	A simple completion of Goodwin's growth cycle and the implications of cooperation	465
19.5	Conclusions	470
	Appendix: An extended objective function of firms	472
References	477
20	The Classical Growth Cycle: Reformulation, Simulation and Some Facts	479
20.1	Introduction	479
20.2	A growth cycle model with a government sector	483
20.3	Some simulation results	488
20.4	A look at the data	491
20.5	Concluding remarks and outlook	501
References	505
21	The Goodwin Distributive Cycle after Fifteen Years of New Observations	507
21.1	Introduction	507
21.2	The growth cycle model: basic ingredients for a limit cycle result	510
21.3	Exploring growth cycles for the US economy: A brief reconsideration	513
21.4	The US economy: Extended data set and basic econometric issues	514
21.5	Business cycles and long phase cycles in the US economy: Bivariate P-SPLINE testing	516
21.6	Conclusions	519
References	523

22 Classical Dynamics in a General Keynes-Wicksell Model...	525
22.1 Introduction	525
22.2 The general model	526
22.3 Comparative statics, dynamics and the steady state	533
22.4 Medium run dynamics	535
22.4.1 Adaptive expectations	535
22.4.2 Regressive expectations	538
22.5 Long run dynamics and global stability	539
22.6 Some numerical results	544
22.7 Conclusions	547
Mathematical appendix	548
References	551

Preface

This book on Classical micro- and macrodynamics collects revised versions of papers which were written between 1983 and 2000, some jointly with co-authors, and it supplements them with recent work on the issues which are raised and treated in them. It attempts to demonstrate to the reader that themes of Classical economics, in particular in the tradition of Smith, Ricardo and Marx, can be synthesized into a coherent whole, also from the perspective of formal model building.

This is accomplished by means of mathematical techniques which, on the one hand, provide a consistent accounting frameworks (labor values and prices of production) as point of reference for Classical micro- and macro-dynamics and which, on the other hand, attempt to apply these accounting schemes – or suitable extensions of them – by showing their usefulness as tools of analysis of the implications of technological change (labor values) and as potential tools for understanding the dynamics of market prices and of income distribution around their centers of gravity (production prices and the wage-profit curve).

It is, however, one finding of this book that the imposition of a uniform profit rate should give way sooner or later to the consideration of significant (more or less stable) profit rate differentials, in order to make production price schemes applicable to real world phenomena, as this is done in Flaschel, Franke and Veneziani (2008) by way of a critical appraisal of the relevance of Han and Schefold's (2006) recent empirical application of Sraffian capital theory. We here act on suggestions made by Farjoun and Machover (1983) already 25 years ago who in particular had argued at that time that the imposition of a uniform rate of profit on price formation for all sectors of a given economy is far too restrictive to be of empirical relevance. This should be obvious on the ultra-micro level of actual physical input-output data, but it is also inadequate for highly aggregated input-output data as we shall show in chapter 8.

The first set of the above two tasks is solved through the application of the so-called Perron-Frobenius theory of eigenvectors and eigenvalues of non-negative matrices and will supply us with a Classical System of National

Accounts (SNA), based on labor values, that serves the purpose to classify what is going on behind the surface of competition in real terms, comparable to the SNA established by Richard Stone and his research group (see the United Nations' (1968) System of National Accounts). Such a SNA provides measures of real output, labor productivity, real growth of both of them and more, constructed both in the Classical theory and in Stone's system as instruments to describe real tendencies behind the nominal aggregates. On the basis of this understanding, Classical labor values are not competing in the first instance with production prices about being the better theory of market prices, but are indeed providing a framework for National Accounting that should be compared with the current (the UN's) System of National Accounts with respect to their weak points and their strong analytical implications.

Considering the current SNA (not Stone's original version) one may hold the view that its various measures do not construct something 'real' behind the 'nominal', for example when real value added is calculated on an industry level in terms of prices of a more or less distant past. Likewise, but much more accepted as judgement, now about the Classical labor theory of value (LTV), one could claim that the construction of labor values is nothing that can be considered as 'real'. But what is the meaning of 'real' here? In our view this can only be substantiated by showing mathematical propositions that demonstrate important implications of the measures proposed by the employed System of National Accounts, be it Classical or Stone's, for the understanding of the capitalist mode of production and its process of creative destruction on all levels of the society.

This is the setup in which the Classical Theory of Value and Competition has to be confronted with the achievements of Stone's SNA. We shall show in this book in its first part that there is no conflict between both approaches to National Accounting, but in fact some complementarity, with labor values originating from the input-output part of Stone's accounting system and this even at the highest levels of generality that is present in Stone's input-output methodology.

Labor values are built on the principle that only labor is productive. Keynes (1936, p.213/4), not at all a proponent of the labor theory of value, is indeed expressing a somewhat similar view, when he writes:

It is preferable to regard labor, including, of course, the personal services of the entrepreneur and his assistant, as the sole factor of production, operating in a given environment of technique, natural resources, capital equipment and effective demand. This partly explains why we have been able to take the unit of labor as the sole physical unit which we require in our economic system, apart from the units of money and of time.

Our view on the role of labor values for economic analysis is a pragmatic one. Labor Values should be well defined for general models of production (see chapter 5 for an example) and they should first of all be applied to generally understandable scientific topics like the implications of technological change in the capitalist mode of production, see chapter 3. There they can be used at the theoretical level for example to show that capital-using labor-saving technical change systematically lowers such labor values, and at the empirical level to measure whether this actually is the case.

Approaching labor values from this pragmatic perspective indicates that there is not really a ‘transformation problem’ to be solved (as in the example of Marx’s (1977) *Capital* Vol. III), since the role of labor values is not primarily one of explaining the movements of prices.¹ Labor values – when based on Richard Stone’s SNA, as done in this book – are nothing counterfactual, but can be calculated and used as measures of the total labor costs or of labor productivity characterizing the various commodities produced in the economy. Such a pragmatic, application-oriented approach to the LTV does not exclude however that labor values, viewed as representation of abstract labor, can be used as in Marx’s (1977) *Capital*, Vol.I, also from a philosophical perspective, as a concept with which one can interpret and analyze the socio-economic relationships (of classes of) human beings in a certain society at a certain time.

Prices of production, our second accounting measure (besides labor values), based on the assumption of a uniform rate of profit (and of wages) between industries and a given numéraire commodity, can also be derived from Stone’s input-output methodology and thus be determined empirically and compared with the profit rate differentials that actually exist in the economy. At the theoretical level they can be used as long period prices for modeling capitalist competition and induced directions of technological change among other things. They are also defined by an application of Perron-Frobenius theory, with the uniform rate of profit given through a simple transformation of the dominant eigenvalue that this theory investigates.

While labor values are characteristics of the sphere of production and devoted to an understanding of what is going on there, prices of production apply to the sphere of circulation and the distribution of net national product. Labor values may be useful in understanding the conflict between capital and labor in the transformation of commodity inputs into commodity outputs, while production prices may be of use for the understanding of capital flows between the sectors of the economy, of investment decisions of firms, and for the comparison of the newest with the average and the oldest production techniques and – at the macro-level – for the study of the conflict about income distribution between capital and labor.

¹ Though it may be an empirical outcome that total labor costs are a fairly significant component in actual price formation.

With these two instruments, labor values and production prices (appropriately generalized), we thus have concepts at hand that in specific ways allow the analysis of the production and the distribution of commodities in capitalist economies from supply-side and long-period perspectives. Keynesian effective demand problems concerning the short-run evolution of the economy and the business cycle need to be integrated into such a supply-side framework, a task that is not really approached in this book. It is however one implication of the book that prices of production may be considered as an unnecessary intermediate step in this reflection of the relationship between production-based labor values and average market prices, in particular when the latter are measured in wage-units (as the ‘real’ magnitudes underlying Keynes’ (1936) theory of the business cycle).

Authors working in the Neoricardian tradition have indeed produced little evidence that prices of production are point attractors of market prices and that uniform profitability is a tendency in capitalism in its earlier or later phases. We will see in part II of the book that the latter may be very questionable (if stock-flow relationships are taken properly into account). Moreover, as part III of the book will show also the theoretical stability of the Classical long-period prices is far from being well proven. We consequently conclude here – until the opposite is clearly shown – that prices of production may represent an unnecessary detour in the study of the results of the capitalist circulation process and that the direct link between labor values and actual average market prices may be the better choice for theoretical as well as empirical investigations (see here chapter 3 in particular) than the addition of prices or production to this link, since the latter may be irrelevant for the actual choice of technique under capitalism.

The second set of tasks described at the beginning concerns dynamics, both on the micro- as well as on the macro-level. It may be claimed with respect to the above that the Classical authors would have created the Perron-Frobenius eigenvalue theory if they, like Marx tried to do it, had attempted to go extensively into the mathematical literature that existed at their time. Similarly, they could have established the Lotka-Volterra mathematics underlying the investigation of population dynamics if they – in particular Marx – would have attempted to formalize the Classical ideas on the dynamics of market prices and capital flows and – on the macro-level – Marx’s general law of capitalist accumulation by the mathematical formulation of these laws of motion.

In Classical ruthless competition, financial capitals are moving into the sectors with a rate of profit higher than the average and are leaving the sectors that are characterized by the opposite. But in doing so they increase the supply of commodities in the profitable sectors and reduce it in the unprofitable ones. Prices will therefore tend to fall in the profitable sectors and rise in the latter ones, thereby providing a check to this type and direction of capital flows. From a predator-prey perspective price reactions counteract profitability levels and are thus the predator in this Classical approach to competition, capital mobility, the law of demand and supply and their consequences.

Price-determined profitability acts positively on supply and supply acts negatively on prices which is exactly the Lotka-Volterra predator-prey mechanism, are here applied to a multi-sectoral economy and thus to microeconomic price and quantity adjustment processes. At the macro-level, in the theory of employment and income distribution, we know of course from Goodwin's (1967) formalization of Marx's general law of accumulation that the roots of his modeling of this law are indeed given by the Lotka-Volterra predator-prey dynamics, with employment as the prey, acting positively on the wage share, and with the wage share the predator, acting negatively on investment and thus on future employment possibilities of the workforce. This is again a cross-dual or cross-over type of dynamics with one positive feedback mechanism and one negative feedback channel, when looked at from this general perspective.

We thus have the result that Classical value and price accounting is from a mathematical perspective intimately related with the theory of non-negative matrices (or more generally: matrix bundles) and the eigenvalue theory that can be based on them, while the Classical theory of competition between industries and between labor and capital shows significant analogies to Lotka-Volterra types of dynamics, and thus not only of the overshooting predator-prey type, but also with respect to other types of interacting population dynamics.

The Classical approach to economics thus not only supplies us with two – from the definitional point of view – clear-cut factual accounting schemes for the investigation of the tendencies that govern the capitalist mode of production and circulation, but also provides us with micro and macro laws of motion around these accounting schemes (when appropriately formulated). The total labor costs accounting schemes, in addition, reminds us of the fact that only labor is productive (as the only really indispensable factor of production) and they provide us with an analytical instrument which allows to detect the tendencies that characterize the capitalist mode of production.

On this background, this book is structured as follows: In its part I we define labor values for general models of production and show that this type of definition not only mirrors the factual cost-accounting behavior of firms, but is also – which came as a surprise – closely related to the principles that characterize Stone's input-output methodology when applied to measures of total labor costs of produced commodities in general models of production.

