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Buying into inequality: a macroeconomic analysis linking accelerated obsolescence, interpersonal inequality, and potential for degrowth

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This article establishes a theoretical link between accelerated obsolescence and interpersonal inequality of income and wealth. The author designs a simple stock–flow consistent macroeconomic model and simulates an acceleration of obsolescence in different budget and fiscal policy scenarios. His results show that, despite the increase in revenues generated by extra constrained expenditures and the associated multiplicative effects, the economic consequences of fast obsolescence remain negative. As effective disposable income declines for workers and either decreases less or increases for capitalists, income and wealth inequalities are exacerbated. Hence an acceleration of obsolescence has detrimental effects both on distributive and on environmental grounds. Conversely, in line with the degrowth paradigm, the author shows how slowing down obsolescence may be sensible both socioeconomically and environmentally. It would be beneficial to wage earners while reducing pressures on the environment; the only losers would be profit earners.

Keywords: obsolescence, inequality, ecological macroeconomics, degrowth, stock–flow consistent modelling

JEL codes: E12, E21, E62, P46, Q52

1 INTRODUCTION

Environmental and economic goals are often perceived as being opposed to each other. From environmental regulations that may incur costs to businesses and reduce their competitiveness to transitions away from entire sectors of activity such as coal extraction, reconciling the two types of objectives can appear as a challenging task. This article investigates the economy–environment opposition in the case of accelerated obsolescence. By ‘accelerated obsolescence’ we mean the disposal and replacement of goods at a faster rate than what could be feasible in a different socioeconomic and technological system. We do not assume or suggest that obsolescence has accelerated over the past decades or century. Because it leads to higher levels of production, accelerated obsolescence implies higher negative impacts on the environment but also more employment, wages and profits. Yet are we really facing a ‘social dilemma’ as Guiltinan (2009) presents it, or is it possible to somehow satisfy both environmental and economic objectives? The answer depends on the economic objectives that are considered since there can be conflicting interests between various categories of economic agents.

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If the increase in income that goes with the increase in economic activity is in fact not beneficial to workers but instead benefits only capitalists, who are already wealthier than workers, then the positive economic aspect of obsolescence can be questioned. Hence tackling these issues requires us to carry out an analysis at the macroeconomic level (in order to account for second-round multiplicative effects) and to include inequality dimensions in it.

Despite a rich literature on the topic of obsolescence and on the issue of inequality, both strands have remained separate and the connection between the two has not been identified so far by economic theory. It is also absent from the numerous articles that explore and explain the links between inequality and the environment (Berthe/Elie 2015). On the one hand, theories on planned obsolescence have remained at the micro-economic level, showing for instance that asymmetry of information, profit maximisation, and competition and innovation dynamics are drivers of fast obsolescence (Kurz 2015) and that monopolist firms and colluding oligopolists also have an incentive to practise planned obsolescence (Bulow 1986; Waldman 1993). On the other hand, the causes and consequences of inequality have been studied by nearly all economic schools of thought, including the two this article is concerned with: post-Keynesian and ecological economics. Post-Keynesians have emphasised the role of a fair distribution of functional income (the shares of wages and profits in national income) for growth, employment and other macroeconomic variables (Hein/Vogel 2008; Kaldor 1955; Kalecki 1971; Onaran/Obst 2016; Pasinetti 1962); more recently Ederer/Rehm (2020) have shown that interpersonal inequality of wealth (that is, the distribution of wealth at the level of deciles, percentiles or individuals) is likely to increase in Europe over forthcoming years. Ecological economists have started to address concerns regarding the risks of rising inequality in the specific context of slower growth. Jackson/Victor (2016) show that inequality can decrease even when the rate of growth goes to zero and the rate of return on capital is positive, a result that contradicts the ‘fundamental law’ of Piketty (2013). However Stratford (2020) argues that low growth perspectives may lead to the intensification of rent-seeking behaviour, and that increases in rentier power would lead to rising inequality between rentiers and the rest of the population.

