Heun Review of old Chapter 2 now 3

P. 22 In Chapter 1, we put forward the idea that economies are like organisms, using energy derived from outside the system to construct, maintain and grow the system itself. This chapter…

Changed text to “we put forward the idea that economies are like organisms, using energy and material resources derived from the natural environment for their construction, maintenance and growth.”

Building, as we introduced in chapter one and use in other chapters, from a one-sector economy up to examples of both two- and three-sector economies.

Example in Chapter 2 is actually a two-sector model (production and consumption). Text has not been altered, though I’m open to other suggestions.

??add at end of first para in 2.1 “..throughout this book.” On a more philosophical front, a biophysical theory is desirable because it starts from an energetics basis and unites economics with the natural sciences.

This is a good sentiment, though I’m not sure it belongs here, where we are discussing a specific methodology. I believe it would be more appropriate in the Introduction. WILL DISCUSS WITH OTHER AUTHORS. Discussed – add to introduction, where we discuss biophysical economics (Section 1.2)

2.11

and the time derivative d/dt , or the dot over a)

This is not accurate. The time derivative (da/dt) and the dot notation () refer to different concepts. The dot notation () represents a flow of material (in this case apples). The time derivative (da/dt) represents the change in the value of the stock of apples.

as waste (in the apple core or garbage)

I’m not sure why this is an either or. I have changed to “as waste (in the apple core in the garbage)”

where are green lines in figure 2.1 OR ITS LEGEND??? Maybe black lines??? No that is capital goods.

Maybe you need to say that energy is not represented but accompanies all flows or something??

Good point. The legend is universal for all diagrams, but that may be somewhat confusing. Have added the following to the caption. “Energy flows are associated with all flows of materials, but are not drawn explicitly in this diagram. Flows of energy will be depicted in diagrams in later chapters.”

After discussion – change legend to only flows shown in diagram

What us stored in birdcage symbol? Explain in legend OK iguess in next paragraph. Green ine is confusing in legend)

Figure caption describes storage of capital within storage tank, “Only capital stock (K ̇ ) may accumulate within the sector, depicted by the storage tank.” We have also added ‘K’ to the ‘birdcage’.

P 26 the resource inflow (crude oil) is literally embodied<< no,except for processing energy, it is contained in the chemical bonds …. within the out-flowing

Likewise as coal – it is indeed embodied in electricity but not contained --embodied means used in past to build, as Marx’s embodied labor in a chair

I think this is a semantic argument. I would argue that ‘literally embodied’ means that the physical stuff that makes up one thing is contained within another. I would argue that the ‘embodiment’ that Marx speaks of is metaphorical. I would also argue this about the use of ‘embodied energy’. The energy is not *literally embodied* within the product.

That said, we may be fighting an uphill battle here, so could switch a different, less loaded term.

P 27 the resource inflow (crude oil) is literally embodied CONTAINED within the out-flowing IT IS EMBODIED

Changed as stated

since the coal is not physically contained [NO >> embodied] in the electricity and leaves the economy (in the form of carbon dioxide

Text changed to “Similarly, the coal or natural gas flowing into a power plant is accounted as an flow, because the incoming chemical elements (carbon and hydrogen) *do not* depart the plant contained within the product, but leave the economy in the form of carbon dioxide.”

and ash) as part of flow S˙ 10. Some of the coal is destined for metallurgical processes

because the carbon in the coal ends up physically [NO ….Yes>>] embodied within the steel in flow ˙P1

Changed ‘embodied’ to ‘contained’

\*\*\*\*\*\*\*\*2.26 I Like this kind of explanation of final equations as you do here: GOOD!!!! Do more of???

Thanks

“ Equation 2.26 tells us that depletion of natural resources

\_

􀀀

dR0

dt

\_

are used within society in order to:

\_ build up societal capital stock

\_ dK1

dt

\_

,

\_ provide short-lived goods and energy to run society (S˙ 11), and

\_ overcome depreciation (K1K1). “

p. 32 I assume you got all your math/subscripts right

I hope so. We’ll double-check all of the math when we do the re-write.