This starting point for the investigation of the Classical concept of labor values should make sense to all schools of economic thought and thus not only be of interest to scientists working on the so-called Marxian transformation problem (which is an issue only when labor values are interpreted as some sort of physical magnitude like energy in place of considering them as a mathematical definition, the usefulness of which must be proved by mathematical theorems and their empirical examination). While chapters 1, 5 - 7 are based on work published in the 1980's, the chapters 2 - 4 show that this earlier work is still relevant for the current debate on labor values and measures of total labor costs.

Part II considers the Classical theory of competition in the form of the long-period prices this theory starts from. It provides – in chapter 8 – an introduction to the results implied by Classical ruthless competition, the perfectly competitive prices of production and the theorems this second Classical accounting scheme gives rise to. Since these pricing procedures and the wage-profit relationship they imply have already been investigated in numerous articles and books we can be brief here. We therefore concentrate in the remaining chapters of part II on two issues, namely: on the usefulness of Sraffa’s concept of basic commodities in general models of production and on the uselessness of his concept of a Standard commodity of a given input-output structure, by which the theory of income distribution is in fact not simplified, but obscured.

Part III is on Classical microdynamics and starts this topic in fact from a Walrasian perspective. Walras (1954) has indeed – as we shall see there – reformulated the Classical cross-dual microdynamics between prices, profitability and quantities supplied, at the level of production economies, by way of a tâtonnement process between firms, households and the auctioneer. This dynamic process is reformulated by means of differential equations in chapters 13, 14 and shown to be of fairly stable nature if a further aspect of actual market dynamics is taken into account, namely that derivative forces, showing the influence of direction of change of the interacting imbalances, also matter in this abstract formulation of the forces of competition in capitalist economies.

Chapter 15 applies these considerations to the Classical von Neumann model and the theory of production prices it implies. We there find clear indication for the proper working of the Lotka-Volterra predator-prey mechanism, and can also apply its features that concern the extinction, in our context, of economic processes and marketed commodities. Chapter 16 finally adds Keynesian dual dynamics to the Classical cross-dual ones, which with respect to quantities is of dynamic multiplier type and with respect to prices uses iterated markup pricing procedures.

The overall outcome of part III of the book is that Classical cross-dual dynamics can be successfully formalized in mathematical terms (and also be extended by Keynesian short-run forces). However, these dynamical structures do in no way depend on the assumption that the restrictive concept of prices of production is to be used as their center of gravity. There may instead exist many reasons that differentiate average profit rates also in the longer run so that average market prices are to be confronted with a long-period price accounting scheme that is more flexible than the conventional formulation of prices of production.

In part IV we reconsider the Classical growth cycle model of Goodwin (1967) from various perspectives, concerning its structural instability, endogenous aspirations in pricing procedures, low-skilled and high-skilled labor solidarity – or cooperations of the latter group with capital in place of labor. We also reformulate the Goodwin growth cycle as a limit cycle that surrounds and tames explosive forces around the steady state caused by the conflict of labor and capital over income distribution and we confront – as in Solow (1990)

– this overshooting, but stable dynamics with empirical phase plots of the Goodwin growth cycle type for various OECD economies as well as – in a new paper, see chapter 21 – with modern econometric investigations (for the US economy) of the long phase cycle that is implied by this cross-dual cycle generator. Finally, its relationships to a general model of Keynes-Wicksell type are explored in chapter 22.

Summing up the preface, we stress that labor values can be investigated in their role to reflect what is happening in capitalist competition and the technological dynamics it implies by contrasting them directly with average market prices (in terms of the wage-unit as in Keynes General Theory). Prices of production (with their strict assumption of a uniform rate of profit) may be a useful intermediate step, at least when reformulated in an appropriate way, yet this is currently far from being obvious. This holds true in particular when they are formulated as in Sraffa (1960) from a purely academic physical perspective and not as in Bródy (1970) from an applicable Leontief approach at some intermediate level of aggregation.

If prices of production are not close to market prices, their role for analyzing technical change may indeed be very limited. It may therefore well be the case – as Farjoun and Machover (1983) indirectly argue – that Samuelson’s (1971) eraser principle does in fact not apply to the usefulness of labor values, as it is repeatedly stated in Steedman (1977), but instead to the alternative accounting concept of prices of production — for which no empirically relevant application may exist.

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Labor Values: Theory and Measurement

This part considers the sphere of commodity production and the question which tools can be of use to analyze its evolution in its own right, a very dynamic process of creative destruction as Schumpeter has characterized it. We therefore are here abstracting from the process of commodity circulation and the explanation or theory of the price signals that drive this latter process. On this basis we assert that only Classical labor values can be of use to analyze the dynamic processes of production and technical change in depth.²

We share in this field the opinion of Keynes (1936, p.213/4),³ who formulated a pragmatic position with respect to production, when he wrote:

It is preferable to regard labor, including, of course, the personal services of the entrepreneur and his assistant, as the sole factor of production, operating in a given environment of technique, natural resources, capital equipment and effective demand.

In contrast to Marx's Labor Theory of Value (LTV), he however uses prices divided by the wage unit, as the real unit underlying his theory of effective demand. We will see in chapter 3 that it may indeed be meaningful to consider labor values and prices measured in the wage unit side by side, in particular, since the latter are an upper estimate of labor values in general. However, labor values (total labor costs) are more closely related to the evolution of the technological structure and thus serve to measure its historical phases in a better way than Keynes' prices in terms of the wage-unit, where income distribution is involved to a significant degree. Keynes' measure of real magnitudes may be useful in demand constrained n -sectoral economies that are using marginal cost pricing principles. This topic however concerns the sphere of commodity circulation and thus not production in its own right. We take here the view that the traditional approach to defining labor values (appropriately generalized) is the more fruitful one, regarding changes in the sphere of production, and it is firmly rooted in general input-output routines established by Richard Stone, see United Nations (1968), as part of a complete System of National Accounts, as we shall see. Part I therefore provides a production-based approach to labor values (total labor cost or – in reciprocal form: indexes of labor productivity). This approach is in general distinct from an alternative measure of total employment effects, the so-called employment multipliers, which can be negative in joint production economies in a meaningful way. Our concept of labor values (total labor costs) does not allow for this, but allows instead for Classical propositions of the LTV also in quite general models of production (and for a variety of price-theoretic approaches). It is however not directly oriented towards a solution of the so-called 'transformation problem', an issue that we consider to be secondary in nature in the

² This part also considers in its ch.3 a measure of total energy costs, but we believe that such measures are of a partial usefulness only and are not related very much with the core relationship within capitalism, i.e., the conflict between capital and labor about production conditions and income distribution.

³ The General Theory of Employment, Interest and Money. New York: Macmillan.

relationship between average actual prices and average total labor cost, the ‘real’ behind the ‘nominal’ as part of Stone’s Systems of National Accounts and the categories it uses as real magnitudes.

Labor value accounting therefore primarily provides a scientific framework that may allow to understand the results of capitalist production. This interpretation of the role of the LTV is quite independent of whether and how labor values can be transformed into price of production (or any other price system) such that certain aggregate expressions remain unchanged under such a transformation. This latter view runs into the danger that a formal scientific definition that attempts to characterize produced commodities qualitatively and quantitatively in an applicable way is reinterpreted as ‘object’ inherent in these commodities, a substance that can be transferred between the firms which constitute the considered economy.

In ch.1 we provide a sketch of one interpretation of the LTV, primarily concerning the understanding of Marx’s rate of exploitation, as the fundamental entity behind profit creation. It shows in addition that central ratios based on labor value accounting may provide measures for the systematic component in their corresponding price ratios. Ch.2 gives a survey on approaches to the LTV that can be classified as single or dual systems. Its main conclusion is that a synthesis between the new interpretation and traditional labor value measurement à la Stone can provide a fruitful approach to an extended LTV. This gives labor values an independent role in National Accounting and separates them methodologically from their potential use as price indicators and their interpretation from a purely price-theoretic perspective.

Ch.3 shows factual uses to which such labor value measurement can be put, concerning technical change and sectoral productivity growth, in contrast to what the United Nations is nowadays proposing as sectoral measures of labor productivity in its System of National Accounts. The chapter also provides important propositions on the relationships between types of technical change, actual prices measured in wage-units and labor values. It thus in particular shows that Sraffian prices of production are not needed to understand the interrelationships between commodity production and commodity exchange and are therefore secondary for a proper understanding of the LTV.

In ch.4 we show by means of examples from Steedman (1977) that neither pure joint production nor fixed capital create problems for labor value accounting from a proper input-output perspective, since labor values are not just prices of production at a zero rate of profit in general. Instead, labor values are related to the full cost accounting principles of firms where it is well-known that physical data are in general insufficient to perform such a task.

General joint production models are considered in ch.5 where it is shown that many propositions of the LTV that hold for square single-product systems can be meaningfully generalized to these economies. This task is solved by using a price system that is not based on Sraffian prices of production accounting which again shows that the LTV is not dependent on the very

special Sraffian approach to the determination of long-period prices. Ch.6 relates these issues again to Stone's formulation of a SNA and its consideration of input-output techniques and the measures that can be derived from them.

Ch.7, finally, applies these general input-output accounting procedures to a commodity called 'energy' and shows how total energy consumption and total energy costs can be calculated in joint production systems. It shows that the definition of such magnitudes is not restricted to the case of 'labor', but is also meaningful for other primary factors of production. The differences between 'labor' and 'energy' are, however, that energy is a produced commodity (which labor is not), that only labor is truly indispensable for social reproduction, that the commodity 'labor' is traded between interacting social groups and that there is awareness of the conditions of capitalist reproduction only within this particular exchange relationship.

Summing up, this part of the book shows that definitions of labor values not based on and related to input-output methodology and its considerations of labor productivity are of a very questionable nature. This concerns all approaches which attempt to solve the transformation problem by an appropriate static or temporal description of labor values that make them more or less an outcome of the sphere of commodity circulation in place of commodity production. Our finding therefore is that the traditional approach to labor values – appropriately extended to general models of production by means of Stone's input-output methodology – is the only approach allowing to detect the 'real' evolution of capitalism behind the nominal interactions on its surface, the sphere of commodity circulation. In principle, we believe, that this result is compatible with the approaches suggested by Foley, Duménil and Lévy and Shaikh, though these authors consider these issues from their own and to a certain degree different angle.

By contrast, Steedman's claim of the redundancy of labor value calculations (for prices of production calculations) does not at all imply that labor values are completely redundant as this part of the book shows. In the next part we will instead see that prices of production accounting procedures may in fact be the redundant element, as far as the sphere of commodity circulation is concerned.

KEYNES, J.M. (1936): *The General Theory of Employment, Interest and Money*. New York: Macmillan.

SRAFFA, P. (1960): *Production of Commodities by Means of Commodities*. Cambridge, UK: Cambridge University Press.

STEEDMAN, I. (1977): *Marx after Sraffa*. London: NLB.

UNITED NATIONS (1968): *A System of National Accounts*. New York: Studies in Methods, Series F, No.2, Rev.3.

The So-Called ‘Transformation Problem’ Revisited

Thus, even if the transformation problem could be solved mathematically, the resulting model would not only rest on the fallacious assumption of the uniformity of the rate of profit, but would actually be inferior to the original unmodified model (of Capital, Vol.I, P.F.) in respect of prices (Farjoun and Machover, 1983, p.134).

