Pedagogical Approaches to Theories of Endogenous versus Exogenous Money

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October 21, 2008

Abstract

Pedagogical pluralism is difficult to implement in practice, but when overlaps between competing approaches are considered, the benefits for the students exceed the costs. An example is given contrasting two approaches to the modeling of money in macroeconomics: the stock-flow consistent macroeconomic modeling associated with Godley and Lavoie [9] and Barro’s [2] more mainstream neoclassical dynamic general equilibrium modeling. I argue students can only contrast and compare approaches effectively when thematic overlaps are significantly large to make these comparisons obvious. Only then should a pluralist approach be considered desirable.

Keywords: Pluralism; Pedagogy; Stock Flow Consistent Modeling; Dynamic General Equilibrium Modeling.

JEL Codes: A1, A2, B5.

1 Introduction

Teaching post-Keynesian monetary economics is not easy. One has to overcome the natural apprehension a masters student must feel when faced with completely new material which purports to rewrite much of what they already think they know about macroeconomics. Students will ask if the work they put into their orthodox courses was in vain. The lecturer must have an answer for them.

A large amount of the lecturer’s time and effort must be expended in comparing and contrasting the orthodox macroeconomics learnt from textbooks on macroeconomics like Barro [2], and Barro & Sala-i-Martin [3] to justify one’s approach and contextualise unfamiliar course material for the students. One spends significant amounts of class time simply setting the basics up before the real benefits of post-Keynesian macroeconomic modeling—dealing with uncertainty, business cycles, and behavioural actors through their generation of stocks and flows of funds—become apparent. Unless great care is taken, all but the most committed students are left behind to muddle through as best they can. The course creates confusion, annoyance, and frustration, and exposes the lecturer to the...
dreaded “so what?” from their students. What then is the benefit of teaching monetary economics using a pluralist approach?

This paper compares and contrasts two approaches to monetary economics from a pedagogical, practical, and pluralistic viewpoint. I ask: what pedagogical benefits if any, does the Dynamic General Equilibrium approach favoured by prominent neoclassical economist Robert Barro have over the Stock-Flow Consistent macroeconomic modeling proposed by prominent post-Keynesians like Godley and Lavoie? Is there an inherent contradiction in teaching both, and does one approach have an obvious advantage over the other? Can an economist interested in pedagogical pluralism tread a middle line?

I outline the stock-flow consistent approach in section 2 and give an example of the type of macroeconomic modeling students might be exposed to using this approach in section 2.1. Then I explore the dynamic general equilibrium model used by Barro in his most recent textbook, and point out similarities and differences between the two approaches in section 3. I conclude with a practical set of steps for implementing a pluralist pedagogical approach.

2 Stock Flow Consistent Macroeconomics

Godley and Lavoie [9] have written a masters-level textbook that reduces many of the costs mentioned in the preceding section. As the book progresses, Godley and Lavoie build models of increasing complexity from a basic methodological premise: the decisions and actions of economic actors (banks, households, governments, etc.,) create financial stocks and flows which must be accounted for in the aggregate [15]. This aggregate is the macroeconomy. Macroeconomics in their conception is a series of causal explanations (or: stories) of how these accounting entities influence one another through time, in the presence of endogenous money, fundamental uncertainty, and differing expectations amongst agents. Each macroeconomic model, then, is the set of behavioural equations imposed by the modeler on the national accounts which hold the information created by the economic actors as they go about their businesses.

In Godley and Lavoie’s Monetary Economics, each model is developed from a simplified balance sheet and transactions matrix, which records the stocks accruing to each actor, and the flows between them. A set of dynamic behavioural equations is posited, effectively determining the direction of the financial flows between the actors. Steady state conditions are derived, and the simulated equilibrium system is shocked under various scenarios to test the responses of differing actors and the national response to changing policies or economic conditions. Each of these simulations is available online to allow students to verify the authors’ claims for themselves.

To take an illustrative example of their approach to modeling money, Godley and Lavoie (author?) [9, Chapter 3] derive a simple stock-flow consistency model which we can use to simulate the effects of a simply Keynesian multiplier.