Bringing macroeconomic expertise and methodology from post-Keynesian economics together with environmental concerns from ecological economics, this article suggests and explains an original theoretical link between accelerated obsolescence (with its negative environmental consequences) and interpersonal inequality. In Section 2 we briefly lay out the different categories of obsolescence and some historical and empirical facts about this phenomenon. In Section 3 we present our theoretical macroeconomic model built using the stock–flow consistent (SFC) framework of Godley/Lavoie (2012). In Section 4 we show simulations for an acceleration of obsolescence under various budgetary and fiscal policy scenarios. We show that faster obsolescence exacerbates inequality between workers and capitalists (in relative or absolute terms depending on the scenario), on top of degrading the environment. Conversely, in line with the degrowth paradigm, we show in Section 5 how slowing down obsolescence may be both socioeconomically and environmentally sensible. It would benefit wage earners while reducing pressures on the environment; the only losers would be profit earners. Section 6 concludes.

2 ACCELERATED OBSOLESCENCE: SOME DEFINITIONS AND A BRIEF HISTORY

Obsolescence can refer both to physical wear and tear and to what Butt et al. (2015: 24) describe as ‘depreciation in value, impairment of desirability and/or usefulness caused by

new inventions, current changes in design, improved processes of production, or external factors that make a system less desirable and valuable for a continued use'. Thus obsolescence has two sides: users of goods can either suffer it completely involuntarily (when goods become no longer useable) or they can participate in the process (when their desire to use the goods vanishes). In other words, the technical lifetime of a product can be shorter than what is technically feasible, than customers' expectations, or than what would be sustainable, but the economic lifetime (the actual duration before disposal or replacement) can also be 'even shorter' than the technical lifetime (Kurz 2015).

In a sense, obsolescence is a 'normal' phenomenon, however it can happen more or less rapidly. There exist many ways through which producers can obtain shorter replacement cycles from consumers, which is generally called 'planned' obsolescence. Guiltinan (2009: 20) identifies five of them: 'limited functional life design (or "death dating")', 'design for limited repair', 'design aesthetics that lead to reduced satisfaction', 'design for fashion', and 'design for functional enhancement through adding or upgrading product features'. Regarding information technology, premature obsolescence can also come from firms that stop updating their software or from hardware whose performance cannot keep up with more demanding new software (Satyro et al. 2018). Although the expression 'planned obsolescence' is the most widely used in the literature, we prefer the adjectives 'accelerated' or 'premature', which are purposefully broader. Indeed, in our view, 'planned obsolescence' may appear too deterministic and associated with direct interventions from the producer, such as in the case of 'death-dating' or non-maintenance of software.

Premature obsolescence is far from being a new phenomenon. Back in the 1930s, Bernard London (1932) proposed to set a maximum lifetime for each object and to ban the use of items which have passed the threshold. The aim was to boost demand, sales and employment and to help the economy out of the Great Depression. Galbraith (1958) warned about the wasteful nature of annual design changes in the automobile industry. Indeed the average duration of the replacement cycle for cars was only eight years before the Second World War and 11 years after it (Hundy 1976, in Wieser 2017). In the 1950s and 1960s, 'death-dating' was common practice in the United States (Slade 2007, in Guiltinan 2009).

Despite repeated criticism of this phenomenon over decades, a few authors have supported the idea that accelerating obsolescence could have positive economic effects. Blonigen et al. (2017) argue that planned obsolescence is good both for profits and for consumer welfare (because consumers like to have new products), while Waldman (1993) claims that it accelerates innovation. One can also find the argument that new products are more efficient, therefore replacing old ones could be environmentally positive. This was put forward by governments during the 2008–2009 global financial crisis in the case of bonuses for scrapping old cars (Kurz 2015). Yet, in order to assess environmental impacts, looking at fuel or energy efficiency is not sufficient since embodied energy, resource extraction and associated pollutions can offset efficiency gains. Full life-cycle analyses should be used (*ibid.*). For instance, in the case of refrigerators and laptops the increase in the energy efficiency of new models is too small to justify premature discarding. Accordingly, they should be used for longer durations (Bakker et al. 2014).