Fig 2.4 As I have said before I like the energy symbol to the left most, but probably too late for that…;

\*\*\*\*

This was done (goods and services on left) because an earlier draft had the two sector model with just energy sector split out of rest of society and then three sector model added in goods and services. To change would take a significant amount of time, as it would require updating all of the arrow notations for all chapters.

Is there a compelling reason why energy is better on the left?

\*\*\*\*

2.5 Materials in the US auto industry

“ Throughout the book, we shall be applying the methodology that has been outlined

through the examples to the real-world case of the US auto industry.” AGAIN PLEASE MAKE THE CASE, (IF TRUE THAT YOU ARE USING THE AUTO INDUSTRY FOR AN EXAMPLE BECAUSE YOU HAVE THE (approximate) DATA FOR IT. DO YOU? DO YOU HAVE I-O DATA WHY DO YOU HAVE THE DATA FOR THAT INDUSTRY? IF NOT WHY DO YOU USE THIS INDUSTRY?

I GUES S YOU TRY TO ANSWER THAT QUESTION IN THE NEXT FEW PARAGRAPHS BUT IT SEEMS TO ME THAT YOU DANCE AROUND IT – CAN YOU/DID YOU DERIVE THEM ATERIAL FLOWS FROM MONETARY FLOWS OR NOT? WHAT DID YOU DO WITH THE EUROPEAN DATA? Or ARE YOU TALKING BOUT WHAT MIGHT BE DONE. VERY FRUSTRATING.

\*\*\*\*

We don’t have special data for the US auto industry. In fact, in terms of materials (i.e. Chapter 3), the data does not exist. It would be a serious data collection effort to obtain it. The data for energy (Chapter 4) exists via EIA survey of manufacturing. The embodied energy data (Chapter 5) exist via old EI-O studies and EIOLCA, though obviously these are based on financial flow proxies.

In theory, you could build up a model of the materials usage by the auto industry from bottom-up LCA of individual cars (with appropriate error bounds!!)

Will discuss with other authors to generate better reasoning for this choice.

New text added to section:

“Although our choice for using the auto industry is somewhat arbitrary, there are a number of compelling reasons for choosing to study it. Automobile manufacture has been used previously in the literature in both process-based [11–17] and Input- Output [18–20] analysis methods. The automobile boom was clearly central to the development of most Western countries during the 20th Century. Furthermore, the industry remains a large portion of many industrialized economies. The automobile industry is a large consumer of material resources, some of which are listed below in Table 3.1. The automobile has obvious links with the energy industry, both in the direct demand for energy used in automobile manufacture, and also indirectly for the oil needed to operate vehicles. This dependence aptly demonstrates demand ‘lock-in’, discussed in Section 1.5. The industry also shows evidence of post-industrial decline (shrinking profit margins, etc.) and thus represents a sector-level analogy of the maturation and decline in growth of economies.”

Charlie, if this is not acceptable, we may need to discuss this in person.

\*\*\*\*

“We categorized the types of materials used to produce

automobiles, but found that industry-level data are difficult to obtain.” So did you in chapters three and four? Can you say that despite these difficulties we made a first approximation in chapters three and four? Or what? This would help to tie the book together very much. We need less ass covering and more directional charge.

\*\*\*\*

In chapters 4 (direct energy) and 6 (value) the data exist (as discussed above). The data is old for embodied energy (chapter 5) and energy intensity (chapter 7) and does not include accumulation of embodied energy in capital goods. Data for materials (chapter 3) has never existed.

The purpose of the book is not meant to make an analysis. The point is to demonstrate the necessary requirements of the model. If the analysis would make the book more compelling, then it could be done in a limited fashion BUT, this would take time.

