Working Paper No. 1083

Integrating the Social Reproduction of Labor into Macroeconomic Theory: Unpaid Caregiving and Productivity in Paid Production

by

Mark Setterfield
New School for Social Research

June 2025

Levy Economics Institute
P.O. Box 5000
Annandale-on-Hudson, NY 12504-5000
http://www.levyinstitute.org

ISSN 1547-366X

ABSTRACT

The purpose of this paper is to contribute to the integration of unpaid caregiving in the household into short- and long-term macroeconomic theory and, in particular, the theoretical structure of production on the supply side of the economy. The ambition of the project is to furnish a general theoretical representation of how unpaid caregiving and its (gendered) social structure contribute to the technical conditions of production in the sphere of marketed output. In so doing, it aims to provide macro theorists with an apparatus that allows consistent description of both short-term (levels of activity) and long-term (rates of growth) macro outcomes in a manner that routinely integrates feminist insights regarding the gendered structure of the social reproduction of labor into macroeconomic analysis.

JEL CODES: E11, E12, B54, E23, J13, J16, J24, O33

KEYWORDS: Social reproduction of labor, unpaid caregiving, macroeconomic theory, potential output, natural rate of growth, technical change.

1. INTRODUCTION

According to Folbre (2023), in addition to its field-specific concerns with issues related to gender and sexuality, feminist economics should permeate *all* micro- and macro-theoretical arguments, because of the breadth and generality of its insights into matters pertaining to both structure and agency in the economic sphere. Responding to Folbre's challenge involves, in part, transcending the "boundary problem," according to which different subjective values are attached to different concepts and activities in economics (Dengler and Strunk 2018). These values then shape the focus of formal economic theory.[1] Motivated by these considerations, this paper seeks to contribute to the project addressing the question: in light of Folbre, what should macro theory look like?

One aspect of this project concerns the effect on labor productivity in the sphere of the paid production of gendered, unpaid caregiving associated with the social reproduction of labor.[2] Heterodox macro models routinely feature class and technological change as associated topics of analysis, linked by the theory of induced, factor-biased technical change. It could therefore be argued by analogy that they should also routinely feature gender and the social reproduction of labor: a source of social stratification (i.e., gender) that, in turn, bears on the efficiency of an input into the production of marketed goods and services (via the process of social reproduction). This connection has certainly not escaped the attention of feminist economists (Elson 2000; Picchio 2003), but the possibility remains that, beyond feminist economics, and like the categories of class and technical change, gender and the social reproduction of labor routinely shape the supply side of the economy (and, in a broader macro-theoretical context, the process of demand formation) in non-negligible ways to which macroeconomic theorists should routinely

[1] That this boundary problem applies to concepts and activities that are the focus of feminist economics—such as caregiving—is no doubt related in (arguably large) part to the particular sociology of economics as a discipline. On the relationship between this sociology, its toxicity, and the attention paid to (and value placed on) feminist economics see, for example, Kim (2023).

[2] The analysis in what follows will focus on the reproduction of labor power between production periods in the short run and the long run. Elsewhere, "social reproduction" is understood as a still-broader project encompassing other aspects of the reproduction of capitalist society as a whole. See, for example, Munro (2019), Quick (2023), and Rey-Araújo (2024) for further discussion of the term social reproduction and its usage.

pay attention.[3] As such, the purpose of this paper is to develop a model of the contribution made by the gendered social reproduction of labor to the determination of both the level and the rate of growth of labor productivity in the sphere of paid production. In so doing, it provides a means of consistently incorporating the gendered social reproduction of labor into descriptions of potential output determination and the natural rate of growth in any short- or long-run macro theory.

Even as narrowly defined in this paper, there exist vitally important institutional dimensions to the social reproduction of labor. Of first-order importance in this regard is the particular pattern of gender relations—patriarchy—that, to date, has provided a *common* institutional basis for the social reproduction of labor across space and time. This cannot be safely ignored, and is not in the analysis that follows. At the same time, the institutions shaping the social reproduction of labor can and do vary over time. As noted by McDonough (2021), social reproduction occurs through changing combinations and patterns of family, community, state, and market activities. These aspects of the institutional dimension of social reproduction will influence the formal modelling of social reproduction processes in macro theory, by affecting either the precise array of structural equations utilized (as in Porcile, Spinola, and Yajima [2023]) and/or the size and sign of the parameters associated with any given structural equation (as in Katzner [1990]). For the sake of simplicity, however, we abstract from such considerations in what follows.

Following a brief review of existing literature in the next section, the remainder of the paper is divided into two main sections. Section 3 takes up short-term considerations (macro statics). This involves studying the effects on potential output of reproducing labor power between production periods within a population of given size. Section 4 then moves on to long-term considerations (macro dynamics). Here, the natural rate of growth is shown to be affected by the social reproduction of labor via effects of social reproduction on technological change. Finally, Section 5 offers conclusions.

[3] It should go without saying that the process of abstraction may sometimes recommend that the sort of considerations that are the focus in what follows be set aside. The argument here does not suggest otherwise, but is instead designed to show that they should not be systematically ignored.

