The Structure of Romer's "Endogenous Technological Change" as Rendered ir

A Diagram of Rates of Interdependent Productive and Monetary F

•Please read the three paragraphs at the bottom of Lonergan's **Diagram of Rates of Flow** for application to this diagram. Unders

•We seek the **immanent intelligibility** of interdependent functionings. We seek **explanation** of the economic process. Our analy

• We are treating analytically distinct, implicitly defined, interdependent, velocitous, and accelerative **functional flows** of produ

explanatory track by the textbooks' single-circuit diagrams of households and firms dealing with one another. One must imagine, d

•The economic process is an integral organic process. It is, so to speak, a single organism scientifically understood as a system of in

•All three of Romer's hierarchical sectors could be contained in one fully-integrated enterprise, in which the functional sectors wou

We have located the handoffs between functional activities in the Redistributive Function. This simplifies institutional arran

Without a 3-D graphics capability, we must show the single Redistributive Function in two locations. But it is really a single f

We need not make decisions between a) building on spec vs. progress payments by purchasers, or b) borrow, pay down and

•The arrows in our diagram are channels containing **RATES** per standard interval of **interdependent flow** s. For pedagogical reas

Thus we entitle this diagram **"Diagram of RATES of Interdependent Productive and Monetary Flows …"** .

•Romer's equations pertinent to the three sectors-levels-circuits are grouped on the left and arrowed to their sector. Lacking a sym

So, $A°$ is the rate of change of the pool of knowledge, A; $K°$ is rate of change of total capital, K; $C°$ for consumption, C; Y

•To avoid unnecessary confusion of institutional purchase-and-sale arrangements (sell vs. lease, or rent vs. license fee plus royaltie

Level 1 R&D hands off to level 2 rights to use the design which level 1 produced. Level 2, in turn, pro

Level 2 hands off to level 3 rights to install and use the durables to produce final outputs in return fo

marginal outlays of $100 incurred on level 2 to produce the durables.

Level 3 hands off the final output to purchasers of final output. The final goods are no longer under

•In Romer's assumption-constrained, equal growth-rate, closed-economy systematics, the supply-demand equilibrium is achieved l

So, there is $950 of total inputs-outlays borrowed in part by each of the three sectors. Depending on assumptions about a) financi

then reborrow, or b) to virtually reloan from the Redistributive Function for the next round of production.

•In Lonergan's more general systematics - a different-sectoral-timings-and-growth-rate, closed-economy, systematics - supply-dem within and between functional circuits in conformity to the transitional expansionary surges of the process.

•For simplification, we regard the interest rate as zero in this diagram. Interest payments are functionally Smith-to-Jones payment

•We ignore the human psychology of utility and liquidity preference. What matters in the current, purely dynamic process are actu

•Romer has engineered an equal growth rate on all levels, by assuming a) a fixed total population and a fixed population of labor (S through production of final products, and d) denomination of loans and units of producer durables in units of final products **η** (S

•The quantities of Romer's algebra may be made velocities by assuming that all occur in a standard interval of time. Therefore, A°,

•While Romer's equal rates of growth do not occur as such in the short term, they are less objectionable in describing civilization's

•There is no royal road to Romer. His scientific dynamics cannot be fully appreciated without understanding his equations, both sep

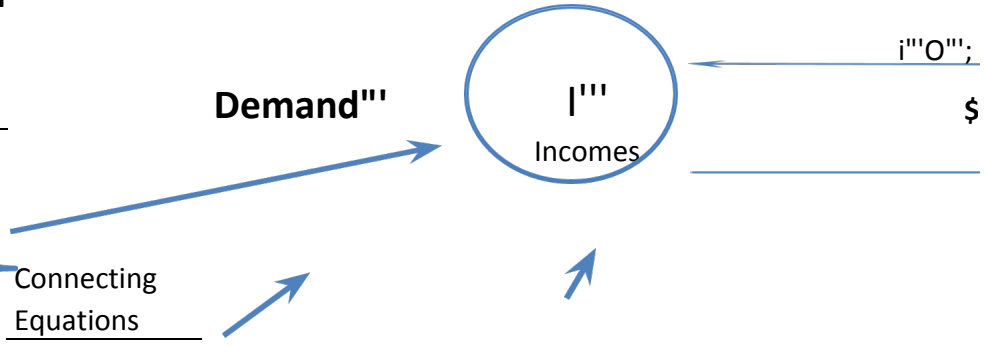
•Romer provides explanation of how economic incentives and subsidies govern **Endogenous Technological Change** via a three-t analytically distinguished and implicitly defined, interdependednt functional flows of products and payments, prior to and indepen