1.1 Introduction and overview

This chapter on the ‘transformation problem between labor values and prices of production’¹ shows that Lipietz’s analysis of the Marxist transformation procedure represents but a simple, though useful reinterpretation of obvious mathematical consequences of a standard Sraffa model – by making appropriate use of its known degrees of freedom. Labor values are not involved in this new interpretation of conventional prices of production. A proposal is therefore made how the role of labor values can be investigated further in such a framework, from the perspective of Marx’s ‘Capital’ and on the basis of Lipietz’s theorem and its reinterpretation of the ‘value of labor power’. Our additions to Lipietz’ definitional procedures suggest that important labor value aggregates such as the average value rate of profit and the value rate of exploitation may be of use in analyzing the systematic consequences of changes in the sphere of capitalist production, while the effects of the actual price dynamics that drive these changes (not yet accounted for by total labor costs) may be unsystematic and may therefore represent distortions of secondary importance. The issues considered here will be further investigated in the next chapters where also Marx’s (1954, p.48) view that labor values are measures of labor productivity, and thus also important in their own right,

¹ This chapter provides an extended version of Flaschel’s (1984) comments on Lipietz (1982), cf. also the comments on his paper by Duménil (1984) in the same Journal and Foley’s (1982) contribution to these issues.

is explored from the perspective of Richard Stone’s System of National Accounts. From this perspective, labor values concern the accounting side of an economy, constructed from the observed dynamics of nominal magnitudes in order to understand in a conventional way or in a Marxian sense what is going on behind the surface of nominal magnitudes.

1.2 Lipietz’s theorem

In the Journal of Economic Theory, Lipietz (1982) has presented a new version of a ‘Marxist transformation theorem’. This chapter argues that Lipietz’s theorem is contained in a conventional Sraffa model in a mathematically trivial way. This does not imply that his idea how to reformulate Marx’s transformation problem must be regarded as useless. Indeed, I find his idea convincing or at least worthy for elaboration. Yet, Lipietz’s mathematical formulation obscures what in fact has been achieved by him. Furthermore, if – as we shall see – the transformation problem becomes a trivial exercise in definitions, one is asked to point to at least one useful application of this exercise. Such an application will be sketched at the end of this chapter.

Let the symbols $A, l, I, x, y = x - Ax$ be defined as is customary in input-output analysis ($x = Y$ in Lipietz (1982)), i.e., we start from a simple Sraffa input-output system with given vectors of gross and net outputs x, y . It is assumed that the input–output–matrix A is productive. If wages w are paid ex ante we get instead of Sraffa’s prices of production the price equations

$$p = (1 + r)(pA + wl), \quad py = lx. \quad (1.1)$$

It is well known that eq. (1.1) can be uniquely solved for each given $w \in [0, 1]$ with regard to prices p and the rate of profit r , in an economically meaningful way (cf. also (H2)–(H2’’) in Lipietz (1982) and note that his symbol p^* in (H2) – and in his following text – should be replaced by p (or $v.v.$) to clear up the formulae employed by him). Solving eqs. (1.1) for $w = 1$ ($r = 0$) defines labor values $v = vA + l, vy = lx$ with regard to which the transformation problem then has to be re-formulated.

In his transformation theorem, Lipietz (1982, p.78) takes the vector y and wages $w \in (0, 1)$ as given and defines – as I interpret his formulations – a capitalist redistribution of value by a solution p of eqs. (1.1) with respect to these data. That such a solution exists and is uniquely determined has already been noted to be a well-known fact. Furthermore, Sraffa’s prices (1.1) of course fulfill

$$r(pAx + wlx) = py - wlx = vy - wlx, \quad (1.2)$$

i.e., profits, of course, must equal (or are a redistribution of) surplus values if w is interpreted to represent Marx’s ‘value of labor power’. Finally, if the rate of surplus value e is defined by $e = (1 - w)/w$, there immediately follows from eqs. (1.2)

$$r = \frac{(1-w)lx}{pAx + wlx} = \frac{1-w}{w} \frac{wlx}{pAx + wlx} = e \frac{V}{C + V}, \quad (1.3)$$

i.e., the third assertion of Lipietz's theorem.

1.3 Labor value ratios: The systematic component in their price expressions?

We conclude that Lipietz' theorem is but a simple reinterpretation of a modified conventional Sraffa model (see Sraffa (1960, ch.3)) by making appropriate use of its degree of freedom w . This corresponds to Robinson's (1969, pp.333/4) proposal that Marx's rate of surplus value e should best be measured by the ratio profits/wages, i.e., by $(1-w)/w$, which also implies the above redistribution property. Yet, what is the use to which such a reinterpretation of Sraffa's prices – besides redefining certain Marxian aggregates – can be put?

With regard to Marx's aims this cannot be demonstrated by Lipietz's final equation on p.80, since this equation is but a formal reformulation of eqs.(1.1) in terms of $e = (1-w)/w$ and $v = l(I-A)^{-1}$, the conventional definition of labor values, the independent use of which we are looking for. This equation consequently does not leave the sphere of Sraffa's price calculations. Lipietz's in our view meaningful reinterpretation of the value of labor power (in particular, if workers are allowed to save) by means of the wage rate (the wage share) of system (1.1) can, however, be supplemented by the value rate of profit ρ , the central link in Marx's own transformation procedure in a meaningful way. This rate is to be defined as follows

$$\rho = \frac{v(I-A)x - wlx}{vAx + wlx} = \frac{(1-w)lx}{vAx + wlx} = \frac{e}{vAx/wlx + 1}, \quad (1.4)$$

$$e = \frac{1-w}{w}, \quad vy = lx \quad (1.5)$$

For the relative deviation between the price rate and the value rate of profit we easily obtain from eqs.(1.1), (1.2), and (1.4) the expressions

$$\frac{r - \rho}{\rho} = \frac{(v-p)Ax}{pAx + wlx} = \frac{(v-p)x}{pAx + wlx} \quad [= 0, \text{ if } x = \alpha y, \alpha > 0] \quad (1.6)$$

This in our view represents the fundamental formula on the basis of which Marx's value theory of the price rate of profit r , i.e., its deviation from the value rate ρ , and thus the transformation problem should be evaluated further – by means of suitable theoretical *as well as* empirical examinations of the difference shown by (1.6).² Hence, Marx's central aim can be examined further

² The above result also holds for all average price rates of profit in place of the uniform rate of profit we have considered so far.

and can in particular be subjected to test by means of the labor values or productivity indexes v as measured by input–output analysts (see Gupta and Steedman (1971) for an example of such a measurement), indexes which play no role in Lipietz’s rate of profit formula (1.3). The real issue for a Marxian analysis of profits, therefore, is to test whether the production–based rate ρ can provide a proxy for the uniform (or average) rate of profit or not. Lipietz’s redefinitions in this respect only serve to pose the problem anew.

We get that the price and the value rate of profit (for any given price vector p with $py = lx$) in fact differ only by unsystematic historically determined price–value deviations from each other which tend to neutralize themselves in the aggregate at least to a certain degree, see chapters 3 – 5 for more details. The systematic forces of capitalism primarily concern the evolution and laws of motion of production, and not so much the many interacting (opposing) forces that determine actual price dynamics. A rising organic composition of capital vAx/wlx will therefore in general not only lower the value rate of profit, but also the price rate of profit if not offset by a rising rate of exploitation e , see Farjoun and Machover (1983, ch.7) on how such an argument can be made more precise from a probabilistic point of view. Note here also that their argument that actual prices and their Marxian ratios should be investigated from the viewpoint of Marxian labor value categories is shared by the chapters that follow, since all of the above does not depend on the use of a production price system which may be a very hypothetical and restrictive (micro or meso) construct in the globalized world we are experiencing now in the age of the internet.

Supplement: If workers do not save and their yearly consumption is given by C_w we can define – in correspondence to the rate e – the value rate of exploitation by:

$$\epsilon = \frac{1 - vc_w}{vc_w}, \quad c_w = C_w/lx$$

and compare it with the price rate of exploitation $e = (1 - w)/w$ we have used in the above calculations. Since there must hold $pc_w = w$ then, we get for their difference:

$$e - \epsilon = \frac{(v - p)c_w}{vc_w pc_w} \quad [= 0, \text{ if } c_w = \alpha y, \alpha > 0]$$

We thus also get that the price and the value rate of exploitation (for any given price vector p with $py = lx$) differ only by unsystematic, historically determined price–value deviations from each other which may neutralize themselves in the aggregate to a larger degree. One may therefore claim that the systematic forces behind an increase in the price rate of profit are the forces that lower either v or c_w (or both) or that increase the labor time the worker family has to work for their consumption bundle c_w . The consideration of the value rate of exploitation therefore directs our view to central causes of increasing exploitation which are not equally well visible if this ratio is expressed in

money terms as the actual profit share divided by the actual wage share, as it was discussed above.

1.4 Conclusions

We have shown in this brief chapter how central aggregates of Marx's theory of capitalistic reproduction can be defined within a system of Sraffian production prices and also for all actual price vectors (fulfilling $py = lx$ for later comparison with labor value analogues). We have moreover shown that the systematic changes in profit and exploitation rates should be represented by labor value expressions rather than by price expressions, due to the chaotic nature of the interacting processes of commodity exchange in space, time and with respect to contingencies. We thus regard the evolution of labor value (or total labor cost) expressions as capturing the essence and the inertial laws of motion of capitalism, while the corresponding price expression are to a larger degree chaotic in their daily worldwide motions, an arbitrariness which may however only be of a secondary degree as far as deviations between the considered price and value aggregates are concerned.

Labor power is the only commodity which (in a systematic way) is not produced by firms and where no profits accrue in the course of its production (in contrast to slavery). Moreover labor power is indispensable for social reproduction, while all other commodities can in one way or another be substituted through each other. Reducing the value of labor power – through a lengthening of the workday (of families), a reduction in workers per hour consumption or most importantly: through technological change – therefore is the central mechanism by which the average rate of profit of an actual economy can be increased.

For further thoughts on such issues the reader is referred to the following chapters and their discussion of the role of labor values for an explanation of the forces that drive technical change in a capitalist economy. We here state already however that it may well be that the so-called 'Marxian transformation problem' can be replaced by a System of National Accounts, calculated in Marxian labor time expressions as the underlying 'real structure' to be used for the explanation of the ways actual price-quantity interactions are determining the accumulation and innovation dynamics of capitalist economies.

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Baseline Approaches to the Labor Theory of Value

A scientific theory cannot confine itself to dealing with what is directly observable, to the exclusion of abstract theoretical concepts. The attempt to expunge theoretical concepts, such as labour-content, from economic theory, leaving only directly observable quantities, such as prices, is a manifestation of instrumentalism, an extreme form of empiricism, which is destructive of all science. Without the concept of labour-content, economic theory would be condemned to scratching the surface of phenomena, and would be unable to consider, let alone explain, certain basic tendencies of the capitalist mode of production (Farjoun and Machover, 1983, p.97).

2.1 Introduction

The dominant price theory from the perspective of models of general equilibrium is in terms of rigor the Arrow-Debreu General Equilibrium Theory (GET) of so-called (neoclassical) perfect competition. The most developed framework for national accounting is the System of National Accounts (SNA) of the United Nations in its current form. Both approaches towards a classification and analysis of microeconomic structures flourished in the 1960's and 1970's, but lost in importance thereafter, in the first case, due to the internal limitations of GET in the fulfillment of Smith's conjecture on the working of market economies and, in the second case, due to a dilution of the current SNA as a rigorous and coherent approach to input-output structures within the System of National Accounts as it was originally formulated by Richard Stone and his research group.