2. EXISTING LITERATURE

The project of engendering macro theory is not new, and so the "challenge" associated with Folbre (2023) in the introduction has not gone unnoticed. To date, the project features both neoclassical and heterodox contributions with demand-side effects frequently emphasized as the novelty of the latter (Seguino 2020). However, the integration of unpaid care into heterodox macro theory is of more recent vintage (Seguino [2020]; Blecker and Braunstein (2022)). Meanwhile, focus on modelling the effects of caregiving and the social reproduction of labor on supply conditions—and in particular, on labor productivity and hence potential output (in the short run) and the natural rate of growth (in the long run)—appears to be the preserve of a small literature (Braunstein, Staveren, and Tavani 2011; Onaran, Oyvat, and Fotoloulou 2022; Vasudevan and Raghavendra 2022).[4]

In Braunstein, Staveren, and Tavani (2011), the (gendered) production of human capacities (H_c) by means of unpaid household labor is described as:[5]

$$H_c = H_c(f(u), m(u)), m' > f' > 0;\ H_{c_m} < H_{c_f} < 0 \quad (1)$$

where $f(u)$ and $m(u)$ are the wages paid to women and men, respectively (both wage rates

[4] See also Zuazu (2024).

Of course, the social reproduction of labor will affect the quantity of labor available for production in the short run, not least because it creates a demand on the limited time resources of a given population. Note, however, that more time devoted to domestic caregiving at the expense of time devoted to paid labor by those already participating in the labor force may, in principle, *increase* the total quantity of labor available in the sphere of paid production if it sufficiently increases labor force participation. The social reproduction of labor may also be linked to the quantity of labor available in the long run if, as in Heintz and Folbre (2022), fertility and hence population growth is endogenous.

[5] Human capacities are defined in Braunstein, Staveren, and Tavani (2011) as "features that make human beings more economically effective (such as emotional maturity, patience, self-confidence, and the ability to work well with others, as well as standard human capital measures such as skills and education)," or more simply, "individual attributes that improve productive contributions" (150). So defined, human capacities are acquired rather than innate, and can be considered equivalent to human capital *broadly defined* (as acquired attributes of individuals that enhance their (marginal) productivity). Human capacities arise from a variety of sources, including *care services* (Elson 1995) that may be either marketed (such as the services of a day spa) or result from unpaid care in the home (such as care for an elderly relative). The latter is the focus of attention in this paper.

increasing in the level of economic activity, proxied by the capacity utilization rate u). The sign of the derivatives H_{c_m} and H_{c_f} captures the notion that rising wages incentivize reallocation of time away from unpaid caregiving and toward the paid labor market, thus reducing the domestic production of human capacities. The relative size of the derivatives $m' > f'$ and $H_{c_m} < H_{c_f}$ reflects the gendered structures of the paid labor market and the sphere of household production, respectively. On this basis, output per person becomes:

$$Q = Q[f(u), m(u), H_c(f(u), m(u))], Q_f, Q_m > 0;\ Q_{H_c} > 0 \qquad (2)$$

where $Q_f, Q_m > 0$ captures classical induced factor-biased (CIFB) technical change.[6] One limitation of this approach is that it describes only the short term (albeit with CIFB technical change treated as a short-term phenomenon—itself a questionable assumption). Articulation of the long-term—that is, derivation of an expression for the rate of productivity growth, q, from the implicit function $Q[.]$—remains unclear.[7]

In Onaran, Oyvat, and Fotopoulou (2022), unpaid care in the home enters directly into the determination of the (log) level of output per worker, together with (inter alia) the CIFB mechanism *and* a Verdoorn effect, according to which productivity varies directly with the level of output. This is effectively an extension of the equation (2). Onaran, Oyvat, and Fotopoulou present their model as one of long-run productivity growth, but as specified, their equation of motion will converge to a steady-state level of productivity. Under the special case conditions that transform their dependent variable into a log-difference in the level of productivity, the resulting rate of productivity growth depends on the log *level* of labor supplied to the process of domestic caregiving. Why a constant level of household caregiving should result in steady, long-

[6] The CIFB technical change hypothesis posits that technical change is spurred by pressure on profits arising from the growth of real wages in excess of productivity.

[7] In particular, the notion that the level of labor productivity depends on the allocation of time toward domestic production of human capacities does not translate into the proposition that long-run growth of labor productivity can be related to reallocation of labor time toward unpaid caregiving, because the share of time devoted to unpaid care is bounded.

run productivity growth in the sphere of production is unclear.[8]

Finally, like Onaran, Oyvat, and Fotopoulou (2022), Vasudevan and Raghavendra (2022) posit a direct effect of time devoted to unpaid care in the home on the level of labor productivity in the sphere of production. As in equation (2), meanwhile, and in common with both Braunstein, Staveren, and Tavani (2011) and Onaran, Oyvat, and Fotopoulou (2022), labor productivity is increasing in both male and female earnings. This is not because of CIFB technical change, however. Instead, an increase in earnings is understood to raise labor productivity by facilitating the substitution of marketed care goods and services for unpaid caregiving and the purchase of goods that increase the productivity of unpaid caregiving itself. Ultimately, Vasudevan and Raghavendra postulate an implicit function for the level of labor productivity akin to equation (2), with additional terms that capture the public provision of care services and the capital stock (public and private).[9] As in Braunstein, Staveren, and Tavani (2011), there is no description of the rate of growth of productivity, and no obvious way of deriving such an expression from the implicit function describing the level of productivity.[10]

A common feature of the existing literature is that its treatments of the social reproduction of labor and how this process affects labor productivity in the sphere of paid production are "built for (some other) purpose." The models surveyed above pursue broader ambitions than those of this paper, with the result that the effects of the social reproduction of labor on labor productivity arise as bespoke means to some other (broader) end in macro theory. The approach taken below involves singling out the effects of the gendered social reproduction of labor on labor productivity as a focus of attention in and of itself. The ambition is to then fashion an "integrated" formal treatment of this process that can be used subsequently in both short- and long-term macro models constructed for various purposes, in much the same way that

[8] One possibility, of course, is that the productivity of domestic caregiving need not be constant. As noted immediately below, this possibility is entertained in the model of Vasudevan and Raghavendra (2022). It is also a feature of the model developed in this paper.

