Heun et al. Chapt 1

Fig. 1.1 Source: Authors’ calculations using data obtained from World Bank databank (Indicator

NY.GDP.PCAP.KD.ZG accessed August 1, 2014.) [? ] <<<<<<<<

Fixed. The caption now reads:

Fig. 1.1 Five-year trailing averages of economic growth, 1960–2013.[4]

Page 3

This emerging paradigm is taking shape with the leadership of theorists such as Robert Ayres, Kenneth Boulding, Robert Costanza, Herman Daly, Charles Hall, Marina Fischer-Kowalski, and others. [\*\*\*\* others?

\*\*\*\*] In this book, we’ll refer to this approach as a “biophysical” approach to the economy.

[ Fix, Blair . (in press) Rethinking growth theory from a biophysical perspective. Springer;

Boyd, Roger, 2013. Energy and the financial system: What every economist, financial analyst and investor needs to know. Springer NY

Kopits, Steven ……..Springer.

Added Boyd, Kopits.

Added an important reference for each author.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

**Added Fix, but couldn’t find a reference to the title. For the time being, I copied Charlie’s suggested reference verbatim. Can Charlie provide a URL or other detailed bibliographic information?**

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Charlie later wrote:

Fix is in press, in the same series

I left things as-is.

4 But, clean air and water, SOILS , forests, and natural areas2

Added SOILS.

p.6 activity are highly correlated, as Cleveland, <<no comma

Removed comma between “Cleveland” and “et. al.”

Writing is good so far

Thanks.

and disposal of the biological or physical (as opposed to financial

Unclear whether the above is a comment to be addressed.

\*\*\*\* Need to obtain permission to use this graph? Yes ask Science Magazine

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

There are several places in Chapter 1 where we need to obtain permission to use images. Will Springer (David Packer) assist with this?

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

In response, Charlie wrote:

go to Springer permissions and ask permission for a Springer book from a Springer book.  Should be very easy.

This is not helpful to us, because we need permission for non-Springer titles. I sent an email to Packer asking for assistance.

Fig. 1.3 Gasoline shortages in 1973. \*\*\*\* We probably don’t need to obtain permission

to use this photograph, because it is from the US national archives. <<<<<<<<<<<<all US data is open access and permission not needed

Removed the comment about obtaining permission for the gas shortage photo.

Added a proper reference and citation.

Fig. 1.4 Oil prices and production. \*\*\*\* Recreate this graph from our own data? http://www.

theoildrum.com/node/8162 <<probably best to use oil alone.(not condensate) I have sent out some in my Energy list Serve. Best to get from Ron Patterson in Texas

We will use crude only when recreating this graph.

p. 9 But, in 1960 could worldwide the <<<<<<<oil production rate have been increased by 20% in

Changed to:

But, in 1960 could the oil production rate have been increased …

p. 10 In these circumstances, oil supply is said to be very inelastic (unresponsive) <<< to price.

Changed to:

In these circumstances,

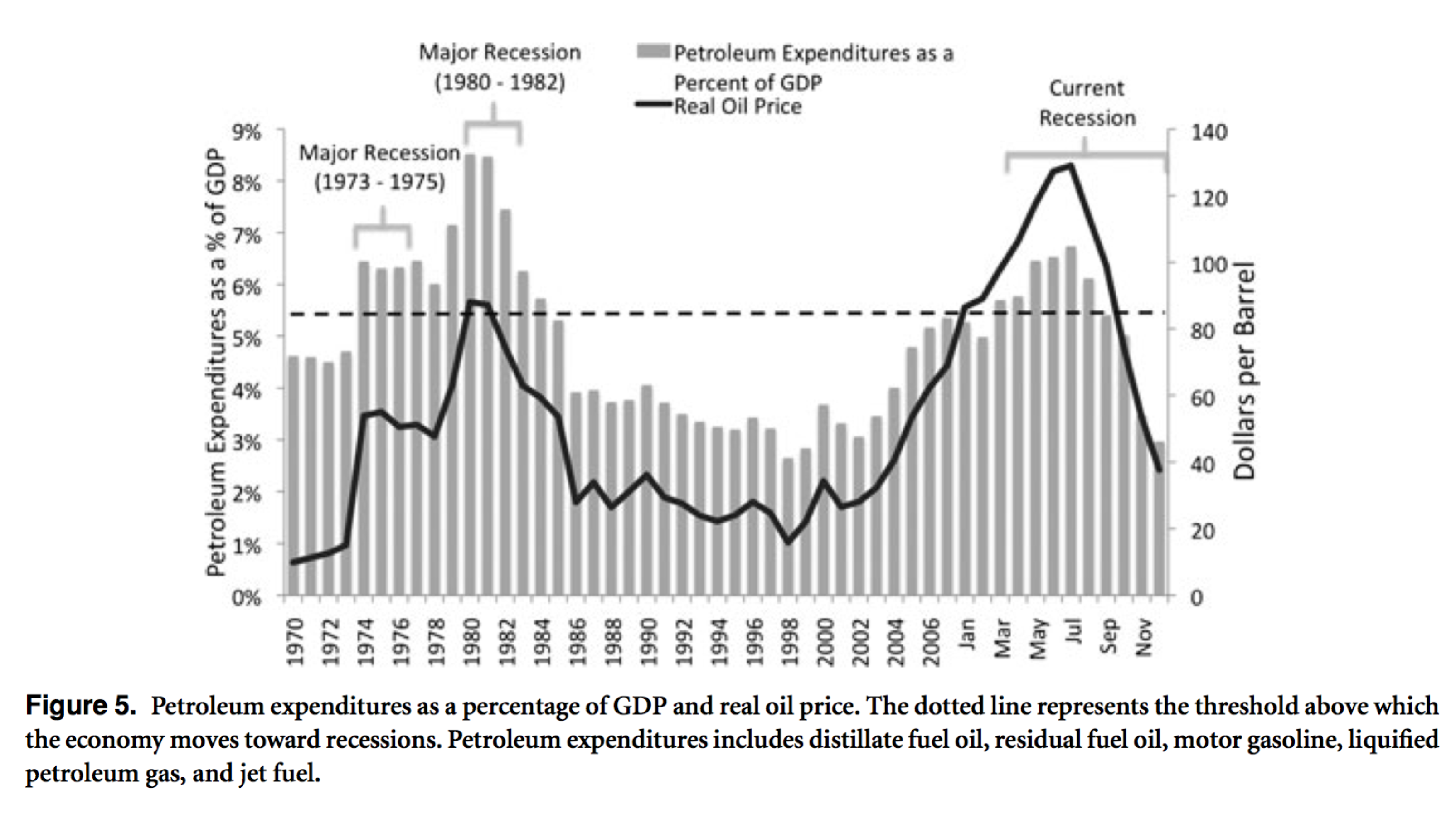
oil supply is said to be very inelastic (unresponsive) to price.

p.11 . For oil only, Murphy and Hall found that the oil cost share threshold that correlates with US recessions is about 5.5%.[14] Not Murphy and Hall but Hamilton is source….

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

**The above comment is unclear. Requesting clarification.**

**Reference [14] is Murphy and Hall. Murphy and Hall [14] do not reference Hamilton. Murphy and Hall [14] has the following figure:**



**which clearly shows the 5.5% cost share threshold.**

**Perhaps Charlie can expound a bit on the comment above.**

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Charlie responded:

from Steve Balogh :

Also, this is how I ended up phrasing it in my dissertation:

"Additionally, when the price of oil increases sharply, there is also a lagged, non-linear response of GDP contraction, which seems to have happened during the last ten out of eleven recessionary periods for most of the Western economies (Hamilton 2003, 2011)."

Hamilton JD. 2003. What is an oil shock? J Econ. 113: 363–398.

Hamilton JD. 2011. Nonlinearities and the macroeconomic effects of oil prices. Macroeconomic

Dynamics. 15: 364–378.