Since premature obsolescence has been practised for decades, one may wonder whether or not it has intensified over time. Unfortunately, data is very scarce and 'there is a striking dearth of research on historical changes in replacement cycles' (Wieser 2017: 426). A few studies show that the average lifespan of electric and electronic devices and household appliances has been declining in the 2000s, from a few percentage points up to 20 per cent for some appliances (Huisman et al. 2012; Wang et al. 2013). However, the evolution is estimated for short periods of time only. By looking at a few products for which data is available for longer timespans, Wieser (2017) finds no evidence supporting the idea of an acceleration.

For instance, from before the Second World War until the 2000s, the long-term trend in the average lifespan of a car was an upward trend. And for mobile phones, ‘even the orchestrated efforts of leading manufacturers, retailers, and operators at accelerating the replacement of mobile phones had limited success so far, as replacement cycles continued to increase in most recent years’ (ibid.: 429).

Given the lack of evidence regarding the idea of a historical acceleration of obsolescence, we prefer not to take such an evolution for granted. When speaking of accelerated obsolescence, we do not refer to a historical evolution, but, rather, to the idea that arguably obsolescence is currently faster than what could be possible in a different socioeconomic and technological system. Indeed we know from experience that washing machines can last for 40 years or more, that cars from the 1960s are still used and repaired today in many poor countries, that robust furniture can last for decades or centuries, etc.

In the next section we lay out the macroeconomic model with which we study the effects on inequality and on the environment of an acceleration (Section 4) and of a slow-down (Section 5) of obsolescence.

3 THE MODEL

3.1 General structure

Our simple closed-economy model is composed of three institutional sectors: (i) households, with a distinction between workers and capitalists; (ii) firms, aggregated into a single sector which produces two types of goods; and (iii) a public sector that gathers a government and its central bank. Table 1 and Table 2 represent respectively the balance-sheet and transactions matrices.

Firms own a stock of physical, productive capital K that we assume does not depreciate over time. In this article we focus on consumption, and to keep the model as simple as possible we omit investment. The liabilities of firms are equities Q , assumed to be constant in volume and in price. In nominal terms, $K = Q$, so that the net worth of firms remains equal to zero. This is consistent with the fact that profits P are entirely distributed (to capitalist households, who own the firms). The price of goods, the mark-up, and productivity are constant. As a result, the shares of profits and wages in value added do not evolve. Total output, or national income Y , is equal to consumption of both goods C_1 and C_2 plus government spending G ($Y = C_1 + C_2 + G$).

Households are composed of workers and capitalists in fixed numbers N_w and N_c . Apart from equities (owned only by capitalists), the wealth of households is made of

Table 1 Balance-sheet matrix

	Households		Firms	Govt/CB	Σ
	Workers	Capitalists			
High-powered money	$+H_w$	$+H_c$	–	$-H$	0
Equipment goods	$+N_w E$	$+N_c E$	–	–	$+NE$
Productive capital	–	–	$+K$	–	$+K$
Equities	–	$+Q$	$-Q$	–	0
Balance (net worth)	$-V_w$	$-V_c$	0	$-V_g$	$-\Sigma V_i$
Σ	0	0	0	0	0

Note: CB = central bank.

Table 2 Transactions-flow matrix

	Households		Firms	Govt/CB	Σ
	Workers	Capitalists			
Consumption (equipment)	$-C_{1,w}$	$-C_{1,c}$	$+C_1$	$-$	0
Consumption (other)	$-C_{2,w}$	$-C_{2,c}$	$+C_2$	$-$	0
Government spending	$-$	$-$	$+G$	$-G$	0
Wages	$+WB$	$-$	$-WB$	$-$	0
Profits	$-$	$+P$	$-P$	$-$	0
Taxes	$-T_w$	$-T_c$	$-$	$+T$	0
Change in cash	$-\Delta H_w$	$-\Delta H_c$	0	$+\Delta H$	0
Σ	0	0	0	0	0

Note: CB = central bank.