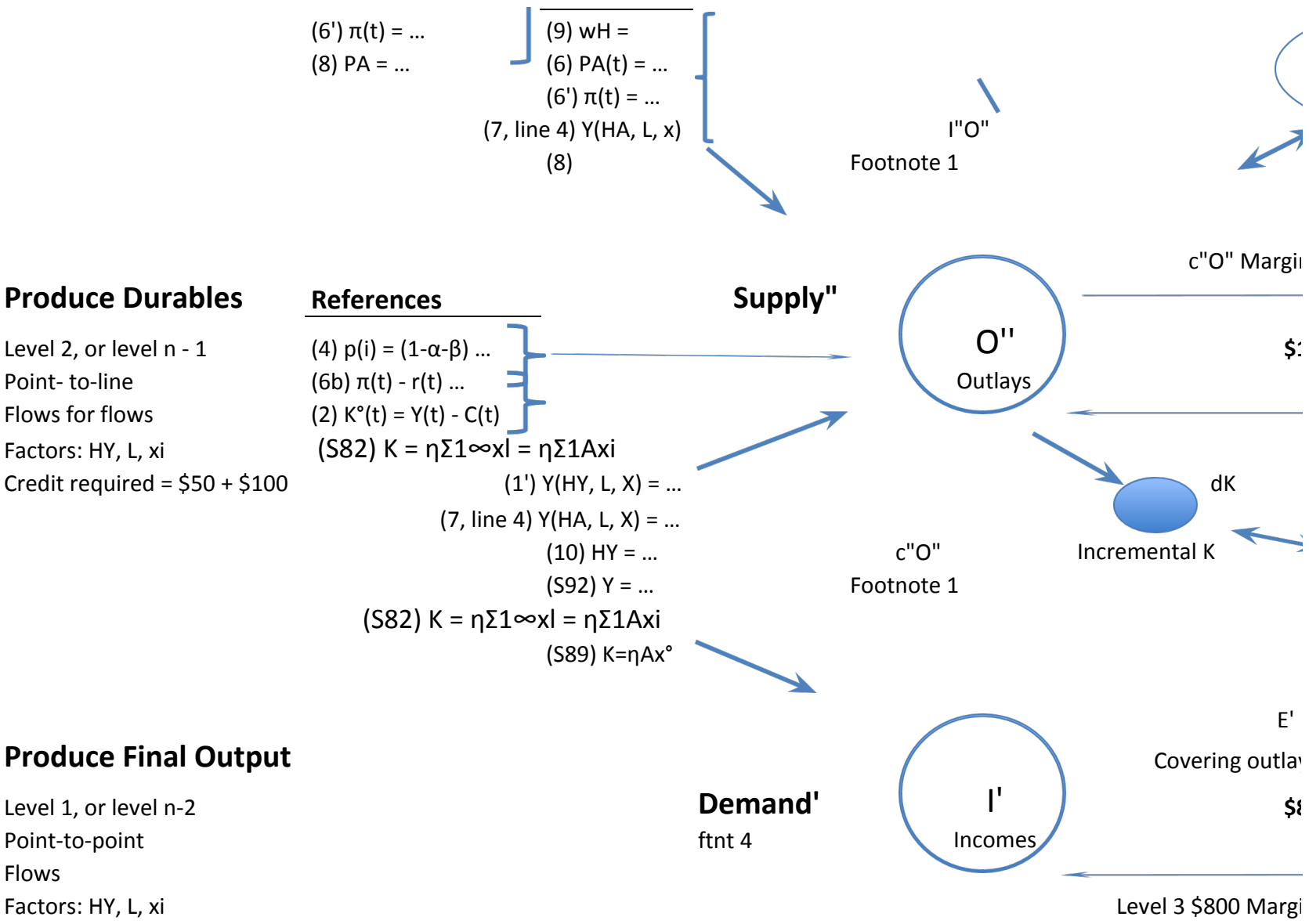
Also, Lonergan advances beyond this framework to a supplemental explanation of a normative, equilibrated **pure cycle**

•Herewith, in Lonergan's universal, always-current, explanatory framework, Romer's always-very-long-run explanatory systematics

Romer's very-long-run growth rates: $g = C°/C = Y°/Y =$
and $g = dHA = dH - [\alpha/(1-$