[9] Labor productivity is described as increasing in both of these variables.

[10] Once again, long-run growth of labor productivity cannot be based on reallocation of labor time toward unpaid caregiving because the share of time devoted to unpaid care is bounded.

characterizations of CIFB technical change are used routinely to integrate class into discussions of labor productivity.

3. SHORT-TERM CONSIDERATIONS: MACROECONOMIC STATICS

We start by describing the production of marketed output (hereafter, "production") by writing:

$$Y_p = min\left[\frac{K}{v}, \frac{N_{max}}{a}\right] \qquad (3)$$

where Y_p denotes potential output, K is the capital stock, $N_{max} = (1 - U_{min})L$ is the maximum possible level of employment, derived from the minimum attainable rate of unemployment (U_{min}) and the total labor force, L, and v and a are the full-capacity capital-output ratio and the labor-output ratio, respectively, the latter being the reciprocal of labor productivity (so that $a = \frac{1}{Q}$). Assuming that the economy is labor constrained, we can write:

$$Y_p = \frac{N_{max}}{a} = \frac{(1 - U_{min})L}{a} \qquad (4)$$

Now consider the labor-output ratio $a = \frac{N}{Y}$ which, as will become clear immediately below, will bring us into the sphere of social reproduction:

$$a = \frac{1}{n}\sum_{i=1}^{n} a_i = \frac{1}{n}\sum_{i=1}^{n} a_{i-1}\, e^{(\delta - \alpha_i)} \qquad (5)$$

where n is the duration of the short run (the period of time for which the capital stock is fixed and during which the flow of potential output in (4) is produced), $\delta > 0$ is the per-production-period deterioration of labor power, and $\alpha_i > 0$ denotes unpaid production of human capacities in production period i designed (in the first instance) to offset δ. In (5), labor power deteriorates as labor is expended in the process of production, due to tiredness and injury, for example. Effort must then be made to restore labor power between production periods. Maintaining the productivity of labor from one production period to the next thus requires $\alpha_i = \delta$—i.e., sufficient social reproduction of labor power (α_i) to offset the per-production-period deterioration of labor power in the sphere of production (δ). Note, however, that even in the short run—and certainly in the longer term explored in the next section—the domestic production of human capacities can enhance (not just restore) the productivity of labor in paid production. Hence, in addition to providing rest, recuperation, and healing, there may be significant learning from interaction with others in an organizational context (the family) and/or activities associated with play, while the pursuit of certain hobbies may improve motor skills or the capacity for recall, for example.

Next write:

$$\alpha_i = \frac{N_c}{a_{c_i}} \qquad (6)$$

where:

$$a_{c_i} = a_{c_{i-1}} e^{\alpha_c} \qquad (7)$$

In (6), the extent of social reproduction depends on the unpaid labor applied to care (N_c) and the productivity of caregiving, as reflected in the size of the caregiving to social reproduction ratio, a_{c_i}. Analogous to the labor-output ratio a in the sphere of production, a_{c_i} is the reciprocal of the productivity of caregiving in the social reproduction of labor process. Essentially, then the flow of human capacities α_i is produced by a flow of unpaid caregiving labor per production period (N_c), with productivity in the unpaid caregiving process of $\frac{1}{a_{c_i}}$. Equation (6) thus describes the "social reproduction of labor power by means of (unpaid caregiving) labor." Note the absence of any commodity inputs from the sphere of production in this reproduction process. We abstract from this (plausible) connection between the sphere of production and the process of social reproduction for the sake of simplicity – as have others (Braunstein, Staveren, and Tavani 2011).

Finally, in (7), $\alpha_c \neq 0$ represents the (in)capacity of the household to maintain the productivity of unpaid caregiving (a_{c_i}) between production periods. Because the process of caregiving demands the expenditure of labor (as in equation (6)), so, then, the unpaid labor power of caregivers will deteriorate between production periods unless it is socially reproduced. The productivity of caregivers a_{c_i} need not, therefore, remain constant between production periods—the possibility of which is captured by equation (7) when $\alpha_c \neq 0$.[11] We will comment further on the sign of α_c (and hence the behaviour of a_{c_i} and its implications for the value of a) in what follows.

Beforehand, however, we consider the determination of L and N_c in the numerators of equations (4) and (6), drawing on Vasudevan and Raghavendra (2022) and Onaran, Oyvat, and Fotopoulou (2022). Turning first to the sphere of production, we write:

$$L = L_{m_p} + L_{f_p} \tag{8}$$

where L_{m_p} and L_{f_p} denote the total labor supplied to the process of production by men and women, respectively. Now write:

$$L_m = L_{m_p} + L_{m_s}$$

and:

$$L_{m_p} = \phi L_m \quad , \quad \phi = \frac{L_{m_p}}{L_m} \tag{9}$$

That is, in accordance with the assumed fixed proportion ϕ, working-age men divide their total time L_m between labor force participation (L_{m_p}) and leisure (L_{m_s}) which, for the sake of

[11] At any point in time the productivity of caregiving will also likely be affected by the size distribution of households and hence the extent to which the domestic reproduction of human capacities realizes household economies of scale.

simplicity, we equate with self-care.[12]