2.1 Example

We begin with a simple balance sheet and transactions matrix, detailed in Godley and Lavoie [9, pgs. 59 & 62]. With all variables in nominal units, setting a tax rate, $\theta$, of 20%, and assuming the parameters of a standard Keynesian consumption function are the propensity to consume out of present income, $\alpha_1 = 0.6$, and past income, $\alpha_2 = 0.4$, the baseline case begins with zero economic

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1See gennaro.zezza.it/software/eviews/gl2006.php for details.
activity. The causal story goes that the government is ‘born’ in some sense, and they start ordering products from the firms by increasing government expenditure $G$ from 0 to 20. The firms employ the households to produce the products being ordered by the government, and off the economy goes. Output $Y$ is the sum of government spending, $G$, and consumption of the goods in the period, $C$. Taxes $T$ are levied on income $Y$, giving a disposable income measure, $YD$. The consumption function $C = \alpha_1 \times YD + \alpha_2 \times H_1$, which is the only behavioural equation in this simple model, gives the convex combination of consumption from present and past income. Obviously past household wealth, $H_{-1} = 0$ in the first period.

The government initially orders (or *injects*) $20 worth of products accounted for through the governmental budget, $G$, which circulates around the system such that the households get the $20 in wages for producing the products (so the wage bill, $WB = Y$), then they must pay taxes $T$ of 20% on this. The equation system below is solved recursively, with household wealth in savings $H_s$ and household holdings of cash $H_h$ fluctuating each period via $H = \Delta H + H_{-1}$ until the economy reaches its steady state.

Taking the example further, the households go off and buy products from each other to the value of $16 in this period. The model continues this process ad infinitum, with the resultant being that the initial injection of $20 causes ripples throughout the economy and we get a multiple effect of government spending on the economy, hence the term “multiplier”. Pedagogically, this is very simple to implement, and is an interesting computational exercise for students to attempt. The fact that this example is very close in spirit to other Keynesian models students will have been exposed to previously makes it a good introduction to stock-flow consistent modeling.

Our system of equations looks like this:

\[
\begin{align*}
G \\
Y &= G + C \\
T &= \theta \times Y \\
YD &= Y - T \\
C &= \alpha_1 \times YD + \alpha_2 \times H_1 \\
\Delta H_s &= G - T \\
\Delta H_h &= YD - C \\
H &= \Delta H + H_{-1}
\end{align*}
\]

### 2.2 Solution

If we start by solving the model for $Y$, then $Y = G + C$, and $T = \theta Y$, and by substituting in for $T$ and factoring, we get

\[
YD = Y - T = Y \times (1 - \theta).
\]

By similar logic, our consumption function, the only ‘behavioural’ equation in this system, is given by $C = \alpha_1 \times YD + \alpha_2 \times H_{-1}$. 

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Since, in period 2, household income $H_{-1} = 0$, so we can say that $C = \alpha_1 \times Y(1 - \theta)$. Substitute this into $Y = G + C$ and we obtain

\begin{align*}
Y &= G + \alpha_1 Y(1 - \theta), \quad (11) \\
Y - \alpha_1(Y)(1 - \theta) &= G, \quad (12) \\
Y[1 - \alpha_1 \times (1 - \theta)] &= G, \quad (13) \\
Y &= \frac{G}{1 - \alpha_1 + \alpha_1 \theta} \quad (14)
\end{align*}

We can imagine numbers for $\alpha_1, G[\text{Period}1], \text{and } \theta = 0.6, 20, \text{and } 0.2$. Plugging these into equation (14), we can calculate $Y$ for period 2. We obtain

$$Y = \frac{20}{1 - 0.6 + 0.6 \times 0.2} = 38.462 \approx 38.5.$$

As soon as $Y$ is solved for, recursive solution obtains the change in household income, $\Delta H$, and therefore the total household income, $H$.

The system reaches a steady state when $\Delta H = 0$ and hence $YD = C$.

In this example, we see the generation of a useful set of macroeconomic concepts for the students which instructors will be aware of: the multiplier, the consumption function, and so forth. But we also see a stock-flow consistent post-Keynesian approach to modeling the macroeconomy which includes simulation and experimentation on the part of the policy maker. Now we move on to consider the dynamic general equilibrium approach adopted by Barro [2].

3 Barro’s dynamic general equilibrium approach

In contrast to Godley and Lavoie’s endogenous conception of money, Robert Barro [2] takes another approach to the derivation of macroeconomic identities, to the creation and usage of national accounts (and their purposes), and to the use of simulation modeling as a tool to understand the effects of differing conditions on the macroeconomy. Barro presents what he terms the ‘market clearing’ approach to the determination of the level of interest, employment, and money. National accounts here describe a series of aggregate consistency conditions, meaning they represent an aggregate budget constraint on the economy’s optimising behaviour. In order for markets to clear in this way, the price level and interest rates must be fully adjustable, so the money markets must clear at all times. There is no storage. We are presented with a top-down (though elegantly micro-founded) optimising system with few behavioural assumptions, and no uncertainty or incompleteness of information (though the latter is added later on in the text). Of course, Barro uses a production function approach, anathema to Godley and Lavoie. These production functions are simulated in the book, mainly as examples of economic growth with Cobb-Douglas technologies. Money does not enter the discussion except in token form in Chapter 9.