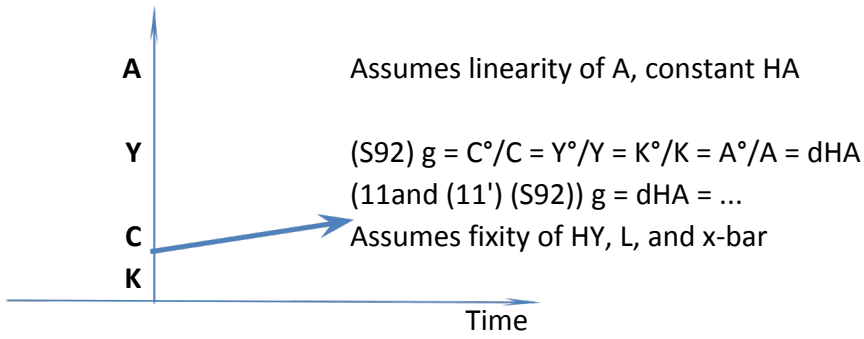
Functional Circuits	**EDC formula (##) or page number, S##**
R&D -For "Designs"	**References**
Level 3, or level n	(3) A° = dHAA
Point-to-surface	(S85) wH = PAdA
Flows for flows of flows	(9) wH = …
Factors: HA, A	(6) PA(t) = …
Credit required = $50	(6b) π(t) - r(t) …




(6') π(t) = …
(8) PA = …
(9) wH =
(6) PA(t) = …
(6') π(t) = …
(7, line 4) Y(HA, L, x)
(8)
I"O"
Footnote 1
c"O" Margi
Produce Durables
Level 2, or level n - 1
Point- to-line
Flows for flows
Factors: HY, L, xi
Credit required = $50 + $100
References
(4) p(i) = (1-α-β) …
(6b) π(t) - r(t) …
(2) K°(t) = Y(t) - C(t)
(S82) K = ηΣ1∞xI = ηΣ1Axi
Supply"
O''
Outlays
$:
dK
Incremental K
(1') Y(HY, L, X) = …
(7, line 4) Y(HA, L, X) = …
(10) HY = …
(S92) Y = …
c"O"
Footnote 1
(S82) K = ηΣ1∞xI = ηΣ1Axi
(S89) K=ηAx°
E'
Covering outla
$8
Produce Final Output
Level 1, or level n-2
Point-to-point
Flows
Factors: HY, L, xi
Credit required = $50 + $100 + $800
Demand'
ftnt 4
I'
Incomes
Level 3 $800 Margi

Credit required = $50 + $100 + $800

Romer's **rates of growth in the very long run** - Equal for all elements. Agrees with CWL 15, 124 re
For a fixed value of HA = H - HY and for a productivity parameter δ, the implied exponential growth r
(S91-2) From the monopoly pricing problem, we know that x°(x-bar) is constant if r is. … Y = … becau



Assumes linearity of A, constant HA

(S92) g = C°/C = Y°/Y = K°/K = A°/A = dHA
(11and (11') (S92)) g = dHA = ...
Assumes fixity of HY, L, and x-bar

Compare Romer's equal growth rate in all sectors
(S92) g = C°/C = Y°/Y = K°/K = A°/A = dHA
(11) g = dHA
with Lonergan's Figure 24-7 [CWL 15, 125] showing different sectors growing at different rates and a
and with Figure 27-1 showing different growth rates of the Pure Surplus-Income Ratio

Footnotes:

1 Zero $ under Romer's assumptions of no depreciation; therefore, dotted line indicates no flow to pu

2	See CWL 21, 169: The costs incurred become the responsibility of a later entrepreneur in the series (
3	CWL 15, 122
4	Workers on all levels bring their incomes to basic demand

ı Lonergan's General, Universal, and Always Current Framework

Flows in the Purely Dynamic, Very-Long-Run, Economic Process

tand clearly the meaning and implications of the words "function", "per", "interval", "per interval", "surplus", "basic", and "dividends"

'sis is **purely functional.**

cts and payments. We are not aggregating the commonsense GAAP accounts of firms and households. One is thrown off the

iagram, and have insight into, the geometrically increasing payments **within circuits and the lags between the initiation of production a**

terdependent, circulatory, vital functional flows.

ıld be called departments or divisions and the transactions would be simply interdepartmental handoffs upon the completion of production..

gements of financing (Who finances What, When, and How?) while preserving the essential form of the interdependent activities.

function. With 3-D we would show one planar circle with arrows to the operative circuits on a plane above.

l reborrow vs. borrow and rollover of existing credit.

ons, the **RATES** may be regarded as **instantaneous velocities,** though in practice they will be **difference velocities** .

ıbolic dot above a letter in our symbols toolkit, we signify accelerations with a "degree" (°) superscript:

° for total output, *Y*, in the production function;

s) and complications in the graphics, we use a pair of internal handoffs and a final handoff as products exit the process:

ɔduces durables and assumes principle-plus-interest credit-repayment obligation of $50 having been incurred in R&D activities.