Moreover, the Arrow-Debreu world pays little attention to the need for a System of National Accounts (though there have been some attempts to combine these two approaches in the study of the 'real' magnitudes usable to

characterize market economies).¹ It is therefore basically a purely ‘nominal’ approach,² despite the fact that it is in fact solely a theory of relative prices and thus faces the problem of the choice of a numéraire, which however is not supposed to reflect something truly ‘real’. It therefore seems to suggest that there is nothing ‘real’ behind the ‘nominal’, not even as a theoretical construction that can help to understand the movement of ‘nominal’ magnitudes. In addition to its pure ‘surface’ orientation, GET pursues a theory of competition that does not reflect any competition at all, since all individuals and firms are isolated utility or profit maximizing price-takers without any interaction with each other.

The United Nations’ System of National Accounts (SNA), now from 1993, scheduled to be revised again in 2008 and based on Stone’s SNA, is a rigorously developed classification system for the economic activities of a whole economy. It considers many complexities of real life, as for example joint production, and attempts to construct from detailed economic data, not only stock and flow matrices that can characterize the evolution of economies, but also real magnitudes like real GDP, physical input-output tables, and labor productivity measures. Quite obviously, its constructions of real magnitudes have to be considered as theoretical concepts intended to increase our understanding of what goes on in actual economies behind their nominal categories and not as representing something ‘real’ in the sense that we can find it in the real world. The United Nations’ System of National Accounts provides therefore a language (with precise qualitative and quantitative meanings) with which we can discuss the progress or regress in the (world) economy.

In my investigation of the United Nations’ Systems of National Accounts I have come to the opinion that this system is more Classical than Neoclassical in nature, where Classical here simply means that its concepts stress more the evolution of average magnitudes than of marginal ones obtained under the assumption of perfect competition. Classical theory, moreover, can be characterized as providing an approach to indeed ruthless competition, where households and more significantly firms interact (sometimes with brute force) such that all differential advantages are swept away. The result are so-called prices of production which are conceived of as the centers of gravity of market prices and which provide some sort of long-period moving averages for the many concrete pricing actions that take place in daily economic life, a process assumed to be working already in this way at the time of the industrial revolution and maybe even with more ruthless sectoral inflows and outflows of capital nowadays. The theory of ruthless Classical competition and its theoretical gravity concept, the prices of production, is one of the building blocks from which this chapter will start its investigations. The other building block will be Marx’s labor theory of value which in my interpretation has the basic

¹ See Fisher and Shell (1972) for a prominent example.

² The expression ‘nominal’ is here used in contradistinction to the concept of ‘real’ (‘quantity’-oriented) magnitudes of national accounting systems.

objective of finding the ‘real’ or the ‘essence’ behind the surface of nominal magnitudes, from a Marxian perspective,³ by way of the qualitative concept of ‘abstract labor’ and its quantitative expression ‘labor content’, measured by the average amount of labor time that is ‘embodied’ in the various commodities (in the sense of full-cost accounting in terms of labor time spent on average in the production of commodities).

We stress here that we take Classical prices of production only as one point of reference (besides actual average prices in terms of the wage unit for example), the properties of which have to be compared with those of the labor values, including the theoretical links that exist between these two types of theoretical accounting systems. Our approach to labor values is however independent from this type of comparison and in fact a purely factual one which needs as inputs the production data (the depreciation of stocks and the flows) of the year that is under consideration and also actual prices in some places (when joint production, heterogeneous labor and the like are taken into account). We thus use only production data (and some price data in addition) for a given economy in a given year in our formulation of the ‘labor time directly and indirectly embodied’ in the various commodities. These data can of course also be supplied from some equilibrium approach like the von Neumann model and the like which then only means that we impute them into this type of framework as an additional tool of analysis.

Marx’s labor theory of value has of course many qualitative and quantitative aspects which cannot be treated adequately in a single chapter.⁴ The aspects of it that I will stress and investigate is that its methodological status is that of a Classical System of National Accounts, with the basic objective of analyzing and explaining what really goes on in a capitalist market economy. As the UN’s SNA it therefore aims at categorizing in real terms what the (dis-)achievements of such an economy actually were in a certain year, not in terms of the very limited concept of Pareto efficiency, but in terms of real growth, productivity progress, exploitation, increasing or decreasing tensions between capital and labor and the like. It is thus not at all of the status of a price theory as Samuelson and others have claimed it to be over and over again, a status that nobody would seriously associate with the SNA of the United Nations as established by Stone.

The aim of the presentations in this part of the book is to demonstrate that Classical price (production prices and labor commanded prices) and value theory are at least as far-reaching in their theoretical and empirical potential as the only loosely connected neoclassical price theory and the accounting principles of the conventional SNA (based on constant price data of a certain base year, which indeed needs to be rebased often in order not to lose contact with the ongoing economic evolution). Classical (labor) value theory is a theoretical concept that can be determined simultaneously with actual prices

³ But based on Marxian categories.

⁴ See Eatwell et al. (1992) for a summary of Marx’s economics.

and prices of production and thus does not need a base year for its proper formulation. The question then however is what rigorous relationships there are between such labor value accounting and the Marxian SNA that is based on it and the prices of production, not in the sense of some sort of transformation theorem, but in the sense of detecting the qualitative and quantitative relationships between the theoretical concept of non-nominal economic reasoning and the centers of gravity of the purely nominal development of actual market prices.

In this respect the chapter will in particular discuss in the next section a list of properties that may help to understand (here primarily) the quantitative relationships of theorizing the ‘real’ behind the dynamics of the nominal magnitudes like profit, wages, value added and more. Concerning the so-called Marxian transformation problem, we start from the state of the art in economic accounting, the United Nations’ SNA (of the 1960’s rather than of the 1990’s), where magnitudes measured in terms of current prices and constant prices coexist without raising the issue whether one scheme can be transformed into the other one in order to obtain a meaningful relationship between the two. It is obvious that our perspective will provide a dual approach to Marxian economics, with labor values providing the means to analyze the ‘real’ behind the nominal resulting from the interactions of the human beings that constitute a certain society at a certain time and certain place in the history of mankind. Yet, as we shall see, this Marxian dual is embedded (from the quantitative perspective) in what is provided by the United Nations’ SNA (with all its details for deriving physical input-output tables in the presence of many technological complications as they exist in modern market economies). We simply have to take its measure total labor costs and to interpret it from the perspective of Marx’s Capital.

This can be done in competition with or in contrast to the categories provided by the conventional SNA and thus provides an ideal scenario by which the explanatory power of the two SNA’s, the conventional one and the Marxian one, can be compared and evaluated, potentially also allowing the conclusion that both systems for a ‘real value accounting’ (labor values vs. magnitudes based on constant prices) have their own advantage in certain areas of their application. The United Nations’ SNA starts from the nominal to construct its ‘real’ magnitudes on this basis, while Marx started from labor values in order to show their explanatory power for the price-quantity dynamics of capitalist economies. Nevertheless, the two ‘real’ SNA’s thereby obtained are both not meant to provide a substitute for a price theory, which is obvious for the United Nations SNA and which was totally confused in its objectives by the discussion on the transformation problem that followed reasonings of Samuelson (1971) and others.

From today’s perspective the task simply is to formulate and prove propositions that show the usefulness of the real SNA of the United Nations and of Marx’s valuation scheme and also maybe to show that they both can face common application problems. This places them on an equal footing with re-

spect to what they claim to be the ‘real’ behind the nominal, which in my view creates a scientific approach that can proceed with rigor and without any necessity for heated ideological debates and terminology. We shall consider here as possible theoretical outcomes either a result that is of the type of Keynes’ (1936) wage units construction, an approach that attempts to have a *single*, basically proportional to prices, reconstruction of values from the sphere of nominal price magnitudes or a *dual* one – which we favor – where an accounting system is created that differs in structure from the one supplied by the nominal price magnitudes.

With respect to such possibilities, we provide in section 2 a set of assertions that can be used – if accepted – to test competing theories of labor values against each other. Section 3 then briefly presents various contemporary approaches to the labor theory of value from the unifying perspective of a system of national accounts’ point of view. Section 4 concludes.

In chapter 4 we will provide the details of our approach to the definition of labor values, there exemplified for the case of Steedman’s (1977) joint production and fixed capital examples, in order to show the working of our definition of labor values in a context where conventionally defined labor values would become negative and thus meaningless (as Steedman has shown). This chapter also compares our procedure of defining labor values using accounting principles from the cost accounting methodology of firms with procedures introduced by Richard Stone into generalized input-output compilations and analyses. We find that there is indeed a close correspondence between these two ways of approaching a definition of total labor costs (if the so-called industry technology assumption is used for input-output table compilation and the so-called sales value method from the accounting perspective of single firms).

2.2 Labor value accounting: Some propositions

The aim of this section is to provide lists of properties that may be of use in evaluating the various proposals for a definition of labor values (or total labor costs) that have been put forward in the literature, and their application to theoretical as well as empirical investigations. This list is not intended to exclude any approach that violates one or another of its principles (maybe with quite different objectives in mind) from serious consideration. Instead, they should help the reader to systemize (and form preferences for) the different approaches to Marx’s LTV with respect to the features they explicitly or implicitly exhibit. We believe however that these list are by and large in accordance with what is stated in Marx’ Capital on the various properties his definition of labor values should give rise to.

1. Simple quantitative features of the Labor Theory of Value (LTV):

- a) Aggregation Theorem: The (labor) value of net production of a given year equals the total labor time expended in this period. A simple matter of the proper definition of labor values.

- b) Profit–Rate Theorem: The average (labor) value- and price-rate-of-profit are of the same magnitude in situations of uniform rates of growth. A very weak side - condition (see also ch.1 on this matter).
- c) Price / Value Theorem: Uniform ratios of profits to wages (in terms of whatever prices) in all sectors of production imply proportionality between labor values and these prices. A methodologically important proposition of Marx’s labor theory of value.
- d) Redistribution Theorem: Total profits are equal to total surplus values (and the rate of exploitation is given by the ratio of total profits to total wages). A simple matter of choosing an appropriate definition of the value of labor power (and net output y as numéraire commodity, see ch.1).
- e) ‘Fundamental’ Marxian Theorem: The rate of exploitation is positive if and only if the uniform price rate of profit is positive. A very weak side - condition.
- f) Labor–Commanded Theorem: Labor values are smaller than actual prices when these prices are normalized by the money wage rate (assuming that all sectors earn positive profits). A proposition with important empirical content.

Most of these assertions are known to hold true in single non-joint production systems (no fixed capital), but some of them are not easy to generalize to general production systems, see ch.4 for example.

2. Basic principles, when generalizing Labor Values (LVs):

- a) Commodity Correspondence Principle (Free good rule): The sign of the price of a good equals the sign of the labor value of the good. In particular: The labor values of free goods are zero. This is not a trivial property of labor values in the light of the discussion of their proper definition for general joint production systems in the 1970’s and 1980’s.
- b) Value–added principle: Value added (per commodity) equals direct labor (per commodity). This is not a trivial property of labor values in the light of the discussion of their proper definition in the 1970’s and 1980’s.
- c) Individual– and Market–value Principle: Labor values are averages of individual values, which in turn are derived from actual production data of multiple activity systems by means of average labor values. A basic construction principle that has been stressed by Marx already.
- d) Labor–Value Continuity Principle: Labor values change continuously with technology. This is not a trivial property of labor values in the light of the discussion of their proper definition in the 1970’s and 1980’s.
- e) Labor–Unit Principle: Labor is to be homogenized by means of wage differentials. One prominent approach towards the solution of the so-called reduction problem which allows for the generalization of the price - value theorem stated above.