The role for money in Barro’s approach is as a simple token or lubricant for the transfer of real assets. Money is held not for it’s own sake, but rather to trade fairly soon for something else, such as goods or services. This conception of money as a simple medium of exchange is found throughout neoclassical pedagogical approaches to macroeconomics [4, 1, 5, 6]. Contrast the conception of money as medium of exchange (and therefore with money’s ultimate neutrality and policy irrelevance in macroeconomic modeling) with Godley and Lavoie’s approach to the definition
of money as an integral part of the economic mechanism. There is no separation of real and nominal variables in Godley and Lavoie until Chapter 8.

It should be mentioned that both texts are really straw men for different approaches to the teaching of macroeconomics, but they serve their roles admirably. The qualifications of each author are in no doubt, and they do represent polar representations of each ‘school’ of thought, so with that small caveat, I press on. The discussion of the aggregation of capital and the role of the production function in economic analysis is beyond the scope of this paper. Here I will just focus on the treatment of money in each approach. The treatment of money, not only as part of the macroeconomic system, but as one of its fundamentals, in the end, is what distinguishes Godley and Lavoie from Barro. Money does not matter when markets always clear and everyone knows everything. It is only when uncertainty is modeled sensibly, and economic actors are forced to make a portfolio choice (bonds or cash, say) based on contingent valuations of an uncertain future that money becomes really useful. The real world is like this. So macroeconomic tools which effect the stocks and flows of money between countries matter. Teaching students models which matter in the real world is not easy, but it is worth it, because the students know something useful about the macroeconomy when they leave one’s class at the end.

3.1 Example: Barro’s conception of money

In Barro’s Modern Macroeconomics [2], we are given a stripped down version of the Dynamic General Stochastic Equilibrium model for undergraduates. The rationale for doing economics this way is simple: by treating money as a social lubricant used only for effecting transactions, Barro neatly sidesteps the need to model the other, time- and value-laden uses of money which Godley spends so much time working on.

Money does not enter the Barro dynamic stochastic general equilibrium model in any real way, because production is instantaneous, so money itself enters the dynamic stochastic general equilibrium model exogenously as a token or ‘medium of exchange’. The model begins from a production function of the form

$$Y = A \times F(\kappa K, L),$$

where $Y$ is output as before, $\kappa$ is a measure of capacity utilisation of capital, $K$, and labour employed is $L$. We can measure technological progress using $A$ as standard, and assume diminishing marginal returns to both capital and labour. Barro portrays the macroeconomy as the interaction of four assumed sectors: firms, households, banks, and the government. Taking firms first, firms maximise real profit, $\pi/P$ subject to

$$\frac{\pi}{P} = A \times F[(\kappa K)^d, L^d] - \frac{w}{P} \times L^d - \left(\frac{R}{P}\right) \times (\kappa K)^d$$

Households maximise consumption $C$ subject to constraints on investment, $\Delta K$, production, summarised in the production function relation, and depreciation, $\delta K$:

$$C + \Delta K = A \times F(K, L) - \delta K$$

One nice pedagogical feature of this approach is the smooth transition for the students between microeconomic explanations of the income and substitution effects, and macroeconomic explanations of the same. For example, in the Barro model, an increase in real income motivates households
to raise current consumption and future consumption, producing an income effect—the increase in
the interest rate or intertemporal-substitution effect, which tends to reduce current consumption.
The net change depends on whether the income effect is stronger or weaker than the intertemporal-
substitution effect.

While discussing money demand and the determination of the price level, Barro gives a rationale
[2, pg. 128] for taking a narrow view of money:

In our model, it is best to use a narrower definition of money, for example, as currency
held by the public.

Here the only money is hand-to-hand currency. Barro assumes the interest rate paid on money
is zero, and the only interest-bearing assets in the system are bonds and ownership of capital, which
pay a positive return to the holder.