Not sure how this helps. We already reference Hamilton elsewhere. And, I don’t think that Hamilton identifies the 5.5% threshold. I left the text as-is.

Low cost share. Ironically, economists assign low importance to energy because of its cheap price, when its cheap price that has allowed our economy to be able to afford to be so productive.

Good point about irony. A sentence has been added here to indicate the irony. This paragraph now reads:

This may be somewhat surprising in light of mainstream economic theory,

which ascribes economic importance

based on financial cost share,

not biophysical factors.

Indeed, the cost share of energy in mature economies is low,

and viewing energy as relatively unimportant is justified if

one's view of ``importance'' is limited to financial information only.

But, many have noted that the physical importance of energy to the economy

far exceeds its cost share.\cite{Ayres:2013aa}

And, as discussed above, because the economy is coupled

to the biophysical world through time constraints (as manifest

by the low price elasticity of energy supply),

the physical importance of energy far exceeds its financial importance.

Ironically, low energy cost share

is precisely the condition that

has allowed economies to be incredibly productive over the last century.

The connection between energy and the economy may be difficult to see,

but, eventually, it becomes impossible to ignore.

but it usually EVENTUALLY REFLECTED IN cost

The above comment is unclear. To what does “it” refer?

Charlie said: I need context, but I think it refers to low EROI   (also add "is"

I now see that this comment was focused on the sentence ““Best” and “easiest” can be measured in several ways, but it usually comes down to cost.”

The sentence now reads:

``Best'' and ``easiest'' can be assessed in several ways,

but physical factors that make a resource ``best'' or ``easiest to extract''

eventually manifest as lower cost.

Turning again to our oil example, EROIsoc for oil has declined from a value of 100 in the 1930s [18, p. 781] to around 20 today.[19, Fig. 2] In other words, ……Actually this is misleading because the value of 100:1 is not for extracting oil but for finding it. The values for US are given in Guilford et al. (aboput 28:1 in 1970s to 10:1 in 2007)v and for the world (publically traded) in Gagnon et al. 36:1 in 1990s to 18:1 in 2006 or so. SO it has declined to ½ to 1/3 of its peak …

Thanks for the clarification. This paragraph now reads:

Turning again to our oil example, $EROI\_{soc}$ for production of US oil has declined

from a value of 23 in the 1950s

to 10 in 2007.\cite[Fig.~2]}\cite{Guilford:2011ci}

$EROI\_{soc}$ for production of oil worldwide has declined

from a value of 35 in 1999

to 18 in 2006.\cite[Fig.~1]{Gagnon:2009fc}.

In other words, it takes about twice as much energy today

than in years past

to make a barrel of oil available to society.

13 The early 19th century economist Ricardo applied this … theowners of <<<

This section now reads:

The early 19$^{th}$ century economist David Ricardo applied this

principle to the theory of land rents.

As population increases,

the demand for food will increase.

Because arable land is not reproducible,

less-productive land will be utilized for crops.

This leads to increasing profits accruing to owners of the best land.

that

has lower EROIsoc than early Texas crude oil. (EROI of tight oil is not too different from regular oil today

…

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

**Hmmmm. Cleveland and O’Connor indicate that shale oil has EROI between 1:1 and 2:1, when self-use is included. See:** **http://www.westernresourceadvocates.org/land/pdf/oseroireport.pdf**

**For now, the text is unchanged, except for adding a reference to Cleveland’s report.**

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Charlie said:

I (or you)  may have confused   shale (e.g.  tight, Bakken   ) oil with oil shales (Colorado)  .  2:1   is correct for the Colorado  but not the Bakken, which is probably closer to 12:1 for th best stuff.

Good points. For the purposes of the book, I don’t think it is worthwhile to go into the details of these issues. Rather, I think it will be productive to talk about “unconventional” oil. So, I have re-written these paragraphs as follows. I have also eliminated the US oil production figure that showed shale comprising the bulk of the increased production:

In the energy markets, recent increases in unconventional oil production

(from tar sands and shale)

have been made possible by new extraction and refining technologies.