- f) Imputation Principles: If full-cost accounting (of any type) is not possible by means of actual physical input-output data alone, the existing practices of firms have to be analyzed and to be applied appropriately to close the then existing degrees of freedom in the definition of such total costs (principles like the sales value method, e.g., see later sections of this chapter).

Most proposed concepts for generalized labor values in the 1970's and 1980'⁵ for general production systems are hurting one or more of these principles so that either these value definitions or some of the above principles must be discarded from a further discussion on the meaningfulness of the labor theory of value.

3. Pragmatic uses of the notion of LVs:

- a) Leontief Multiplier Theorem: Monetary input-output calculations of total labor costs per unit of output value determine the value/price ratios of individual commodities also in general production systems – if input-output tables are calculated appropriately (by means of the so-called industry technology assumption, see later sections of this chapter).
- b) Inflation Measurement: The 'monetary equivalent of labor time' (MELT) is to be determined by total nominal net output (NNP) per unit of labor time expended which leads to an index formula of the type

$$\epsilon = py/lx = \sum_i (p_i/v_i) \frac{v_i y_i}{\sum v_i y_i},$$

see the preceding chapter and note that change of this expression in time can be used to determine the rate of inflation of the economy.

- c) Labor Productivity Measurement: The reciprocal values of labor values are the appropriate measures of labor productivity of the corresponding sectors of commodity production.
- d) Technical Change Theorem (one example): Capital-using labor-saving technical change which is profitable raises labor productivity (in the sense just defined).
- e) The General Law of Capitalist Accumulation (Marx's Capital I, ch.23) implies the need for a macroeconomic presentation in real terms that is independent of base periods as they are needed – and often rapidly updated – in the measurement of real magnitudes in the conventional system of national accounts.

These assertions attempt to link the theoretical concept of labor values to actual data and the measurement of so-called real magnitudes and try to avoid the pessimistic conclusion: 'The only real in a capitalist production economy are the nominal (price times quantity) expressions' as judgement on the value of conventional accounting practices in so-called real terms (and all the fallacies they may exhibit).

⁵ By Morishima, Okishio, Steedman, Wolfstetter, Krause, Holländer, and others.

The purpose of the presentation of the above lists of features of and assertions on Marx's labor theory of value lies in the suggestion that all these points can be considered as systematic outcomes of the reflection of Marx's labor theory of value in the 1970's and 1980's – and this on the level of simple two-sectoral models as well as general n-sectoral models of production – on the basis of which the remaining possibilities for a coherent and applicable LTV can then be investigated and judged in detail.

In the next section we will provide a brief survey of baseline definitions and approaches to the Marxian concept of a value rate of profit and an underlying value rate of exploitation that are still proposed, including a comparison with the status of the United Nations' SNA and its considerations of total labor costs. We will however not go into a detailed discussion here, that confronts the above list of assertions with the approaches to be presented next, but leave this for future research and debate of the issues that are raised in this chapter.

2.3 Four baseline approaches to Marx' labor theory of value

The following discussion of various approaches to a value accounting in Marxian or in other terms will be very short, since we solely want to provide a framework where all four approaches that are here discussed can be compared from the unifying perspective of National Accounting and a specific angle, namely by their provision of a 'real' accounting system, in addition to the official purely nominal one and its categorization of economic activities, stocks, flows and the growth processes the interaction of stocks and flows gives rise to.

One possibility to evaluate the following approaches (where we consider the UN approach here from the perspective of its nominal categories and its definitions of inflation and growth, but not of so-called real magnitudes) is to briefly apply the criteria of the preceding section to these approaches in order to evaluate their proposals for the determination of labor values or total labor costs. Ultimately the theoretical and empirical application of the proposed definitions and the quantitative expressions derived therefrom will decide which approach is the more fruitful one in constructing something behind the UN's nominal magnitudes that can be of help in the understanding of what is actually observed in nominal terms for capitalist market economies in space and in time. We stress that the statements made in the following subsections are still somewhat preliminary and need further discussion and elaboration, in particular of those contributions that are not considered as appropriate in this book.

2.3.1 The Temporal Single System Interpretation (TSSI)

In this approach, labor values v_{t+1} are derived from the physical and labor input costs of firms, see McGlone and Kliman (1996, p.46),⁶ the former evaluated at current prices p_t and divided through a given scalar ϵ , called the monetary expression of labor time (MELT) in the literature, which renormalizes the price expressions for the input costs towards a measurement in terms of labor units: $v_{t+1} = (p_t/\epsilon)A + l$.⁷ Otherwise, the definitional procedure is as in the conventional algebraic approach to labor values, with the important difference however that input costs (in prices) are taken from the beginning of the production period and the labor values of outputs are defined as end of period values (beginning of the next one).⁸ Labor values – and prices of production, see below – therefore are here employed in a dynamic fashion, one that leads from exogenously given prices (of production) to an appended updating of labor values (and prices of production). We set the MELT expression ϵ equal to 1 for expositional simplicity (and in order to avoid confusion with the value rate of exploitation we defined in the preceding chapter). On the basis of the notation of this chapter we can then define the average rate of profit of the value system by⁹

$$\rho_t = \frac{p_t(I - A^+)x_t}{p_t A^+ x_t} = \frac{(1 - w_t)lx_t}{p_t A^+ x_t} = \frac{e_t}{p_t A^+ / w_t lx_t + 1}, \quad e_t = \frac{1 - w_t}{w_t}, w_t = p_t c_w \quad (2.1)$$

since there holds $p_t y = lx_t$ due to $\epsilon = 1$.

We define next¹⁰ the uniform rate of profit system (the prices of production in this dynamic setup) by:

$$p_{t+1} = (1 + \rho_t)p_t A^+$$

It is easy to show on this basis that there holds (r_t the average price rate of profit):

1. $p_{t+1}x_t = v_{t+1}x_t$
2. $\Pi_t := \rho_t p_t A^+ x_t = S_t := lx_t - w_t lx_t = p_t y_t - p_t c_w lx_t$
3. $r_t = (p_{t+1}x_t - p_t A^+ x_t) / p_t A^+ x_t = \rho_t = (1 - w_t)lx_t / p_t A^+ x_t$

⁶ I have to thank Andrew Kliman for detailed comments on this section of the chapter which contributed to improving its presentation. Of course, the usual caveats apply.

⁷ A, l are the unit input data of standard input-output analysis, see also ch.s 1/3, that is augmented by workers average consumption data.

⁸ In contrast to the simultaneous equations approach there are however no linear equation systems to be solved here.

⁹ See McGlone and Kliman (1996, p.46). Note that p_t is here interpreted in terms of a historically given vector v_t .

¹⁰ See McGlone and Kliman (1996, p.46).

These equations provide the core equations of the TSSI solution to the Marxian transformation problem, an interpretation which preserves the Marxian accounting identities in his transformation example. If iterated in time, they give – on the basis of what was assumed above – in the limit (if it exists) rise to:

$$v = vA + l, \quad p = \frac{px}{pA^+x} pA^+, \quad i.e.,$$

the conventional equations for labor values and prices of production, see Bródy (1970) for example and for convergence proofs. As temporal values, old prices (and values) determine the average value rate of profit and the amount of surplus value that is produced,¹¹ while the next periods values and prices of production are just appended to the current situation's characteristics (and may need adjustment with respect to the MELT condition).

The basic question here is (as in any scientific approach that deals with phenomena of real life) which theoretical and empirical propositions can be obtained from these definitions of the value and price schemes v_{t+1}, p_{t+1} , apart from the three identities they give rise to by definition. Following Mohun (2004) we would also stress here that the central point of a quantitative expression or definition is to be able to use it in the form of proposition on v_{t+1}, p_{t+1} relationships and in empirical investigations of the actual behavior (measured in terms of actual prices) of the economy with respect to production and technical change on the one hand and competition and exchange on the other hand.

Due to the dynamic nature of the definition of labor values this is labelled a temporal approach, since it implies an evolving system of labor values even if all technological data are given (where also prices of production are updated by an iteration procedure as proposed by the TSSI). The advantage of this definitional procedure is that it preserves Marx's basic aggregate accounting identities. This approach is discussed and evaluated in detail in Duménil and Levy (2000a,b), Foley (1997, 2002), Freeman et al. (1996, 2004), McGlone and Kliman (1999), Mavroudeas (1999), Mohun (2003), Mongiovi (2002).

There is also the question how such labor values can be properly generalized¹² to the treatment of pure joint production systems (with a rectangular output matrix B), in particular if the jointly produced commodities are used again in production (in different processes), without giving rise to negative values for some commodities, indeterminacy of value accounting or other quan-

¹¹ Constant capital, variable capital and surplus value are thus all given magnitudes when the price-value iteration is started.

¹² This seems to be a general problem for the presentations of the TSSI in the literature, since there meanwhile exist numerous examples for its formulation, but by and large no compact, concise definition for general models of production which avoids the various shortcomings of the examples.

titative 'anomalies'.¹³ This is a topic where in our view also actually employed methods of dealing with joint production within firms should be taken into account (an empirical orientation of the labor theory of value clearly found in Marx's *Capital*, Vol.II). The further question is how the definition of labor values in the TSSI can be related to Marx's (1954, p.48) understanding of the relationship between labor values and the measurement of labor productivity. The latter should change systematic fashion (ignoring 'secondary' influences of actual prices on labor values as they are discussed in the chapters 4 and 5) when methods of production are changing, for example in the simple input-output system considered by McGlone and Kliman (1996, p.46), while labor values according to the TSSI can change in proportions when the proportions of prices (of production) are changing in the iteration procedure they propose for labor values and prices of production.

In our view, the most basic problem of this approach to values and prices however is that it makes use of a uniform point-input (t) point-output (t+1) assumption for all production processes happening in the considered economy. This is extremely implausible from the empirical perspective.¹⁴ Input-output flow data are accumulated data transformed into averages by appropriate normalizations and input-output stock data measure inventories needed for production at certain moments in time, also transferred to averages by appropriate normalization procedures. We thus have average items for capital consumed (including wages) as well as for capital advanced (also including wages). To assume that all flows are consumed uniformly at the beginning of the year and all outputs sold uniformly at its end is introducing an abstraction that is not adequate in the context of a Marxian approach to reality, see Marx's detailed factual analysis of the turnover of capital in *Capital*, Vol.II. We have production processes that use up inputs and produce new outputs each day during the year as well as processes where even one year is not sufficient to produce a finished commodity. Turnover times of inputs therefore can vary in extreme ways and should thus not be forced into a purely theoretical Austrian point-input point-output approach to capital theory.

Instead input-output averages moving continuously in time (based on data that are changing on a daily basis, but normally only measured once per year) should be used to measure labor values and prices of production (both pure accounting concepts in such a framework) which therefore also represent moving averages to be defined at each moment in time and thus necessarily not of the temporal type we considered above. The task then is to state laws of motion for such moving averages and their interactions and to show their

¹³ A possible solution could be found here by using the distinction between individual and market values in the way proposed in Flaschel (1983a) or alternatively of the kind proposed in Duménil and Lévy (1989).