Meanwhile:

$$L_f = L_{f_p} + L_c \tag{10}$$

where:

$$L_c = L_{c_m} + L_{f_s}$$

$$L_{c_m} = \theta L_f \quad , \quad \theta = \frac{L_{c_m}}{L_f}$$

$$L_{f_s} = \psi L_f \quad , \quad \psi = \frac{L_{f_s}}{L_f}$$

so that:

$$L_c = (\theta + \psi)L_f \quad , \quad 0 < \theta + \psi \leq 1 \tag{11}$$

and hence (substituting (11) into (10)):

$$L_{f_p} = (1 - [\theta + \psi])L_f \tag{12}$$

In other words, working-age women divide their time between labor force participation (L_{f_p}) and unpaid caregiving (L_c); their unpaid caregiving is divided between caring for men (L_{c_m}) and leisure/self-care (L_{f_s}); and their labor force participation is ultimately determined as a residual (equation (12)), given the demands on their time associated with caregiving in accordance with the parameters θ and ψ, which determine the proportions of L_f devoted to caring for men and for self-care, respectively.[13]

---

[12] We abstract, then, from the possibility that labor force participation is endogenous to outcomes in the sphere of production, such as the value of the real wage (Braunstein, Staveren, and Tavani 2011) or the value of output per working-age person (Heintz and Folbre 2010). See, however, Appendix 7, which entertains the possibility that fertility and hence population growth vary endogenously in response to outcomes in the sphere of paid production in the context of longer-term macrodynamics.

[13] In Vasudevan and Raghavendra (2022), the share of time devoted to unpaid caregiving is endogenous to (*inter alia*) the level of labor productivity in the sphere of production. It may also be affected by household bargaining and by variation in α_c (the capacity of the household to maintain the productivity of domestic caregiving) in equation (7). We abstract from these influences in what follows for the sake of simplicity.

Finally, the allocation of men's and women's time as outlined above implies that:

$$nN_c = L_{m_s} + L_c = (1-\phi)L_m + (\theta+\psi)L_f$$
$$\Rightarrow N_c = \frac{(1-\phi)L_m + (\theta+\psi)L_f}{n} \qquad (13)$$

Several remarks on the allocation of time are in order. First, note that if we assume that $1-\phi < \theta+\psi \Rightarrow \phi > 1-(\theta+\psi)$, then gender affects the *quantity* of male/female labor force participation as well as its *structure* (the latter is reflected in women's treatment of labor force participation as a residual, given the time demands of caregiving). Second, $\theta \neq 0$ captures the assumption that unpaid caregiving is gendered: only women care for household members other than themselves.[14] Note that in this formulation, caregivers care for themselves,[15] and must do so to a sufficient extent if they are to maintain productivity in the spheres of both production and social reproduction and thus (ceteris paribus) the productivity of men in the process of production. In other words (and again, ceteris paribus), ψ sufficiently large, is instrumental in the achievement of $\alpha_c = 0$ (no decline in productivity of caregiving) and $\alpha = \delta$ (sufficient production of human capacities to offset the per-production-period deterioration of labor power).

Third, the expression in (12) suggests that there exists a linear trade-off between caregiving for men and self-care that leaves women's labor force participation unchanged. This trade-off may ultimately be non-linear, however (Vasudevan and Raghavendra 2022), and in any event, is constrained by the sufficient amount of self-care required by women to reproduce their own labor power. Fourth, in addition to the possibility that the parameters ϕ, θ and ψ may be endogenous to (for example) the value of the wage rate and/or the level of economic activity, "caring spirits"—i.e., "the tendency ... to provide care for one's self and others" (Braunstein, Staveren, and Tavani 2011) – may influence these same parameters in accordance with social

[14] This should be considered a simplifying first approximation. In practice, caregiving work (paid and unpaid) is performed by both men and women, with gender affecting the value attached to such "female-coded" work (Folbre, Gautham, and Smith 2021). Note that race and class also stratify caregiving, affecting (for example) whether or not any given household provides its own (unpaid) care and if not, with whom the household contracts to provide paid caregiving services. We abstract from these sources of stratification here and in what follows.

[15] There is, then, no infinite regress problem arising from the question "who cares for the caregivers."

norms. Finally, and for the sake of simplicity, we abstract from the caregiving time that women devote to children. This is because children do not contribute to the workforce in equation (8). Even so, unpaid childcare will impose an additional demand on L_f that may affect the relationship between production and social reproduction.[16]

We are now in a position to combine the insights outlined above and, in so doing, spell out their implications for Y_p in equation (4). First, substituting (9) and (12) into (8), we get:

$$L = \phi L_m + (1 - [\theta + \psi])L_f \tag{14}$$

$$\Rightarrow Y_p = \frac{(1 - U_{min})[\phi L_m + (1 - [\theta + \psi])L_f]}{a} \tag{15}$$

Here we see the effects of gender on potential output (in equation (15)) operating via *participation in production* (as in equation (14)).