But most unconventional oil production is accompanied

by the same or lower $EROI\_{soc}$

compared to conventional crude oil production.

Furthermore, today's unconventional oil is more expensive to produce

than the crude of yesteryear.

Consequently, oil prices must remain high for

unconventional production to remain financially feasible into the foreseeable future.

Unfortunately, Section~\ref{sec:energy-economy\_coupling} showed that

high energy prices can lead to high energy cost share in the economy

and recessionary pressure.

The fact that shortages of crude oil provide incentives for

technological advancements that bring unconventional production online

appears, at first glace, to be a good thing.

However, energy substitutions are beneficial to society

in the long run only when the $EROI\_{soc}$ of the substitute

is equal to or higher than the original.

Thus, the benefits of unconventional oils are modest, at best, when the

high financial and energy costs of production are considered.

Fig. 1.6 US oil production. http://ourfiniteworld.com/2014/07/23/

world-oil-production-at-3312014-where-are-we-headed/ \*\*\*\* Becky–can you

obtain this data and plot it similarly? \*\*\*\* >>>again Ron Patterson has this updated

OK. We’ll pursue this.

consequence, more financially expensive to extract oil today than it was 10, 20, 30,

and 100 years ago. It Not 100 (see Gilford et al )

This sentence now reads:

All of this comes about simply because it is

more physically ``difficult,'' and, as a consequence,

more financially expensive

to extract oil today than it was just a few decades ago.

Without going into detail, we state without discussion that similar dynamics will

apply to any non-renewable material (e.g. copper, fish, soil, timber) or energy stock (natural gas, hydro dam sites) in the biosphere

This sentence now reads:

Without going into detail, we state without discussion

that similar dynamics will apply to

any non-renewable material (e.g. copper, fish, soil, timber)

or energy stock (natural gas, hydro dam sites)

in the biosphere

for which substitution is difficult.

Page 15

Fig 15 What does free cash flow OF mean (vs TO?)?

We’re using free cash flow (FCF) as an accounting term used in corporate finance. I think the proper proposition is “of” or “for,” because FCF is a metric that applies to a firm at a given point in time. Thus, you say “free cash flow of Exxon,” for example. The figure itself uses the preposition “of.” At the moment, the wording is unchanged.

Here are some additional resources:

From the Motley Fool: **Free cash flow** is the [cash](http://wiki.fool.com/Cash) a [company](http://wiki.fool.com/Company) produces from its operations less the [cost](http://wiki.fool.com/Cost) of expanding its [asset base](http://wiki.fool.com/wiki/index.php?title=Asset_base&action=edit&redlink=1). It is essentially the money that the company could return to shareholders if the company was to grow no further.

From investopedia: Free cash flow (FCF) represents the cash that a company is able to generate after laying out the money required to maintain or expand its asset base. … Some believe that Wall Street focuses myopically on earnings while ignoring the "real" cash that a firm generates. Earnings can often be clouded by accounting gimmicks, but it's tougher to fake cash flow. For this reason, some investors believe that FCF gives a much clearer view of the ability to generate cash (and thus profits).

See

<http://en.wikipedia.org/wiki/Free_cash_flow>

http://wiki.fool.com/Free\_cash\_flow

http://www.investopedia.com/terms/f/freecashflow.asp

Charlie later said:

Define free cash flow in text I would say...

I decided against this. It broke up the flow of the paragraph too much.

They are making less profits? That is true I think, but needs more explicit statement and better validation maybe….

Profit and free cash flow are different things, because of the way that capital investment is accounted. Nevertheless, I changed the text to read:

The challenges of energy substitutions are highlighted

when examining the financial situation of oil producers.

Figure~\ref{fig:oil\_company\_free\_cash\_flow}

shows that despite the recent increase in oil production rate

and continued high prices,

the free cash flow%

\footnote{

Free cash flow is defined as the cash produced by a firm's operations

less the cost of expanding its asset base.