¹⁴ If at all, a continuous-input continuous-output model type would here be the more appropriate starting point for the modelling of a capitalist economy, see Foley (1986) for a formulation of this type of approach in the context of Marxian economics.

theoretical as well as empirical validity. Definitions – whether temporal or simultaneous – therefore must be based on empirically relevant formulations of the production processes of a capitalist economy and be employed to a theoretical and empirical understanding of what we observe in reality through more or less conventional statistical procedures.

Following Kliman (2007) the TSSI is primarily concerned with refuting the myth of inconsistency of Marx’s solution to the transformation problem from labor values to prices of production. It provides a specific solution to this problem and is as such concerned about value – price relationships, where production prices are just the first step when going from theory and essence (abstract labor) to the surface of price-quantity adjustment processes (including commercial capital, banking capital, international exchange and so on). Yet, handling the transformation problem in our view leads to a combination of value and price expressions that distorts the distinction between essence (abstract labor) and surface (price and quantity interactions). It runs the risk of not separating Marx’s System of Labor Value Accounts (Capital, Vol.I) in a persuasive way from what happens on the surface of capitalist competition.

We close this brief section on the TSSI with the conclusion that its primary contribution is to make the TSSI comparable – from our perspective – to the treatments of the LTV that are now following. There has been an extensive debate in the literature on the merits and the deficiencies of this interpretation of Marx’s Capital which we will not discuss here any further, see however – besides the contributions already mentioned – the papers by Veneziani (2004, 2005), Mohun and Veneziani (2007) and also the response by Kliman and Freeman (2006).

2.3.2 The Aggregate Single System Interpretation (ASSI)

To a certain degree this approach is similar to Keynes’ (1936) approach who considered the working of the economy from the perspective of prices normalized by the wage unit, i.e. in his case, neoclassical marginal cost prices in terms of labor commanded, representing the amount of labor that is exchanged for one unit of the considered commodity. In the ASSI interpretation of Marxian categories, prices of production or actual prices) are normalized in terms of the labor time expended in the year under consideration, leaving actual prices p as remainder the expression py/lx , the monetary equivalent of labor time (MELT) we have already considered in the preceding subsection. The ASSI approaches to the labor theory of value share, on the one hand, a common core in their understanding of Marxian price ratios, but are also and on the other hand to a certain degree significantly distinguished from each other. Original contributions that are related to what was discussed in ch.1 are given by the works of Duménil (1983, 1984)¹⁵ and Foley (1982, 1983, 1986)¹⁶ and – with a different twist – in Germany by work of Krause (1980a,b,

¹⁵ See also Duménil and Lévy (2000a,b).

¹⁶ See also Foley (2000)

1998) and Picard (1979), where the postulate of a uniform rate of exploitation is discarded in favor of a single value and price interpretation. Mohun (1993, 1994, 2003) has considered the Duménil-Foley (DF) interpretation in detail, while we have done so (indirectly) in ch.1.¹⁷

The DF single system approach rescales actually observed market prices (or prices of production) such that they represent the price of net product py by the amount of labor $L = lx = vy$ expended in its production, see here ch.1, in order to define on this basis Marxian categories like the value of labor power, surplus value, the rate of exploitation and more. Assuming that workers do not only consume, but also save, makes it necessary to depart from the subsistence definition of the value of labor power as measured in terms of labor values applied to the assumed subsistence basket. A new interpretation of the value of labor power is then provided by money wages divided by MELT, i.e., the wage share in national income, see again ch.1, whereby the sum of wages (divided by MELT), i.e., measured relative to $py = lx$, becomes identical to Marx's concept of variable capital and the sum of profits becomes identical to Marx's notion of surplus value. The accounting identities of this particular framework are therefore given by these three sets of equations. The attractive thing with this approach lies in the fact that it is empirically the least demanding one to be implemented and that it therefore can progress rapidly from a given nominal system of national accounts to the consideration of the tendencies that are implicitly contained in these data sets and their evolution over time (including the determination of the rate of inflation, see the next subsection).

The ASSI therefore interprets the existing data in a new way and is immediately applicable to the analysis of the evolution of capitalist economies, such as in the study of Duménil and Lévy (1993) on the economics of the profit rate. In this work however, in the appendix on pp.48/49, a brief account of the transformation of values into prices of production is provided that stresses the difference between appropriation and realization of surplus value, stating that (p.49):

Surplus value is appropriated proportionally to labor inputs, but realized (under ordinary circumstances) proportionally to capital advanced. This separation between appropriation and realization hides the existence of exploitation.

With respect to the use of conventionally defined labor values and their role in defining rates of profit and exploitation, see here ch.1, the ASSI is therefore somewhat inconclusive and does in any case not erase this definition as it was proposed by Samuelson (1971). In our view, the statement from Duménil and Lévy (1993) can be associated with the approach to the definition of labor values and the value rate of profit we have considered in ch.1, which bases the

¹⁷ See also Mohun (2004) for further remarks on the literature and an outline of some recent approaches to an accounting structure which relates observable prices to Marxian labour values.

stated difference again on dual concepts of value and price and the proximate relationships they imply for central Marxian aggregates (which re-direct the focus again on capitalist production and the forces that are shaping it). It is in principle also obtained from what is supplied by the United Nations' System of National Accounts and its application to the data of particular economies if one replaces their concepts of (aggregate or sectoral) labor productivity by labor values and their aggregates as indexes of labor productivity, see the following two subsections.

2.3.3 The Conventional Dual System Approach (CDSA)

In theoretical debates on Classical economics and their considerations of value and price in the framework of given input-output data the work of Piero Sraffa (1898 – 1983) is clearly of outstanding importance, represented in particular by his 1960 book 'Production of Commodities by Means of Commodities' which may be considered the Classical equivalent to Debreu's 'Theory of Value', both very compact publications with an overwhelming impact on the corresponding scientific communities. Both contributions are heavily concentrated on the sphere of competition and thus on price theory, in one case long-period production prices and in the other case short-run market prices. From a Marxian perspective these theories therefore concern 'surface phenomena' that do not penetrate what is going on behind commodity exchange in the sphere of capitalist production.

Be that as it may, conventional economics goes beyond such categories of competition in significant ways in that it constructs accounting concepts on the micro as well as on the macro-level that are intended to provide insights on the dynamics of a capitalist economies by snapshots of its real behavior underlying by definitional construction its nominal magnitudes and their movement in time. These efforts have been started on a larger scale, since the appearance of Keynes' General Theory and have found their culmination point in the work of Nobel Laureate Richard Stone (1913 – 1991) and his co-authors, in their joint efforts to establish a coherent framework for national accounting, published in compact form as 'A System of National Accounts' by the United Nations in 1968. Reading both Sraffa's and Stone's work (who both lived in Cambridge, UK) reveals striking common features (for example between Stone's Commodity Technology Assumption and Sraffa's Standard Commodity in the case of joint production), interrelationships that have been totally ignored in the mainly academic debate on capital controversies, but also in the pragmatically oriented, but theoretically very refined work of Stone and his followers.

With the abbreviation CDSA we here simply mean the current practices in the System of National Accounts of the United Nations as far as the calculation of real magnitudes, besides nominal expressions, based on double deflating procedures are concerned. Such an approach is clearly dual in nature, since it employs besides a full set of nominal categories a constructed

set of so-called real magnitudes, calculated at constant prices (where inputs and outputs are deflated differently), or prices of a certain base year, like real GDP, real growth, real value added, labor productivity measures and more. We may also call this approach a temporal one, because it gets into trouble when the base period departs too much from the current period, in which case magnitudes have to be rebased in some way or another. Furthermore, it is questionable what is really measured when one calculates for example real value added at prices of a base year, i.e., at prices that may be quite different in structure from the one of the present period, leading for example to potentially virtual income expressions thereby. This however does not mean that the double deflating methods applied in this accounting approach are generally suspect from a theoretical point of view, for example when they are used as in input-output methodology where different things have to be deflated differently. The important thing here however is that such differently deflated things (the inputs) should then still be treated as different and not deducted from separately deflated output in order to arrive at a difference, then called real value added, with which indeed no economic meaning can be associated.

This has lead some researchers in this area to declare that the only real object of investigation in the SNA is the purely nominal one, or less strictly that only a single deflator should be applied throughout (the so-called single deflating method) when going from nominal magnitudes to real ones. Yet, the example of input-output compilation shows that double deflation can in principle be applied to certain areas of the System of National Accounts, though of course subject to well-known aggregation problems as well as changes in process and product properties. The current system of national accounts – as routinized by the methodology published since the 1950's by the United Nations Statistical Division – provides however a wealth of categories, classifications and definitions which demand for closer inspection from the perspective of advanced economic theory, in particular in the area where quantity expressions for real magnitudes are derived and applied.

In this part of the book, we make the general assumption that there is something 'real' behind the dynamics of nominal magnitudes, and that these real magnitudes are given by theoretically sound definitions and not by some substance hidden behind the interaction of nominal expressions as we observe them as individuals and from a scientific perspective. These real magnitudes of an economy with many production and household sectors are to be constructed with great care and precision and they of course are only justified if we can use them to measure, explain and predict what is going on in the economy in greater depth than is possible by means of nominal prices and their aggregates, regardless of whether market prices or prices of production are used for this purpose. We view Stone's SNA as a big step forward into such a direction, in particular what its detailed and very general input-output methodology is concerned. From this perspective, microeconomics of any type is nowadays always characterized by a dual system approach, the accounting system on

the firm as well as on the national level (which have to correspond to each other) and the theory of prices, be it a Classical or a Neoclassical one. We will call the combination of Stone's SNA with the Sraffian theory of long-period prices the Conventional Dual System Approach (CDSA) in this section. Their common origin is Cambridge, UK in the 1950's and 1960's and their treatment of input-output data is in many respects interrelated as we have tried to show in Flaschel (1984). In a subsequent section we shall moreover show how value theory fits into such a framework, indeed by correcting for undesirable developments that have taken place in its further evolution, since the seminal contributions of Stone (1968), see United Nations (1993).

From a macroeconomic perspective the most important measures provided by a SNA are the rate of inflation and the rate of growth. With respect to inflation rates π_t one starts from expressions of the type:

$$\begin{aligned} 1 + \pi_t &= \frac{\sum_i p_{i,t+1} y_{i,t}}{\sum_i p_{i,t} y_{i,t}} = \sum_i \frac{p_{i,t} y_{i,t}}{\sum_i p_{i,t} y_{i,t}} \frac{p_{i,t+1}}{p_{i,t}} \\ &= \sum_i \alpha_{it} (1 + \pi_{i,t}) = 1 + \sum_i \alpha_{it} \pi_{i,t}, \quad \text{with } \alpha_{it} = \frac{p_{i,t} y_{i,t}}{\sum_i p_{i,t} y_{i,t}} \end{aligned}$$

From these expressions there easily follows by iterative extension:

$$1 + \pi_{t,o} = (1 + \pi_t)(1 + \pi_{t-1}) \cdots (1 + \pi_o) = \frac{\sum_i p_{i,t+1} y_{i,t}}{\sum_i p_{i,o} y_{i,t}}$$

i.e., accumulated inflation factors are just given by the value of current output levels divided by their value measured in prices of the base period $t = 0$. So far, everything is fine. We measure inflation by a specific weighted average of sectoral inflation rates where the weights are given by the relative sectoral output value in the current value of total output. The weights therefore depend on the current price vector, but having taken note of this, we just have an average of sectoral inflation rates at our disposal to measure and apply inflation rates for a whole economy.