ɔr level 3's assumption of a principle-plus-interest credit-repayment obligation of $150, which includes

process. Whether shirts, stoves, or houses, they have exited the current process.

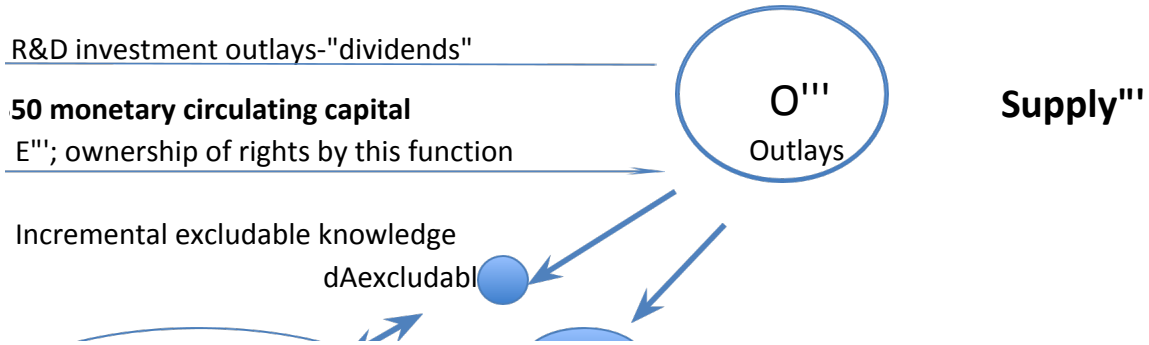
ɔy the demand of income-receiving-owner-consumers themselves matching the supply by themselves as owner-outlayers.

ŋg, and b) purchase-sale contracts, $950 is received to be used either to a) pay down the loans from the Banking System,

ıand equilibrium is constituted by the normative concomitance of interdependent functional flows

s. The money circulates like any payments. The question is, What does Jones do with it?
ıal functional payments regardless of the fuzzy psychology of the payers.
ś79), b) linearity of HA and A when the other is held constant (S84), c) instantaneous transmission of effects from R&D down
ś79, 82).
Y°, K°, and C° represent accelerations, or in Romer's terms, how these quantities "evolve".
advance in the economics of the very long run.
ɔarately and in their coherence with one another. Serious students will study and critique the equations referenced in the diagram.
iered vertical **pure stack** of functional activities, while Lonergan provides a more general explanatory science of a
dent of human psychology.
ɔf accumulations , subject to disequilibria caused by human maladaptations.
of interdependent functional velocities implicitly defned by a set of coherent and purely relational equations.

= *K°/K = A°/A = dHA* (S92) equal only in the very long run; ftnt 3)
-α-β)(α+β)]r (S92) (11)



R
Transfer of rights and amount of loan obligation
Ftnt. 2

Increment to non-excludable knowledge pool
dAnonexcludable

c"'O"'
Footnote 1

nal outlays-"dividends" on machines $100

L00 monetary circulating capital

I''
Incomes

Demand"

p(i)

Demand Function
(4) p(i) = (1-α-β) …

E"; ownership of rights by this function

R
Transfer of rights and amount of loan obligation
Ftnt. 2

I'O'
Footnote 1

.

x(i)

(5) max for so-called "profit" n
x

Coverage of all outlays $950

ys on all levels

300 monetary circulating capital

O'
Outlays

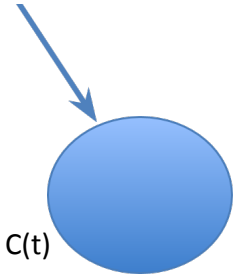
Supply'

inal outlays-incomes to produce final output c'O'

	Financing $ (including r)
Level 1 or n	$50
Level 2 or n-1	$100
Level 3 or n-2	$800

$950	Total borrowin
-$950	Receipts for fin
$0	Balance

Final output exiting the current, purely dynamic process



absurd conclusions

ate for A is δHA. From the monopoly pricing, growth rate for A is δHA. (S83)

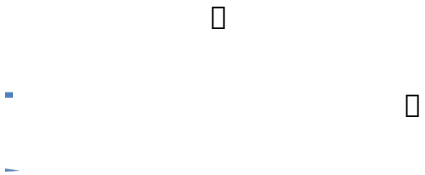
se total usage of capital is Ax°η. (S92)

t different times,

rchase repair and maintenance items

ɔn the way to final sale of final products.

nd the completion of production .



naximization

gs
al outputs