}

of independent oil producers is negative.

This situation implies that capital investments are unproductive.

It remains to be seen how independent producers

can continue advancing the oil production rate (which implies capital investment)

while their free cash flow is negative.

p. 16 To first order, replace with to a first approximation ….

Done.

p. 17 Paradoxically, and contrasting with mainstream policy prescriptions, expansion of

the stock of capital in the economy can contribute to the ULTIMATE slowdown of economic

growth.

Added the word “ultimate.”

focused on increasing many material, energy, and financial flow rates in the economy. Set against the backdrop of Section 1.4, we see that consumption-driven policies are ine↵ective, because of biophysical limits that ULTIMATELY constrain the scale of the economy

Added the word “ultimately.”

In short, the economic analyses that support consumption-driven policies are

incomplete. Consumption-driven economic growth is ULTIMATELY unsustainable. [For the time being we can and do just use more energy to exploit lower grade resources….]

Added the word “ultimately.”

Bottom half of page 17 kind of redundant (could remove sentence above)

Looking at this again, I agree that it was redundant. I cleaned it up significantly. This section now reads (rather succinctly):

In Section~\ref{sec:stall\_capital\_stock} above,

we noted that today's consumption-enhancing policies have the side-effect of

increasing many material and energy flow rates into the economy.

Thus, today's policies also

hasten the day when we reach binding biophysical constraints

due to resource depletion.

Unfortunately, biophysical limits

are not included in the mainstream economic thinking and modeling

that informs today's policy decisions.

Three factors, in combination, are vitally important

but nearly-always ignored:

(1) the economy is tightly coupled to the biosphere,

(2) there are physical and technological limits

to the rate at which materials and energy can be extracted

from the biosphere, and

(3) today's emplacement of capital locks in

tomorrow's material and energy demands

for both operation and maintenance of that capital.

Set against the backdrop of Section~\ref{sec:exogenous\_factors},

we see that consumption-enhancing policies are ineffective,

because of the biophysical limits that ultimately constrain the scale of the economy.

In short, the economic analyses that support

consumption-driven policies are incomplete.

Consumption-driven economic growth is ultimately unsustainable.

P. 18 This is the end of an era. In mature economies, consumption-enhancing economic

policies can no longer guarantee growth of living standards and well-being. But, the

mainstream is blind to what should be done instead. This has to change! <<I WOULD REMOVE AS IS redundant with next nsection.

Removed “This has to change!”

Markets are, AT LEAST IN ECONOMIC THEORY,extremely efficient allocators of resources.

Added “at least in economic theory.”

\*\*\* reference here about higher average fuel economy of autos in the US. \*\*\*\*

PN 18-19 Seems like if we need to add in stocks but the market etc are incapable of putting a value on them then why are we sayin g we ust do it? Just a little ironic…

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

**At this point, not sure how to respond. The authors request clarification on the above comments.**

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

Wordy: Because the allocative efficiency of markets is predicated upon correct and complete

information being available to market participants, today’s markets are a poor choice

for allocative decisions about scarce and difficult-to-substitute resources (such as oil)

or non-property goods (such as clean air, clean water, and other ecosystem services).

In the age of resource depletion, the allocative efficiency of markets is attractive.

Indeed, life would be better if the markets could shift supply and demand away from

binding biophysical constraints when they are encountered. But, lack of information

in today’s markets leads us to argue that they are not up to the task.

??Change to: In the age of resource depletion, the allocative efficiency of markets is attractive.

Indeed, life would be better if the markets could shift supply and demand away from

binding biophysical constraints when they are encountered. But, lack of information

in today’s markets leads us to argue that they are not up to the task. Thus today’s markets are a poor choice for allocative decisions about scarce and difficult-to-substitute resources (such as oil)

or non-property goods (such as clean air, clean water, and other ecosystem services).