In the same way we can measure the average growth rate of an economy by:

$$\begin{aligned} 1 + \gamma_t &= \frac{\sum_i p_{i,t} y_{i,t+1}}{\sum_i p_{i,t} y_{i,t}} \\ &= \sum_i \frac{p_{i,t} y_{i,t}}{\sum_i p_{i,t} y_{i,t}} \frac{y_{i,t+1}}{y_{i,t}} \\ &= \sum_i \alpha_{it} (1 + \gamma_{i,t}) = 1 + \sum_i \alpha_{it} \gamma_{i,t}, \quad \text{with } \alpha_{it} = \frac{p_{i,t} y_{i,t}}{\sum_i p_{i,t} y_{i,t}} \end{aligned}$$

From these expressions there again easily follows by iterative extension:

$$1 + \gamma_{t,o} = (1 + \gamma_t)(1 + \gamma_{t-1}) \cdots (1 + \gamma_o) = \frac{\sum_i p_{i,t} y_{i,t+1}}{\sum_i p_{i,t} y_{i,o}}$$

which in a specific way provides an expression for accumulated growth factors. It is also easy to show that the growth factor of nominal output fulfills the equations

$$1 + \eta_t = \frac{\sum_i p_{i,t+1} y_{i,t+1}}{\sum_i p_{i,t} y_{i,t}} = \sum_i \alpha_{it} (1 + \pi_{i,t}) (1 + \gamma_{i,t}), \quad i.e.$$

there holds approximately $\eta_t = \sum_i \alpha_{it} \pi_{i,t} \gamma_{i,t} = \pi_t + \gamma_t$.

We here concentrate on the determination of inflation rates and now show that they are identical to the fractions formed from the MELT expressions used in the preceding section if the net output vector $y = (y_1, \dots, y_n)$ is the vector used in above summations for average inflation rates. This follows easily from

$$MELT_{t+1}/MELT_t = \frac{p_{t+1} y_t / l x_t}{p_t y_t / l x_t}$$

if the data characterizing production are kept constant (since $l x_t$ can be canceled in these expressions).

Growth rate calculations, whether for prices or for output, therefore enrich the consideration of nominal data such as $p_t y_t$ in that they separate price level effects from output level effects in terms of their rates of change, i.e., as dimensionless percentages. This adds information to the consideration of the time series $p_t y_t$ and thus helps to distinguish price level growth from output level growth. A big error however occurs in the United Nations' (1993) SNA when one proceeds from there to an interpretation of the fraction $Y_t = \sum_i p_{i,o} y_{i,t}$ in the denominator of the accumulated inflation rate expressions, by calling it the real NNP of period t and by proceeding from there to the measurement of average labor productivity in terms of $Y_t/L_t = p_o y_t / l x_t$.¹⁸

$$\frac{Y_t}{L_t} = \frac{\sum_i p_{i,o} y_{i,t}}{\sum_i L_{i,t}} = \sum_i \frac{L_{i,t}}{L_t} \frac{p_{i,o} y_{i,t}}{L_{i,t}}$$

Viewed from its bare definition, Y_t is nothing but the current net output basket valued at price of a base period 0 which remains a price expression, based on a price vector of some arbitrary past. Output at hypothetical past prices cannot be used to measure labor productivity in a technically convincing way. This will be shown in detail in the next chapter 3, but should be already relatively obvious here from an input-output theoretic perspective. Similarly, since y_i are the net output levels of a whole economy (where intermediate inputs have been deducted) we cannot use $y_i/L_i = ((I - A)^{-1}x)_i/L_i$ as a sectoral measure of labor productivity, since this is providing an expression that cannot be considered as isolated from the other sectors of the economy. On the other hand, using x_i/L_i is but a partial measure of sector's i performance, since it neglects its capital consumption in the form of intermediate

¹⁸ $y = (I - A)^{-1}x$ as usual.

inputs. Finally, the United Nations (1993) measure of sectoral labor productivity $(p_{oi}x_{i,t} - p_o A_i x_{i,t})/L_{i,t}$, i.e., value added of sector i in terms of arbitrary base years prices p_o divided by the total labor input of this sector is again contaminated by arbitrary price-dependent aggregators which prevents that anything characterizing the production side of the economy can be defined meaningfully in this way.

We conclude that the measurement of labor productivity should be left to the consideration of input-output theory and not become a byproduct of the measurement of real GDP or NDP as it is the case in the Systems of National Accounts in their current form (which differs from what was originally proposed by Stone himself). To show this in detail is the task of ch.s 3 and 4. Here we only conclude that the construction of SNA's behind the evolution of nominal magnitudes is a meaningful activity, independently of whether it is classically oriented or neoclassical in nature. SNA's provide theoretical concepts intended to measure evolution not visible from the consideration of purely nominal magnitudes and aggregates and in this sense they are dual in nature as compared to the sphere of competition, exchange and money prices. As economics is taught and investigated today it is indeed dual in nature. This however does not automatically imply that all of its categories are well-defined and coherently applicable, but they may sometimes be flawed by erroneous definitional attempts. The next subsection will argue on this basis that Marx's Capital I – III forms such a dual system of national accounts and long-period or market prices where one should not immediately proceed to the conclusions that the labor values of the Classical System of National Accounts are but – in the majority of interpretations of the Labor Theory of Value: bad – predictors of prices of production or even market prices. It is not the central task of a System of National Accounts to provide price predictors, but its foremost duty is to provide categories (including their quantification and measurement) that are of use for the understanding of the dynamics of nominal magnitudes in the working of capitalist economies.

The structured macro-data as supplied by the United Nations' System of National Accounts will be the point of departure and also a point of reference for our proposal, in the next section, to formulate a system of indexes of labor productivity by means of labor values from a Marxian perspective. We stress that the United Nations' System of National Accounts (in the original version as formulated by Stone and his research group in 1968) indeed defines labor productivity indices (and thus implicitly labor values, there called total labor costs) in the tradition of the Classical authors, and does so in the presence of joint production and even more general modes of production, see the concluding section of this chapter.

2.3.4 The Marxian Dual System Approach (MDSA)

With respect to the single commodity production system A, l , as considered already above in our representation of McGlone and Kliman's (1996) trans-

formation procedure of the TSSI, the MDSA approach is based on the traditional algebraic and simultaneous type of labor value accounting in line with the work published by Okishio and Morishima among others in the 1960's and 1970's, and also in line with the measures for direct and indirect or total labor costs in the United Nations' System of National Account based on the work of Richard Stone, i.e., its definition of labor values is simply given by the matrix equation $v = vA + l$. This approach is therefore the conventional approach in the literature on Marxian economics and thus seems to offer nothing really new for the interpretation of Marx's *Capital*, Vol.s I – III.¹⁹ Yet, first of all, this conventional approach to the definition of labor values is quite general in nature. It has been generalized to the treatment of multiple activities for the production of a single commodity, pure joint production, fixed capital and heterogeneous labor in Flaschel (1980, 1983a, 1983b, 1995) making use of certain accounting practices actually applied by firms, certain accounting practices of input-output methodology and above all of the averaging approach put forth by Bródy (1970), see also Bródy (1987) and Simonovits and Steenge (1996), in place of Steedman's (1977) generalizations of labor values by means of Sraffian zero-profit approaches to joint production and fixed capital. Moreover, and more importantly, the conventional approach to the definition of labor values is not only providing a very general accounting framework for the determination of total labor costs, but in addition allows for various theoretical as well as empirical applications of this valuation scheme that prove the meaningfulness of this approach. We will consider some of these applications below, after some short comments on the generality of the conventional approach to the definition of labor values.

Multiple activities lead in a natural way to the distinction of market from individual values, the former being certain averages of the latter as in Marx (1954), and as in the aggregation procedures of input-output methodology. Pure joint production is compatible (with respect to a disentangling of joint input costs that is neutral with respect uniform rates of profit) with only one allocation method of firms' actual cost accounting procedures, the so-called sales value method. This method is applied, but barely understood in standard books on cost accounting. It in fact represents the only method that allows to allocate costs in pure joint production activities that does not introduce a distortion in the profitability statements of the whole process as compared to its single disentangled activities. From the perspective of Marx's *Capital*, Vol.II (where the actual behavior of firms is always paid attention to) it thus recommends itself from the practical and the empirical point of view. Astonishingly enough, this method reappears (unnoticed) in the treatment of secondary products in input-output methodology designed by Richard Stone, by way of the so-called industry technology assumption for the reallocation

¹⁹ An interesting non-standard approach to a definition of labor values – which includes capitalists' consumption basket into the 'means of production' in a stationary economy – has been provided recently by Wright (2007).

of such secondary products towards the sector where they are produced as main products. This happens without any reference to the actual accounting practices of firms and may be interpreted as fact driven behavior on the level of firms as well as on the level of national accounting.

Fixed capital is already treated in a detailed way in Bródy (1970), there too by the application of actual accounting techniques that define the concept of turnover times and its relationship to capital advanced as opposed to capital consumed. Such a distinction makes the relatively arbitrary or even hypothetical distinction between circulating and fixed capital superfluous, since nearly every means of production appears in the form of capital advanced and capital consumed, by referring to an accounting period of one year in general (or one quarter), with respect to which turnover times are then measured as being less or larger than one. The sharp distinction between circulating and fixed capital by contrast refers to a hypothetical period of production with no factual content and thus assumes that turnover times are either exactly one or – if larger than one – lead to a vintage approach with close connection to joint production and fairly academic valuation schemes for the various vintage types of fixed capital.

Skill differences with respect to labor inputs finally are here evaluated by way of actual wage differentials, which may be subject to purely arbitrary valuation conventions in different countries and at different times, which thus includes a historical dimension into labor value accounting. Like the TSSI the ASSI needs market prices, now however only in certain accounting procedures, namely when disentangling joint productions activities (where relative sales values are used) and also in the solution of the so-called reduction problem of skilled to simple labor. It is a purely ex post approach and can be directly applied to actual input-output tables when these tables have been constructed by way of the industry technology assumption. It distinguishes between stocks and flows in the same way as firms do it in their accounting procedures and also as in the stock-flow distinction in the United Nations' Systems of National Accounts. In sum this approach in fact allows for all the assertions summarized at the beginning of this chapter, without any need to construct data for labor value calculations that are not already provided by the conventional System of National Accounts, at least in principle. It in addition bears relationships with the work provided by Shaikh and Tonak (1994). These authors also discuss the United Nations' Accounting methodology to a certain extent (as it derives from make or supply matrices and use or absorption matrices), quite independent from the question of whether their use of the data is already a convincing one, see Mohun (2005) in this regard.

Duménil and Levy (1989), see also Duménil and Levy (1987, 1988), have reconsidered the labor value definition of the joint production approach of Flaschel (1983a) from a more general perspective that initially makes use of physical relationships (market shares) solely. Such an approach allows for more than just one definition of labor values, with Flaschel's (1983a) case as a special example. We would however maintain here that firms' actual behavior

should be taken into account when searching for a determined labor value definition. Firms indeed reverse the order in cost allocation procedures in the case of pure joint products (by using relative sales values to obtain the costs to be allocated to a single item in the joint output basket) in order to get determinacy. We should therefore also be prepared to use such values in total labor cost allocation, since joint production exhibits unavoidable degrees of freedom that must be closed in reference to factual procedures in firms' behavior.