The demand for money, then, in this schema is the average holding of money that results from
the household’s optimal strategy for money management. This is a statistical description of the
level of money in the economy at any one time, and only motivated properly once the economy is
in an equilibrium position. This allows Barro to posit the long run neutrality of money argument,
which goes something like this: Suppose that the price level, $P$, doubles. The nominal demand for
money, $M_d$, doubles. Since $M_d$ and $P$ have both doubled, the ratio, $M_d/P$, is the same. The result
is that the real demand for money, $M^d/P$, does not change when P changes. To put it another way,
the money demand function, $M^d/P = L(Y, i)$, built on a variable interest rate, $i$, is homothetic in
$L(.)$

Barro assumes Walras’ law throughout, so solving for three sectors is sufficient for general
equilibrium.

What benefits to teaching the dynamic general stochastic equilibrium model give a modern
undergraduate student of economics? First, and most importantly, we are given a vision of a micro-
founded microeconomics, which sits well with the highly mathematised microeconomics students
will be more familiar with. This gives the student certain sense of methodological rigor, and
allows the instructor more leeway when it comes to discussing derivations from the general basic
model, because they have more time for these types of discussions\(^2\). For example, after a brief
foray into neoclassical growth theory, Barro begins his exposition of the dynamic stochastic general
equilibrium model with the standard exposition of microeconomic supply and demand. We are then
shown a vision, mediated by the presumed existence of Walras’ law, where all these individually
equilibrating markets aggregate to generate the macroeconomy. From there, it is a hop, skip,
and a jump to the full blown macroeconomic dynamic stochastic general equilibrium model. In
this model we see identical economic agents receiving payments as if they were households and
firms, assumed similar through their shared constraint-maximising behaviour. The macroeconomy
reaches equilibrium about trend, and receives shocks to his tune through (random) changes to the
flows of technology, capital, and labour. The basic model is extended to include differing levels of
capital capacity utilization, labour utilization, and finally money demand.

Thus the vision presented by the Barro model is a macroeconomy which would be in equilibrium
were it not for the presence of random, exogenous shocks to the various factors influencing the path
to equilibrium. Money is treated in the same way as later or capital or any other stock, in that

\(^2\)None of the lecturer’s time is spent in motivating and explaining the need for alternative approaches. There is
an opportunity cost to introducing pedagogical pluralism, and the time lost in the motivation and comparison stage
of the process is a large part of that cost.
its value does not change except in a predictable manner, and it is only used for transactional purposes. This view of money is at odds with Godley and Lavoie’s conception of money as an endogenous determinant of time-dependent effective demand.

3.2 In contrast: Godley’s treatment of money

In Godley’s models, the demand and supply relationships are themselves derived and causal relationships. Demand for consumption is equal to supply of goods and services for consumption, but the ‘demand’, say, comes from the fact that both behavioural relationships and accounting balances influence demand and supply. The ‘supply’ of tax revenue, for example, follows from income levels and tax rates. ‘Demand’ might be set by government spending less net borrowing.

In each of Godley’s increasingly complex models, the key feature is that all columns and all rows sum to zero thereby enforcing the fundamental principle that all balances between income and expenditure generate equivalent changes in stocks of financial assets and liabilities and, more generally, that ‘everything comes from somewhere and everything goes somewhere’. Without a comprehensive accounting framework of this kind, the system properties of macroeconomic models can never be securely tied down. This framework makes it mandatory, for instance, to make it explicit how investment is financed – a key process which is systematically ignored in most conventional macroeconomics. The key differences between Godley and Barro may be summarised as:

- There is a gap in (historical) time between production and sales which generates a systemic need for finance;
- bank money is endogenously determined by the flow of credit and;
- total real income must be considered to be divided into three parts – that received by entrepreneurs, that received by labour, and that received by banks.

We have already travelled far from the Barro model, where production is and must be instantaneous, where money must be exogenous and fixed and has no counterpart liability, and where the distribution of income is determined by the marginal products of labour and capital – a construction which depends entirely on the assumption that all firms sit perennially on a single aggregate production function frontier. Discussing financial markets, for example, Godley and Lavoie look at money, bonds, and equities, but reverse the traditional Keynesian closure of allowing the interest rate to vary, which solves the model. Rather, Godley and Lavoie fix the interest rate, and allow the money supply to adjust endogenously via open market operations to meet demand.