Your suggested change is an improvement. The only thing that was lost was the note that allocative efficiency is predicated on complete and correct information available to market participants. I think that is a key point, so I kept it in. This section now reads:

However, the market's price mechanism may not be enough. We showed in Section~\ref{sec:energy-economy\_coupling} that the physical importance of scarce and difficult-to-substitute resources (e.g., oil) far exceeds cost share in the economy, suggesting that prices alone cannot provide comprehensive signals of importance to producers and consumers. Consequently, producers and consumers participate

in the market with incomplete information. This is a big problem, because the allocative efficiency of markets is predicated upon correct and complete information being available to market participants.

Furthermore, a good must be owned before it can be sold. Thus, prices cannot be set and market value cannot be determined for goods that are not considered ``property,'' such as clean water, clean air, and other ``ecosystem services.'' In addition, today's markets are simply incapable of deciding important issues such as the optimal scale (size) of the economy relative to the biosphere. (See Section~\ref{sec:metabolic\_scale}.)

In the age of resource depletion, the allocative efficiency of markets is attractive. Indeed, life would be better if the markets could shift supply and demand away from binding biophysical constraints when they are encountered. But, lack of information in today’s markets leads us to argue that they are not up to the task. Today’s markets are a poor choice for allocative decisions about scarce and difficult-to-substitute resources (such as oil) or non-property goods (such as clean air, clean water, and other ecosystem services).

Second paragraph is good…..

Thanks!

Final paragraphs are good but unlikely to be implemented….

Thanks.

I gave it another quick read and liked it a lot.

Good!

had these two thoughts:

1.4.3 Stall is related to capital stock     What does STALL mean?    Might change subtitle

Changed to “Stalled growth…” in two section titles.

last part of chapter 1    Can you change this a bit to lead into rest of your book?

We suggest that all of this information (economic, material, and energy indicators)

should be collated by a single agency and reported from a single location. Doing so

will provide convenience and consistency and indicate the interconnectness of the

economy and the biosphere to policymakers and researchers.

Until these crucial pieces of information are routinely available in a centralized

location, society will be unable to properly frame and conceptualize the “problem”

of “stalling” growth. Until this information is available to markets, investment,

consumption, and policy decisions will not lead to socially optimal outcomes

I took a first cut at providing a better lead in to the rest of the book. The last paragraphs of Chapter 1 now read:

We suggest that all of this information

(economic, material, and energy indicators)

should be collated by a single agency and

reported from a single location.

Doing so will provide convenience and consistency and

indicate the interconnectness of the economy and the biosphere

to both policymakers and researchers.

We understand that these suggested changes will be both

revolutionary in scope and

challenging to implement politically.

Therefore, we would do well to be sure of our direction.

We would do well to put ourselves on rigorous and firm theoretical grounding

\emph{before} proceeding toward implementation.

The role of this book is to provide just that:

a rigorous theoretical framework

for a better system of national accounts,

one that goes beyond GDP and

one that is relevant to the age of resource depletion.

Until these crucial pieces of information are routinely available

in a centralized location within a rigorous theoretical framework,

society will be unable to properly frame and conceptualize

the ``problem'' of ``stalling'' growth.

Until this information is available to markets,

investment, consumption, and policy decisions cannot

lead to socially optimal outcomes.

Charlie later wrote:

So I think you have to address this in some way.  Something like:

OK now I will add something

"We believe it important to  generate a very explicit set of guidleines as to how to undertake a biophysical analysis of an economy or some portion of that.  Consequently the next  x chapters develop the methods step by  using as much as possible the same diagrams and the same type of equations to allow for, as much as possible, a step by step   understanding our approach".

<<modify as you see fit...\

The end of Chapter 2 now reads:

Throughout the methodological chapters~(\ref{chap:materials}--\ref{chap:intensity}),

our accounting framework is developed

through a series of increasingly-disaggregated

models of the economy~(Table~\ref{tab:examplesABC})

using, as much as possible, the same structure for each.

Doing so provides a detailed, step-by-step explanation of our approach.

We use the US auto industry

as a running example for application and discussion.