\*\*\*\*

p.n48 We begin by noting that direct energy travels with material through an economy (and opposite to money flow).

This is a good point and generally true (though not always, as in the case of waste treatment), but probably more appropriate when we discuss flows of economic value.

Fig. 3.1 Energy content (˙E ) of material flows (˙R, ˙ S , and ˙K) from Figure 2.1.

(Energy flow symbols from Howard Odum).

This is a good point. This reference has been added to Fig 2.1 when we first introduce the energy circuit diagrams.

49 the direct energy associated WITH flows of steel

Good spot. Text changed as stated

EQU. 3.4 WHERE IS FLOW01 ON DIAGAM?

LIKEWISE e1 FROM BIOSPERE???

Thanks, Fig. is labeled wrongly. Flow E02 should be labeled E01.

Note that ˙E 1 is the gross direct energy production rate of society. For example,

firms extract crude oil (a component of ˙E01) and refine it into petroleum products (a

component of ˙E1) that are consumed by society. The direct energy consumption of

extraction and refining firms is a component of ˙E11 ??All this needs to be made clearer relativeto diagram

New text:

“Note that E ̇1 is the gross direct energy production rate of society. For example, firms extract crude oil from the biosphere (a component of E ̇01) and refine it into petroleum products (which in Figure 4.3, leave as part of flow E ̇1) that are then consumed by society. The direct energy consumption of extraction and refining firms is a component of E ̇11, that is some of the energy that circulates back into society in flow E ̇11 is used within the extraction and refining processes to generate flow E ̇01 from the biosphere.”

Eq 3.11 ref 3 EROI should not be attributed to Ayers but Hall (e.g.1986)

Refs 2 and 3 are for the ‘muscle work’ within the economy and are correctly attributed to Ayres and Warr. Citation for EROI has been added.

Fig 3.5 Energy module should be moved to LEFT of goods and services as it must come first

(OK chicken and egg, but conceptually)

\*\*\*\*

Again, re-arranging the figures could be done. If it would make the book more compelling, then it could be done BUT, this would take time.

\*\*\*\*

The First Law of Thermodynamics around APPLIED TO ? the biosphere (0)

Changed as suggested

The First Law around APPLIED TO the goods and services sector (3) i

Changed as suggested

Table 3.1 Can you add in KJ for each component??? As a separate column?

Energy content in kJ added to table

Chpt 4

In Chapter 3, the First Law of Thermodynamics accounted direct energy (˙E ) flowing

among sectors of an economy. In this chapter, we will adapt the First Law to account

FOR THE embodied energy in the material flows of an economy.1

Changed as stated

p. 58 Total energy (T) is defined as the sum of direct energy (E, see Chapter 3) and embodied

energy (B).DEFINE EMBODIED ENERGY

Text changed to, “Total energy (T) is defined as the sum of direct energy (E, see Chapter 3) and embodied energy (B),
which we will not define at present.
This analysis will lead us to a mathematical definition of embodied energy.
“

59 bottom: waste heat is ignored when accounting for total energy ????? It is in equations

The embodied energy accounts for all of the waste heat. As discussed for Equations 5.6-5.8

60

The final term ( ˙Qout) is a proxy for all direct energy (˙E) consumed (i.e. turned into heat)

within the sector.

Fig. 4.2 Total energy flows (T˙ ) in a one-sector economy.(see fig 3.3 ).

Don’t see a comment for Fig 3.3. Labels on flows are wrong (should be T01=E01, not T02=E02). Have changed to be correct.

dBK;1

dt = ˙B11 􀀀 ˙B1 􀀀 ˙B10 + ˙Q10: (4.21)

>>>>>Add In words this say that the change in the embodied energy etc etcc I think o be perf3ectly clear you should give the final equation in words each time !!!!!!!!!!!!!!

p. 64 The term ˙B10 in Equation 4.21 represents the disposal rate of embodied energy from

Society (1) to the Biosphere (0). (i.e. dumps etc). …depreciated physical <<<<assets.