Next, combining equations (5), (6), (7), and (13) yields:

$$a = \frac{1}{n}\sum_{i=1}^{n} a_{i-1}\, e^{\left(\delta - \frac{(1-\phi)L_m + (\theta+\psi)L_f}{n a_{c_{i-1}} e^{\alpha_c}}\right)} \tag{16}$$

$$\Rightarrow Y_p = \frac{(1 - U_{min})L}{\frac{1}{n}\sum_{i=1}^{n} a_{i-1}\, e^{\left(\delta - \frac{(1-\phi)L_m + (\theta+\psi)L_f}{n a_{c_{i-1}} e^{\alpha_c}}\right)}} \tag{17}$$

Here we see the effects of gender on potential output (in equation (17)) operating via *the labor-output ratio* (in equation (16)) and hence the productivity of labor in the process of production. Note that if we assume $\alpha_c = 0$, so that the productivity of unpaid caregiving remains constant in the short run, then $\forall i = 1, \dots, n$, $a_{c_i} = a_{c_{i-1}} \equiv \bar{a}_c$ so that:

[16] See Appendix 6 for reflections on the inclusion of unpaid child care in the model developed here.

$$\alpha_i = \frac{N_c}{a_{c_i}} = \frac{(1-\phi)L_m + (\theta+\psi)L_f}{n\bar{a}_c} \equiv \bar{\alpha}$$

If we further assume that ϕ, θ and ψ are sufficient to yield a value of $\bar{\alpha}$ such that $\bar{\alpha} = \delta$, then it follows that $a = \frac{1}{n}\sum_{i=1}^{n} a_{i-1}\, e^{(\delta-\bar{\alpha})} = \frac{1}{n} a_0 n \equiv \bar{a}$. Finally, combining these insights, (17) becomes:

$$Y_p = \frac{(1-U_{min})L}{\bar{a}}$$

This exercise reveals what is required of the social reproduction of labor ($\alpha_c = 0$; ϕ, θ, ψ s.t. $\alpha = \delta$) to produce the "standard" short-run macro assumption of a constant labor-output ratio given the current state of technology. Contrary to the conventional wisdom, that $a = \bar{a}$ simply because of the absence of technical change during the short run, and in keeping with the longstanding claims of authors such as Elson (2000) and Picchio (2003), $a = \bar{a}$ in the sphere of production *also* requires that certain conditions hold in the process of social reproduction. Finally, if we combine equations (4), (14), and (16), we obtain:

$$Y_p = \frac{(1-U_{min})[\phi L_m + (1-[\theta+\psi])L_f]}{\frac{1}{n}\sum_{i=1}^{n} a_{i-1}\, e^{\left(\delta - \frac{(1-\phi)L_m + (\theta+\psi)L_f}{n a_{c_{i-1}} e^{\alpha_c}}\right)}} \tag{18}$$

This expression provides us with a full account of the determinants of Y_p, taking into account the gendered structures of both labor force participation and the social reproduction of labor that is required to support labor productivity in the sphere of paid production in the short run. It can be used as a component of structural macro models, or to make clear what must be assumed about the gendered social reproduction of labor in order to justify appeal to the simpler expression $Y_p = \frac{(1-U_{min})L}{\bar{a}}$.

4. LONG-TERM CONSIDERATIONS: MACROECONOMIC DYNAMICS

Suppose now that we change the "timescale" of reference for the social reproduction of labor. The previous section referred to social reproduction between production periods within the short run. Hereafter, we will analyze both production and social reproduction on a short-run basis, so that the timescale for the social reproduction of labor is synchronized with the implicit timescale in the sphere of production (i.e., one calendar year). On the basis of these considerations, and starting from (4), we now write:

$$y_p = l - \hat{a} \tag{19}$$

where y_p denotes the annual average rate of growth of Y_p – that is, Harrod's natural rate of growth—while $l \equiv \hat{L} = \hat{P}$ (where P denotes total population),[17] so that the share of the working-age population in the total population $\left(\frac{L_m+L_f}{P}\right)$ and the labor force participation rate $\chi = \frac{L_{m_p}+L_{f_p}}{L_m+L_f} = \frac{L}{L_m+L_f}$ are both assumed constant in the long run and:

$$a = a_0 e^{(\delta_a - \alpha_a - \tau)t} \tag{20}$$

where δ_a is the annual deterioration of labor power in any given short run, α_a is the annual unpaid production of human capacities designed to address δ_a during the same short run, and τ denotes Harrod-neutral (labor-saving) technical change of the sort that, in heterodox macro models, is ordinarily associated with CIFB technical change and/or the Verdoorn law. Finally, $t = 1, \dots, \infty$ denotes successive short runs.

Now consider δ_a and α_a. First, we assume that:

$$\delta_a = \delta_{a0} e^{lt} \tag{21}$$

[17] The value of l is taken as given here, but can be endogenized along the lines suggested by Foley (2000) and Heintz and Folbre (2022), with further implications for the social reproduction of labor. See Appendix 7.

In other words, the aggregate quantity δ_a grows over time at a rate equivalent to that of the total labor force. Next, consider the determination of α_a. Recalling equation (7), we can write:

$$\alpha_a = \frac{nN_c}{\frac{1}{n}\sum_{i=1}^{n} a_{c_i}} = \frac{(1-\phi)L_m + (\theta+\psi)L_f}{\frac{1}{n}\sum_{i=1}^{n} a_{c_i}} \tag{22}$$

and

$$\frac{1}{n}\sum_{i=1}^{n} a_{c_i} = \frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}}\, e^{\alpha_c} \tag{23}$$

which, upon substitution, yields

$$\alpha_a = \frac{(1-\phi)L_m + (\theta+\psi)L_f}{\frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}}\, e^{\alpha_c}}$$

$$\Rightarrow \alpha_a = \frac{[(1-\phi)L_{m0} + (\theta+\psi)L_{f0}]e^{lt}}{\frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}}\, e^{\alpha_c}} \tag{24}$$

where we assume that total labor devoted to care also grows at a rate equivalent to that of the total labor force.[18]

Finally, it follows from equation (20) that:

$$\hat{a} = \delta_a - \alpha_a - \tau \tag{25}$$

Substituting equations (21) and (24) into (25) we arrive at:

[18] Note, then, that we are implicitly assuming that any productivity growth in the domestic production of human capacities is realized in the form of additional output of human capacities. This assumption could, of course, be relaxed.

$$\hat{a} = \delta_{a0}e^{lt} - \frac{[(1-\phi)L_{m0} + (\theta + \psi)L_{f0}]e^{lt}}{\frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}}\, e^{\alpha_c}} - \tau \qquad (26)$$

Equation (26) reveals that even assuming that the annual deterioration of labor power and the quantity of caregiving labor devoted to offsetting this deterioration grow at the same rate, l, labor productivity growth in the sphere of paid production ($\hat{a} < 0$) is sensitive not just to technical change, but also to the gendered structure of labor devoted to care (as reflected in the parameters ϕ, θ and ψ) *and* the capacity of households to maintain the productivity of caregiving (α_c 0) between production periods within any given short run. In other words, the co-determinants of the rate of labor growth productivity are technical change in the sphere of production *and* the extent and productivity of unpaid labor designed to maintain human capacities by socially reproducing labor power. Given the role of $\hat{a}$ in determining y_p in (19), it follows that unpaid caregiving will be similarly influential in the determination of the natural rate of growth.

Bearing out this last statement, a summary of the results derived above can be achieved by combining equations (19) and (26). This results in the following expression for the natural rate of growth:

$$y_p = l - \delta_{a0}e^{lt} + \frac{[(1-\phi)L_{m0} + (\theta + \psi)L_{f0}]e^{lt}}{\frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}}\, e^{\alpha_c}} + \tau \qquad (27)$$

Once again, equation (27) can be incorporated into structural macrodynamic models to make clear the role played by the gendered social reproduction of labor in macrodynamics, or else used to specify what must be assumed about the latter process to justify appeal to the simpler expression for the natural rate found in (19).

Further Reflections on the Long Run

The results derived thus far merit several remarks. First, note that the presence of τ in the long run means that in principle, labor-saving technical change can substitute for the production of human capacities $\alpha_a = \frac{[(1-\phi)L_{m0}+(theta+\psi)L_{f0}]e^{lt}}{\frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}} e^{\alpha_c}}$ in equation (26) when it comes to simply maintaining the value of $\hat{a}$ in the face of deteriorating labor power $\delta_{a0}e^{nt}$. A corollary of this observation is that technical change in the sphere of paid production can conceal problems associated with the social reproduction of labor (specifically, $\alpha_a < \delta_a$). Either way, this demonstrates that issues arising from the sphere of unpaid caregiving can prevent full realization (reflected in the size of $\hat{a}$) of the fruits of technical progress, since $\hat{a} = \delta_a - \alpha_a - \tau > -\tau$ when $\delta_a - \alpha_a > 0$. On this basis, and unlike existing research in macroeconomics (Goldin, Koutroumpis, and Winkler 2024), it is appropriate to direct attention toward unpaid caregiving when seeking to explain macroeconomic phenomena such as productivity growth slowdowns.

Consider, for example, the determinants of α_a itself, bearing in mind the gendered structure of social relations in the household. This draws attention (once again) to the functional relationship between α_c (and hence the productivity of unpaid caregiving) and $\psi = \frac{L_{s_f}}{L_f}$ (the time devoted by women to self-care). Suppose, for example, that given the values of ϕ and θ, ψ is too low to maintain $\alpha_c \leq 0$ – which may arise if the financial needs of the household are such that women cannot treat either their own labor force participation or the time that they devote to caregiving for other household members as adjusting residuals. Since $\alpha_c > 0$ implies a higher value of $\frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}} e^{\alpha_c}$ (relative to the case where $\alpha_c \leq 0$) in (27), the result will be an increase in the value of $\hat{a}$ – that is, a productivity growth slowdown.

Another issue concerns the possible endogeneity of δ_a in the long run. Suppose, for example, that $\delta_a = \delta_a(\tau)$, $\delta_a{}' \neq 0$. In other words, the extent to which labor power deteriorates in the short run depends on the extent of labor-saving technical change. Specifically, whether $\delta_a{}' > 0$ or $\delta_a{}' < 0$ will likely depend (inter alia) on power relations in the sphere of production and hence on the *power bias* of labor-saving technical change (Skott and Guy 2007). For example, technical change that increases the surveillance of, and hence effort extracted from, production workers will increase δ_a, ceteris paribus. This will imply that a higher value of $\alpha_a = \frac{[(1-\phi)L_{m0}+(\theta+\psi)L_{f0}]e^{lt}}{\frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}} e^{\alpha_c}}$ is required to maintain $\alpha_a = \delta_a$ and hence (ceteris paribus), the values of $\hat{a}$ and y_p in equations (26) and (19), respectively. These developments will have implications for both the household and the sphere of paid production. Thus, suppose that the power-bias of technical change in a *male-dominated* industry is such that ${\delta_a}' > 0$, the implications for the household being that a higher $\theta = \frac{L_{c_m}}{L_f}$ is now required. This may, in turn, result in adverse implications for ψ given the time constraints faced by women and financial constraints faced by the household, which together may prevent the treatment of women's labor force participation as an adjusting residual. The circumstances thus far described may ultimately have adverse implications (via α_c and hence α_a) for $\hat{a}$ and hence y_p in equations (26) and (19), respectively, as the productivity of unpaid caregiving labor falls, reducing the production of human capacities below the level necessary to offset the deterioration of labor power in the short run. In this scenario, because of its implications for the social reproduction of labor and the feedback effects of the latter onto the sphere of paid production, labor-saving technical change may be (at least partially) self-defeating in terms of its effects on productivity growth and the natural rate of growth.