one financial asset, high-powered money H_j , and various tangible assets grouped in the category of ‘equipment goods’. By ‘equipment goods’ we think of all the goods that can be used more than once, as opposed for instance to food and drinks. This category encompasses what is generally considered as ‘durable consumption goods’ (vehicles, furniture, light and heavy appliances, leisure equipment, tools) plus what is considered as ‘semi-durable consumption goods’ (clothes, footwear, and small objects). These goods are subject to depreciation and obsolescence (more details on this in the next sub-section). Equations (1) and (2) show the after-tax disposable income of households YD_w and YD_c (WB stands for the wage bill, T_w and T_c for taxes on workers and on capitalists):

$$YD_w = WB - T_w \quad (1)$$

$$YD_c = P - T_c. \quad (2)$$

The difference between disposable income and expenditure constitutes households’ saving, which incurs variations in their money balances $H_j, j \in \{w, c\}$:

$$\Delta H_j = YD_j - (C_{1,j} + C_{2,j}). \quad (3)$$

The public sector is kept simple: it spends an amount G on goods and services provided by firms; its revenues T come from taxes $T_w = \tau_w WB$ and $T_c = \tau_c P$ levied on the income of households. The difference $G - T$ constitutes the budget deficit DEF , which is financed by the issuance of high-powered money $\Delta H = DEF$; H represents the public debt. Note that, although the government can run a budget surplus (in which case $\Delta H < 0$), this will only happen momentarily in our simulations. As a result, the net worth of the public sector remains negative at all times and we do not need to include a public asset in the model.

3.2 Behavioural equations and other assumptions

We now specify a few assumptions and behavioural functions.

The determinants of consumption for equipment goods and for other goods differ. Regarding the first, we assume that each household holds an amount E of equipment goods, which for simplicity is the same for workers and for capitalists. These goods depreciate at a rate δ that can evolve over time (when obsolescence is accelerated or

slowed down).¹ Our key assumption here is that, whatever the value of the depreciation rate, households need to replace worn out or obsolete goods with new ones. In other words, in a given socio-technological environment, households cannot but replace a broken vehicle or appliance, or renew an old-fashioned smartphone or garment of clothes. Therefore the consumption of equipment goods does not depend on income, instead it is autonomous (constrained):²

$$C_{1,j} = N_j \delta E_{t-1}. \quad (4)$$

The consumption of ‘other goods’, on the other hand, depends on past levels of income and wealth (equation (5)). This feature is consistent with the composition of the category: on top of immediate consumption goods such as food and drinks (the demand for which is relatively inelastic), it includes all kinds of services, for instance tourism and leisure activities, the demand for which is very income-elastic.

$$C_{2,j} = \alpha_{yde,j} YD_{j,t-1}^{eff} + \alpha_H H_{j,t-1} \quad (5)$$

This specification is slightly different from usual (post-)Keynesian consumption functions found for instance in Godley/Lavoie (2012), since it features a concept we call ‘effective disposable income’ (YD_j^{eff}) instead of disposable income. This concept refers to the income that households effectively have at their disposal for discretionary expenditures once tax payments (and also constrained expenditures) have been carried out. In our model, we have:

$$YD_j^{eff} = YD_j - C_{1,j}. \quad (6)$$

We explain in Sections 3.3 and 4 the reasons why, in our view, effective disposable income is a useful concept and is more appropriate than usual disposable income.

One simplifying assumption we make is that hours worked per worker are proportional to output and that the overall number of hours are distributed evenly among all workers. As a result, there is no unemployment. Moreover, our assumption that the wage share and productivity remain constant requires that the hourly pay is fixed. This implies that when aggregate output Y fluctuates, income per household varies not only for capitalists but also for workers.

Finally, the behaviour of the government with respect to budget deficits or surpluses can change according to different scenarios. It can modify its spending or the tax rates, in line with the following dynamics:

$$G = G_{t-1}(1 + g_G) \quad (7)$$

$$g_G = -\eta_G DEF/Y \quad (8)$$

$$\tau_w = \tau_{w,t-1}(1 + g_{\tau_w}) \quad (9)$$

$$g_{\tau_w} = \eta_{\tau_w} DEF/Y \quad (10)$$

$$\tau_c = \tau_{c,t-1}(1 + g_{\tau_c}) \quad (11)$$

$$g_{\tau_c} = \eta_{\tau_c} DEF/Y. \quad (12)$$

1. Being out of fashion can reduce the value of goods, just as physical deterioration does. In most cases the more out of fashion a product, the lower its price.
2. This specification ensures that the nominal stock E of equipment goods per household remains constant.