4 Pluralist pedagogical approaches must use semantic overlaps to be successful

One approach to curbing methodological monism in economics is to offer postgraduate students a critical coverage of more than one set of methods of economic analysis. The problem with this approach is scarcity of student and faculty time, expertise, and incentives to learn. Methodological pluralism is not in any sense a desirable quality when teaching students whose objective is to maximize marks without regard to the traditions within which they learn their craft. However,
when some atmosphere of shared intellectual enterprise can be fostered, a pluralistic attitude to teaching economics can be beneficial.

The method through which a synthetic, critical attitude to both approaches is through a discussion of the various overlaps of the two approaches. First, there is an overlap between the two models in the reality each is trying to describe. Both Barro and Godley take their data from national accounts and supranational indices compiled by the UN, IMF, and World Bank. Second, each approach deals roughly with the same division of total real income by sector. That is, they recognise most of the same actors, although each approach treats the interactions between these actors differently. Third, both Godley and Barro overlap in the manner in which payments to the sectors are made, though Godley is obviously more explicit in their treatment of stocks and flows of funds. Fourth, both approaches agree the estimation and derivation of gross domestic product indices are flawed, but stand in workable opposition to measuring less than the total product of the macroeconomy. Fifth, though Barro simply ‘switches off’ the functions of money apart from money’s qualities as a transactional lubricant, reducing Godley’s model to the same transactional model with no role for credit money gives us the textbook Keynesian model, so there is a pedagogical benefit to simplifying these models to aid student comprehension.

5 Conclusion

This short paper contrasts the stock flow consistent approach with the dynamic general equilibrium formation of the macroeconomy. The paper takes as an example the treatment of money in both models for effect, because there is a stark contrast in theory, implementation, resultant policy prescriptions from each approach as a result of the choice of how to model money. Each approach was considered with regard to a standard undergraduate problem, and the strengths and weaknesses of each compared. When overlaps were found, they tended to be more definitional in nature, so for example, both approaches agreed on what inflation was, but disagreed as to what to do about it. Both approaches talked about the uses of money as a social lubricant, but Godley and Lavoie’s work uses nominal values for money almost exclusively, while Barro’s models money as simply having transactional (and therefore not trade-affecting) uses.

The lack of a proper role for money in general equilibrium theory and macroeconomics has been lamented in several places [8, 15, 14, 16], though several attempts have been made to bring money into the neoclassical fold (for example, [10]). A route towards a sensible inclusion of money in macroeconomic modeling has been set forth by Godley and Lavoie in their attempt to bring sensible monetary economics into the forefront of macroeconomic policy analyses and debates. Barro’s textbook version of the Neoclassical macroeconomic model deals with money in a cursory way, trading off theoretical elegance for more realistic modeling of economic phenomena. There is no doubting Barro is easier to read than Godley and Lavoie, for the simple reason that Godley and Lavoie, through their accounting, must include many extra equations to balance their models—some later models have upwards of eighty equations, a fact lamented by one reviewer a least3 [15, pg. 25].

Pluralism in economic pedagogy should be organised around data- or problem-driven definitions of an economic phenomenon, like unemployment, the definition of which all sides agree upon. Otherwise student confusion is guaranteed. Then differing theories of the causal forces acting on

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3Taylor’s exact lament is “One might wish that he had pursued some lines of analysis more aggressively and perhaps put a bit less effort into others. And maybe not have written down so damn many equations.”
these phenomena can be compared by asking whether their predictions about the phenomena are broadly true, or broadly false [7].

McCloskey has shown in her writings [11, 12] that economics, no more than other modes of inquiry, are as prone to mild (and less than mild) semantic disagreements and the usage of non-neutral words as other social sciences. As Paul Samuelson, in the original 1948 edition of his bestselling principles textbook reminds us [13, pg. 7]:

…words may be treacherous because we do not react in a neutral manner to them. Thus a man who approves of a government program to ration housing will call it a program of “social planning,” while an unsympathetic opponent will describe the same activity as “totalitarian bureaucratic regimentation.” Who can object to the former, and who could condone the latter?

Those wishing to justify a particular worldview in the classroom will use these kinds of differences to justify the use of one model over another. Indeed, the very act of seeking alternatives to the mainstream pedagogical approach bespeaks a dissatisfaction with that approach, which the instructor will feel compelled to discuss at some length in order to sway their students’ interests’. Thus merely introducing choice into a module does not ensure we will bring about methodological and therefore practical pluralism in our students. We must show the students why learning about these competing approaches is to their benefit, and to do so we must emphasize what is new in terms of what is already known. Through judicious use of overlaps in concepts, definitions, and implementation, we can achieve practical pedagogical pluralism.

References