The interaction of productivity in the sphere of reproduction with productivity growth in the sphere of production just described may shed light on the suggestion by Weiskopf (1987), that threat-based elicitation of effort in the sphere of production need not succeed in raising productivity growth. Whereas providing incentives to increase the supply of effort ("carrots") allows for the exercise of household choice (given power relations within the household), "sticks" designed to compel effort supply for fear of adverse consequences (e.g., job and/or income loss) do not. The possibility therefore exists that the use of sticks in the sphere of production will more often elicit sub-optimal effort-supply responses, by failing to take into account the requirements of social reproduction and the household income and hours constraints to which the latter is subject—with the result that the positive effects of sticks on productivity growth in the sphere of production are accompanied by negative effects operating via the sphere of reproduction where, *cet. par*. (and as noted above), a decline in α_c caused by a reduction in ψ that renders $\alpha_a < \delta_a$ will diminish productivity growth.

5. CONCLUSIONS

As is demonstrated by surveys of the field (Seguino 2020; Zuazu 2024), concern with the social reproduction of labor is but a small part of a much larger feminist macroeconomics ecosphere. This point is also made by observation of the fact that the literature devoted to the task of integrating the social reproduction of labor into formal macroeconomic models of potential output in the short run and the natural rate of growth in the long run is as-yet small (Braunstein, Staveren, and Tavani 2011; Onaran, Oyvat, and Fotopoulou 2022; Vasudevan and Raghavendra 2022). Nevertheless, as the contributions just cited demonstrate, modelling the social reproduction of labor in a macro-theoretical context can make important contributions to our understanding of both short- and long-term macroeconomic outcomes.

One common problem with the existing literature is that its focus on the social reproduction of labor is subservient to its focus on other issues. As a result, unresolved problems exist with respect to the consistent treatment of the social reproduction of labor in both short- and long-run macro-theoretic contexts. The purpose of this paper is to furnish a generic "technology" for integrating the social reproduction of labor consistently into both short- and long-run macro theory and in so doing, to help foreground the potential importance of this process in macro theory. Although its treatment of—among other things—power relations within the household and the resultant allocation of time toward paid production or unpaid caregiving in the home is simple, the approach taken reveals that unpaid caregiving may have important effects on the determination of the potential output ceiling on economic activity in the short run and the natural rate of growth in the long run. Insights into phenomena such as productivity slowdowns and the impact of labor-saving but power-biased technical change on productivity growth also emerge. Ultimately, it is hoped that the analysis in this paper will provide a robust platform for macroeconomic research that more routinely and consistently seeks to integrate processes associated with the social reproduction of labor into macroeconomic theory.

REFERENCES

Blecker, R. A. and E. Braunstein. 2022. "Feminist perspectives on care and macroeconomic modeling: Introduction to the special issue." *Feminist Economics* (3), 1–22.

Braunstein, E., I. van Staveren, and D. Tavani. 2011. "Embedding care and unpaid work in macroeconomic modeling: A structuralist approach." *Feminist Economics* (4), 5–31.

Dengler, C. and B. Strunk. 2018. "The monetized economy versus care and the environment: Degrowth perspectives on reconciling an antagonism." *Feminist Economics* (3), 160–183.

Elson, D. 1995. "Male bias in macro-economics: The case of structural adjustment," in *Male Bias in the Development Process*, edited by D. Elson, 164–90. Manchester: Manchester University Press.

Elson, D. 2000. *Gender at the Macroeconomic Level*, pp. 77–97. London: Palgrave Macmillan UK.

Folbre, N. 2023. "Telling fortunes: Feminist theory and the future of political economy." *Review of Political Economy* (1), 129–144.

Folbre, N., L. Gautham, and K. Smith. 2021. "Essential workers and care penalties in the United States." *Feminist Economics* (1-2), 173–187.

Foley, D. K. 2000. "Stabilization of human population through economic increasing returns." *Economics Letters* (3), 309–317.

Goldin, I., P. Koutroumpis, F. Lafond, and J. Winkler 2024. "Why is productivity slowing down?" *Journal of Economic Literature* (1), 196–268.

Heintz, J. and N. Folbre 2022. "Endogenous growth, population dynamics, and economic structure: Long-run macroeconomics when demography matters." *Feminist Economics* (3), 145–163.

Katzner, D. 1990. "Institutionally determined parameters in economic equations." *Économie Appliqueé XLIII* (3), 35–52.

Kim, M. 2023. "Gender in economics fifty years ago and today: Feminist economists speak." *Review of Radical Political Economics* (1), 8–25.

McDonough, T. 2021. "Social structure of accumulation theory," in *Handbook on Social Structure of Accumulation Theory*, edited by T. McDonough, C. McMahon, and D. Kotz, 15–32. Cheltenham, UK: Edward Elgar Publishing.

Munro, K. 2019. "'Social Reproduction Theory,' social reproduction, and household production." *Science & Society* (4), 451–468.

Onaran, O., C. Oyvat, and E. Fotopoulou. 2022. "Gendering macroeconomic analysis and development policy: A theoretical model." *Feminist Economics* (3), 23–55.

Picchio, A. 2003. "A macroeconomic approach to an extended standard of living," in *Unpaid Work and the Economy: A Gender Analysis of the Standards of Living*, edited by A. Picchio, 11–28. London: Routledge.

Porcile, G., D. Spinola, and G. Yajima. 2023. "Growth trajectories and political economy in a Structuralist open economy model." *Review of Keynesian Economics* (3), 350–376.