When the government chooses not to react to a budget deficit or surplus, we have $\eta_G = \eta_{\tau_w} = \eta_{\tau_c} = 0$. When it wishes to bring the deficit-to-GDP ratio or the budget-surplus ratio to zero, one (or several) of the η parameters is (are) set strictly positive.

3.3 Economic well-being, inequality, and ecological damage

Given that, in our model, the consumption of ‘equipment goods’ is forced and only serves the replacement or renewal of previous goods, we consider that it does not bring economic well-being to consumers. For instance, we think that buying a new refrigerator when the one currently in use breaks down does not increase well-being (one could even argue that it decreases well-being). Conversely, we assume that consumption of the second type (category ‘other goods’) is correlated with economic well-being. Thus effective disposable income and wealth, as determinants of this consumption, are correlated with well-being as well.³ In our view, this is one advantage of the concept of effective disposable income over traditional disposable income.

In line with these ideas, when analysing the evolution of inequalities between workers and capitalists we will focus mainly on effective disposable income and wealth.⁴ Our results will illustrate how, although functional income inequality remains unchanged, wealth and interpersonal (effective disposable) income inequality can evolve. The indicators are the following (*pcratio* stands for ‘per-capita ratio’):

$$YD_{pcratio} = \frac{YD_c/N_c}{YD_w/N_w} \quad (13)$$

$$YD_{pcratio}^{eff} = \frac{YD_c^{eff}/N_c}{YD_w^{eff}/N_w} \quad (14)$$

$$H_{pcratio} = \frac{H_c/N_c}{H_w/N_w}. \quad (15)$$

Since workers and capitalists own the same kind and amount of equipment goods, their difference of wealth only comes from financial wealth H_j . As a result, we will refer to $H_{pcratio}$ as a measure of wealth inequality, while strictly speaking it represents financial wealth inequality.

The calibration of our model is such that inequality between workers and capitalists is pre-existing. This comes from the discrepancy between the proportion of capitalists in the population ($N_c/N = 1/10$) and the share of national income they receive ($P/Y = 1/3$). In terms of primary income, a capitalist household earns 4.5 times more than a worker household. With progressive tax rates $\tau_w = 0.2$ and $\tau_c = 0.4$, the ratio of per-capita disposable income drops to 3.4 but since the consumption of equipment goods represents a larger share of income for workers than for capitalists, the ratio of per-capita effective disposable income $YD_{pcratio}^{eff}$ is equal to 4 in our calibration. As for wealth, the ratio of wealth per capita $H_{pcratio}$ is equal to 6.4.⁵

3. We are not dealing with the numerous non-economic dimensions of well-being, or with life satisfaction in general, which are more complex issues.

4. We also keep track of inequality of disposable income in order to show how it differs from inequality of effective disposable income.

5. The values for the propensities to consume are the following: $\alpha_{yde,w} = 0.75$; $\alpha_{yde,c} = 0.6$; $\alpha_H = 0.15$. The former two are ‘reasonable’ values compatible with standard estimates; the latter is calibrated so as to get a plausible initial debt-to-GDP ratio.

Finally, we keep track of the negative effects of production, consumption and disposal on the environment with an indicator we call *ecological damage* (ED). Studies on obsolescence often mention the unnecessary generation of waste, focusing on downstream environmental impacts of production. However, the environmental consequences of producing more goods go far beyond the generation of waste, since this implies almost always extracting more non-renewable resources from the ground, using more energy, machines and vehicles to make and transport the goods, opening more stores (air-conditioned with doors open) to sell them, etc. Hence we consider our variable ED to be a synthetic indicator that encompasses greenhouse gas emissions but also resource use and emissions of water, soil and air pollutants.⁶ For simplicity, its relationship with the consumption of each type of good is linear:

$$ED = \beta_1 C_1 + \beta_2 C_2. \quad (16)$$

In our calibration, $\beta_1/\beta_2 = 2$, to reflect the fact that the production of equipment goods is generally energy- and material-intensive.