In a comparable case, Rowthorn (1974) has solved the reduction problem of skilled to simple labor in terms of a physical approach solely. The question here too is to what extent market prices should have an impact on labor value accounting or not. In view of the preceding section and its principles (also with respect to the rule for free goods) we believe that the contact to actual accounting procedures on the level of the firm and the level of the whole economy is a necessary one in order to arrive at a concept of labor values that is factual in nature and applicable to the data generated by the evolution of capitalist economies. Yet, in this respect the ASSI has surely its own merits, in categorizing and measuring facts of this evolutionary process based on nominal magnitudes solely and has in this respect for example received recent reconsideration and application in the work of Mohun (2004) and others. Our dual approach (of this subsection) is more difficult to handle than this approach, and in fact an extension of it, and is directed towards a total cost measure of labor inputs into the production of the various commodities which can be applied to an analysis of the labor productivity implications of price- and profitability-driven capitalist technological change, an important issue at least on the level of macroeconomics (where for example productivity slowdowns have been discussed intensively), but similarly on the level of industries whose productivity changes are to be measured and evaluated.

Turning now to applications of labor value accounting (in the case of the single production system A, l so far considered), we use actual prices p to show the relationship between input-output tables A^n that are measured in nominal terms (and their corresponding labor usage vector l^n), which show the \$-inputs (labor inputs) per \$ of output value and the ones measured in physical terms. Denoting by \hat{p} the diagonal matrix which can be obtained from the price vector p the relationship between the monetary and the physical tables are then given by: $A^n = \hat{p}A\hat{p}^{-1}$ ($l^n = l\hat{p}^{-1}$). There follows that the measurement of total labor costs per \$ of output value, v^n , is given by the matrix equation $v^n = v^n A^n + l^n$, while labor values per unit of output are of course still given by $v = vA + l$. It is straightforward to show that there holds $v^n = v\hat{p}^{-1}$. We thus get that labor values can immediately (in principle) be calculated from monetary input-output data which in fact even deliver the value-price relationship at one and the same time.

Conventional labor values are therefore (and this also holds for joint production when the industry technology assumption of input-output analysis is used, see the next chapters) factual magnitudes that can in principle be mea-

sured and studied in their evolution in time. In the following chapters we will consider uses of these accounting magnitudes in detail, which will here only be summarized in their essential features. The principles we have considered in section 2 in this chapter can all be applied to the now considered dual to the sphere of prices (of production), but we shall concentrate here our efforts on the fundamental properties our MDSA gives rise to.

A first basic property of labor values is that they are always smaller than prices measured in terms of the wage unit (if profits are positive in all sectors of the economy), i.e., we have $p_w = p/w > v$. The labor time commanded by the various commodities thus provide an upper estimate of the labor time that was embodied (imputed) into them. This provides an important bridge to what Keynes considered as real magnitudes in the General Theory, namely the nominal expressions divided by the wage unit.

A second important property of conventionally defined labor values or the total labor costs of commodities is that they fulfill the following proposition:

Assume that technical change is profitable (as measured by actual prices) and in a strict sense capital-using and labor saving. Then: the total labor costs of commodities as measured by the above vector v (all) decrease (if the input-output matrix is indecomposable).

This theorem will be formulated and proved in detail in the next chapter. It shows that there are deterministic foundations for the statistical ‘law of decreasing labor content’ that is formulated and proved in Farjoun and Machover (1983, ch.7). Such a law is assumed to exist on the macrolevel by nearly every macro-theory (if applicable) and it here receives a fundamental formulation through a comparison of prices in terms of the wage unit and our labor value accounting scheme.

A third important property of labor values (in their own right) is that they can be used to measure labor productivity, as proposed in Marx’s Capital I (by means of the reciprocal values $1/v_i$), and in the United Nations (1968) SNA. Using the matrix equation $x_i = Ax_i + e_i$, where e_i is the i th unit vector, i.e., calculating the total input basket in order to produce one unit of commodity i immediately implies the relationship:

$$L_i = lx_i = l(I - A)^{-1}e_i = v_i, \quad i.e.,$$

the labor time needed to produce one extra unit of net output of commodity i is given by the labor content of this commodity. This property of labor values will be investigated in detail in the next chapter.

Final important properties of a system of labor value accounts have already been studied in ch.1 where we have identified the average value rate of profit as the systematic (production oriented) component in the average price rate of profit which – following again Farjoun and Machover (1983) may be subject to chaotic influences from the sphere of commodity exchange that are statistically viewed of second order type.

Summarizing this subsection we would claim here that the conventional type of labor value accounting has important roots in firms accounting procedure as well as national input-output accounting procedures that not only imply that such labor content are well-defined in general models of production, but also give rise to meaningful proposition concerning labor productivity, technical change, the price rate of profit and Classical labor commanded prices and that allow to proceed with the labor theory of value as expressed by the principles formulated at the beginning of this chapter. This implies that the line of research which has been put forward in Bródy (1970) can be continued successfully in very general and applicable terms.

2.4 Conclusions

Summing up, we would conclude that the CDSA and the MDSA are closely related with each other and can supplement each other. The CDSA lays more stress on (however sometimes questionable) macroeconomic real accounting, obtained from single or double deflating methods, like real GDP, real values added and the like in order to characterize the performance of capitalist economies. By contrast, the MDSA puts more emphasis on multisectoral flow matrices and, with respect to the them, on the derivation and application of measures of directly and indirectly embodied labor efforts (labor content or total labor costs) and their implications for the measurement of labor productivity, see Stone's productivity considerations in United Nations (1968, p.69) for a bridge between the two approaches. The two approaches to a system of national accounts should therefore be further integrated with each other in future research, paying also attention to the contributions provided by the ASSI of G. Duménil, D. Foley and others on the level of price aggregates normalized by the labor efforts of the yearly production cycle.

The TSSI, by contrast and on the one hand, is in our view however not of help here because its definition of labor values is too temporarily oriented or too futile to provide an anchor for actual productivity measurements as they are discussed in Marx's (1954, p.48) *Capital*, Vol. I:

In general, the greater the productiveness of labour, the less is the labour-time required for the production of an article, the less is the amount of labour crystallised in that article, and the less is its value; and *vice versa*, the less the productiveness of labour, the greater is the labour-time required for the production of an article, and the greater is its value. The value of a commodity, therefore, varies directly as the quantity, and inversely as the productiveness, of the labour incorporated in it.

This quotation is much more in line with what is proposed in Stone's SNA as labor productivity indices, see United Nations (1968, p.69, 4.42) which in our notation and slightly simplified reads:

$$\begin{aligned} \Lambda^{***} &= \frac{x'(1)(I - A'(1))(I - A'(0))^{-1}l'}{x'(1)l'(1)} = \frac{l(I - A(0))^{-1}(I - A(1))x(1)}{l(1)x(1)} \\ &= \frac{v(0)y(1)}{v(1)y(1)} \end{aligned}$$

where 0, 1 denote points in time and x, y are feasible vectors of gross and net production. Stone's measure Λ^{***} thus exactly describes (in inverted form) the change in (the conventional) labor value of the net vector of period 1 that occurs through the technical change leading from $A(0), l(0)$ to $A(1), l(1)$. The increase of his measure thus shows increasing labor productivity in the sense of Marx (1954, p.48).

On the other hand, the TSSI concept of prices of production and their uniform rate of profit (on which level of dis-aggregation?) may not be a well-suited one as far as an analysis of capitalist competition, in particular in the age of globalization – we are currently subject to – is concerned. Therefore, identities between labor value aggregates and production price aggregates are not the most important thing a Marxian theory of value (essence) and prices (surface) has to investigate. We would follow here at least partly the suggestions of Farjoun and Machover (1983) that we should use empirically applicable measures of labor content and actual prices (normalized by the wage-unit) to further study in particular their law of decreasing labor content from the theoretical as well as from the empirical perspective. Actual prices normalized by the MELT condition on the other hand may be used to study the conflict about income distribution in the spirit of Marx's (1954, ch.23) formulation of a general law of capitalist accumulation.

Another subject for future research may be to reconsider the concept of abstract labor introduced by Marx in *Capital*, Vol. I, and to provide a sociological framework where Marx's objective to understand the laws of motion of capitalism from the perspective of 'equivalent exchange' (as the underlying link between human beings, but covered by the laws that regulate actual commodity exchange) can be substantiated from the quantitative point of view under general production relationships. In this respect, Keynes (1936, p.213/4) is indeed expressing a somewhat similar point of view, when he writes:

It is preferable to regard labour, including, of course, the personal services of the entrepreneur and his assistant, as the sole factor of production, operating in a given environment of technique, natural resources, capital equipment and effective demand.

From such a point of view it may then be a worthwhile attempt to understand the reported stock-flow interaction of capitalist economies from the angle of the single factor of production that allows this interaction to continue in time, by help of the Classical concepts for the analysis of the evolution of capitalist economies were labor commanded prices (Keynes' concept of prices in terms of the wage unit) and total labor costs (Marx's concept of value) are of central importance. The present section has argued in this regard (see

the next chapter for details) that there are links between these two measures (expressed in terms of labor) that may be relevant for the understanding of the general laws of capitalist accumulation, the technical changes that drive this accumulation and the forces of competition by which these laws are implemented.

In the next chapters we concentrate on the MDSA approach to labor values and show that this dual approach to social accounting is indeed compatible with the accounting practices on the level of firms as well as on the level of whole economies, as provided by the United Nations' (1968) System of National Accounts, not only as far as pure joint production is concerned, but also in the treatment of fixed capital. Marx's labor theory of value therefore performs quite well when compared in the details of its accounting with the accounting practices of the conventional SNA, its proper counterpart when comparisons have to be made. Prices of production by contrast – which are just another accounting scheme – must prove their relevance as centers of gravity of market prices theoretically as well as empirically and it may happen here, if one follows and extends Farjoun and Machover's (1983) arguments, that Samuelson's (1971) eraser must be applied to them as a suggested 'relevant' link between the sphere of production (labor values) and the sphere of competition (actual prices). Theoretical as well as empirical relevance decides what type of accounting concepts are of help in the analysis of capitalist reproduction and here it may happen that the law of decreasing labor content is much more to the point than the law of equalizing profit rates in a globalized world with agricultural production, manufacturing and industrial as well as consumer services production.

Summing up, we view Marx's (1954) *Capital*, Vol.I as providing through appropriate definition the essential categories and theoretical (internally consistent) structure the underlying the analysis of competition discussed in Vol.III of 'Das Kapital'. This marxian System of National Accounts need not be transformed to the interaction of price and quantities happening on the surface of the economy. Instead it must show its usefulness by its application to what happens empirically in the monetary dynamics of a capitalist economy, the observed real phenomena, like productivity increases as well as productivity slowdowns. Here it may be that the Marxian definition of the rate of exploitation and its changes provides the essential source for increases in the rate of profit, though there are of course secondary elements – like changes in the turnover time of capital – that may lead to increases in the observed average rate of profit as well. All concerned magnitudes – and the input-output data they are based on – have to be understood as moving averages (which may only be measured once a year). This latter fact should therefore not lead us to the empirically false conclusion that we can use point-input point-output models in the discussion of the baseline approaches to the labor theory of value.

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