Fig 4.4 see comment fig 3.5

Chpt 5

The monetary flow is an easy and logical (if hardly perfect ) l proxy for the value of the material

and energy flows. At least most ordinary humans accept that.

Fig. 5.1 Flows of value (˙X ) for a single sector. The value flows are associated with each of the

dfferent material and energy flows outlined in previous chapters. ----------I do not see a green flow

Why are the/re not dashed lines indicating money (value) ??? How are we connecting to title of chapter???

Fig. 5.1 Flows of value (˙X ) for a single sector. The value flows are associated with each of the

di\_erent material and energy flows outlined in previous chapters. ??? is value flowing in opposite direction??

The contrast between THE BIOPHYSICAL REAL) FLOWS OF Figures 2.2 and 3.3, on the one hand, and THE USUAL ECONOMIST’S DEPICTION OF Figure 5.3, on the other, is striking <<<<<<<NOTE HOW I AM TRYING TO HIT THE READER OVER THE HEAD …

Fig. 5.3 Flows of value (˙X) for a one-sector economy. <<<NOW IS ThIS THE ECONOMISTS VIEW?? (yes) Or what? Link with what comes before

The next 2? sections are representing the economists’ view of value. Be explicit when you are representing economists when your biophysical perspective

5.2.2 Value generation INCLUDING BIOPHYSICAL INPUTS (˙Xgen) <<TELL THE READER YOU ARE SHIFTING PERSPECTIVES…

Fig. 5.4 Flows of ??BIOPHYSICAL?? value (˙X) within a two-sector economy. AGAIN I AM CONFUSED. THE RROWS ARE SHOWING THE FLOW OF BIOPHYSICAL VALUE (UPGRADED STUFF) BUT THE FLOW OF M0NEY IS OPPOSITE. (DOTTED LINES). YET YOU SAID YOU WERE VALUING VALUE IN MONEY, WHICH YOU ASRE NOT SHOWING FLOWING. MAYBE IT’S THE FLOW OF BIOPHYSICAL VALUE….ALSO FIG 5.5

5.5 Value in the US auto industry

To estimate value flows through the automobile industry (ONE OF THE FEW SECTORS OF THE US ECONOMY WITH N ADEQUATE DATA BASE) , we use publicly..

Define KLEMS and PERKS

From fig 5.6 I see you are using dollars to represent the biophysical flows…. You are measuring the value of the biophysical flow in dollars

Chapter 6

such that for sector j, (such as tires??)

Define R, S and K after eq. 6.4 as some readers will have forgotten

T jk = "jajk˙Xk: (6.5) : likewise, please define terms first time used in chapter

I guess you Can find each .. I stlill like lots of definitions….

WE ASSUME all goods produced by a sector are produced at the

average energy intensity of that sector.

T jk = "jajk˙Xk: (6.5)

Now give as words

Likewise give eq, 6.11 and 6. 12 in words … I don’t know if you agree but I much prefer to give final equations in words as well as symbols …then you know you are conveying correct info to everyone

Equations 6.15 and 6.16 can be rewritten in vector notation as

8>>><>>>: <<<<Explain why we want to do this and what it means …

Is B embodied anery as before? I assume so . We (you) really need a glossary at beginning of book

with the “Kronecker delta” …explain

YOU ARE WRITING FOR ENGINEERS, NOT MORTALS!!!!!!!!!!! I ASSUME ALL YOUR MATH/NOTATION IS CORRECT !

extension of the algebraic form of the energy intensity equation.

Equation 6.37 provides a means to estimate energy intensity (") of the sectors of

the economy, under the assumption that final consumption (Sector 1) is exogenous

to the economy (Sectors 2: : :n).

BUT WE DO NOT HAVE THE DATA SINCE 1977……….????????? Are you saying tht yu have th I-O data for the uto industry???