Quick, P. 2023. "Capitalism and household production: A Marxist-Feminist critique of Social Reproduction Theory." *Science & Society* (4), 447–474.

Rey-Araújo, P. M. 2024. "Social reproduction theory and the capitalist 'form' of social reproduction." *New Political Economy* (3), 432–446.

Seguino, S. 2020. "Engendering macroeconomic theory and policy." *Feminist Economics* (2), 27–61.

Skott, P. and F. Guy 2007. "A model of power-biased technological change." *Economics Letters* (1), 124–31.

Vasudevan, R. and S. Raghavendra. 2022. "Women's self-employment as a developmental strategy: The dual constraints of care work and aggregate demand." *Feminist Economics* (3), 56–83.

Weisskopf, T. E. 1987. "The effect of unemployment on labor productivity: an international comparative analysis." *International Review of Applied Economics* (2), 127–151.

Zuazu, I. 2024. "Reviewing feminist macroeconomics for the twenty-first century." *Review of Evolutionary Political Economy* (2), 271–299.

APPENDIX

6. Caring for Children and the Implications for the Allocation of Women's Time

Suppose that, in keeping with assumptions made previously about the gendered structure of caregiving, we re-write the allocation of women's caregiving time as:

$$L_c = L_{c_m} + L_{c_c} + L_{f_s}$$

where:

$$L_{c_c} = \gamma L_f \quad , \quad \gamma = \frac{L_{c_c}}{L_f}$$

denotes time devoted to care for children, and all other variables are as previously defined.[19] Then equations (11) and (12) become:

$$L_c = (\theta + \gamma + \psi)L_f \quad , \quad 0 < \theta + \gamma + \psi \leq 1a \qquad (28)$$

and:

$$L_{f_p} = (1 - [\theta + \gamma + \psi])L_f a \qquad (29)$$

respectively. Women now divide their time between labor force participation and unpaid caregiving (L_c), the latter itself divided between caring for men, caring for children, and leisure or self-care. As is clear from equation (12a), caring for children further reduces the labor force participation of women, ceteris paribus. However, in and of itself it will have no effect on the quantity of unpaid labor devoted to the social reproduction of labor in each production period (N_c) since children do not participate in the sphere of production. This last observation may be modified, however, if the demands of the household fiscally constrain the ability of women to treat L_{f_p} as an adjusting residual. Suppose that L_{f_p} must be held constant while children's play

[19]As will become clear below, the focus on care for children in this appendix is motivated by the contribution that such caregiving makes to the social reproduction of labor inter-generationally. Note, however, that otherwise, caregiving for others—and hence the definition of L_{c_c} above—can be extended to include elder care and care for the disabled.

becomes less self-organizing and demands greater parental supervision—as, for example, when organized sports substitute for “scratch” games played in the street. This will reduce θ and/or si which will, in turn, affect the efficiency of the social reproduction of labor, and hence the efficiency of labor in the sphere of production and the value of potential output (see equation (17)).

Of course, caring for children contributes to the reproduction of labor between generations, so childcare will inevitably affect the sphere of production in the long run. It could be argued that L_{c_c} will ultimately contribute to α_a in equation (24), as part of the process by which retiring workers are replaced by new workers entering the labor force. However, we abstract from these long-term dynamics in this paper, leaving their full and proper investigation to further research.

7. A Remark on Endogenous Fertility

Suppose that, following Foley (2000) and Heintz and Folbre (2022), we posit that fertility and hence (ceteris paribus) population growth vary inversely with per capita income. Specifically, following Heintz and Folbre, we write the rate of change of the total population as:

$$\dot{P} = \mu \left[\sigma \frac{\beta Y_p}{L_m + L_f} \right]^{-\gamma} P - \epsilon P \qquad (30)$$

where ϵ is the (constant) mortality rate, μ captures the effects of socio-cultural norms on fertility, $\frac{\beta Y_p}{L_m+L_f}$ is current output per working-age adult (with $\beta = \frac{Y}{Y_p}$ assumed constant) and captures the opportunity cost of children—the foregone real output associated with devoting time to children rather than participation in paid production – σ is a scaling parameter that, based on the gendered structure of the labor market, captures the size of the opportunity cost just described for women; and γ is the elasticity of the rate of change of population with respect to the same opportunity cost. Note that,

$$\frac{\beta Y_p}{L_m + L_f} = \frac{\beta Y_p}{(1 - U_{min})L} \frac{(1 - U_{min})L}{L_m + L_f} = \frac{\beta (1 - U_{min})\chi}{a}$$

Substituting this expression into (30) and standardizing by the total population, we arrive at:

$$l = \mu \left[\frac{\sigma\beta(1 - U_{min})\chi}{a}\right]^{-\gamma} - \epsilon \tag{31}$$

Finally, combining (21) and (24) with (20) and then substituting the result into (31) yields:

$$l = \mu \left[\frac{\sigma\beta(1 - U_{min})\chi}{a_0 e^{\left(\delta_{a0} e^{lt} - \frac{[(1-\phi)L_{m0} + (\theta+\psi)L_{f0}]e^{lt}}{\frac{1}{n}\sum_{i=1}^{n} a_{c_{i-1}} e^{\alpha_c}} - \tau\right)t}}\right]^{-\gamma} - \epsilon \tag{32}$$

Equation (32) reveals that when population growth is endogenous to per capita income and productivity is in the sphere of paid production depends on the domestic production of human capacities, the two components of the natural growth rate—the rates of growth of the labor force and labor productivity—are subject to simultaneous interaction and determination. We leave exploration of this simultaneity to further research.