4 ACCELERATION OF OBSOLESCENCE

In this section we use our model to simulate an acceleration of obsolescence. For the first ten periods, before the acceleration, the economy is at a stationary state. The level of output at this state Y^* is determined and equal to the ratio of public spending G^* to the average tax rate $\tau^* = (\tau_w^* WB + \tau_c^* P)/Y$.⁷ In period 11 the rate of depreciation, initially equal to 20 per cent, increases to 30 per cent and remains at this value for the rest of the simulation. This acceleration of obsolescence forces the consumption of equipment goods upward both for workers and for capitalists. As a result, output increases beyond its initial stationary-state level and a budget surplus appears. The next sub-sections explain the evolution of the economy, and especially of inequalities, in different scenarios regarding the response from the government to the budget surplus: no government response in the first main scenario, an increase in public spending in the second, and tax cuts in alternative scenarios.

4.1 Without government response (scenario 1)

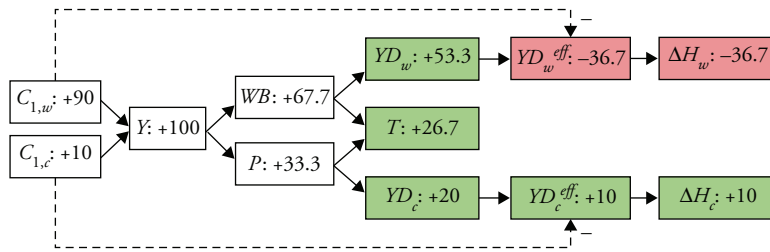
In this scenario, the government does not react in any manner to a budget surplus or deficit. Our simulation results show that the economic impacts of the acceleration of obsolescence are different in the short run and in the medium to long run (hereafter called the medium run, since the *long run* is a tricky concept).

4.1.1 The very short run

Figure 1 shows the very first effects of an acceleration of obsolescence (period 11 of the simulation). An increase in consumption of good 1 by 100 monetary units adds

6. Our indicator should not be confused with damage functions of environmental economists who try to estimate damage on production, capital or productivity incurred by climate change.

7. The expression for Y^* can be easily derived from the condition $\Delta H^* = 0 = G^* - \tau^*$ necessarily verified at the stationary state. The stationary state values for all variables can then be deduced analytically, which allows us to initialise the model exactly at the stationary state. For subsequent timesteps, the values for all variables are found numerically through a simple iteration algorithm which can deal with the simultaneity of equations.



Notes: Grey panels represent the seemingly positive income effects for workers, capitalists and the government; black panels illustrate/emphasise that in reality the effects are negative for workers.

Figure 1 Differentiated income effects on workers and capitalists of accelerated obsolescence in the very short run

67.7 units to wage income and 33.3 units to profits. In terms of primary income, both classes benefit. After-tax disposable income increases respectively by 53.3 and 20 units, while government revenues increase by 26.7 units (recall that $\tau_w = 0.2$ and $\tau_c = 0.4$). Stopping the reasoning at this stage would give the impression that every actor except the environment is better off: economic activity, wages, profits, and tax revenues all increase. However, by simply looking at effective disposable income instead of usual disposable income one can realise that the issue is more complex. After subtracting the constrained expenditures to examine the income effectively at the disposal of households to consume other goods and services, it appears that workers are losing 36.7 units of purchasing power while capitalists still enjoy a 10-unit increase of effective disposable income. In the very short run these amounts are directly impacting the wealth of households: workers are forced to dissave while capitalists see their stock of savings increase. Coherently with our macroeconomic framework, the improvement of the financial position of the public sector corresponds to the overall deterioration of the position of the private sector (26.7 units).

Let us emphasise this crucial result: at least in the very short run, an acceleration of obsolescence increases inequalities of effective disposable income and of wealth. This is an ‘absolute’ increase in inequality, since workers are losing out while capitalists are winning.

Here a few remarks need to be made. First, this result is closely tied to the fact that inequalities pre-exist to the acceleration of obsolescence. The dynamics explained above take place because the extra spending on good 1 comes in majority from workers (in line with their proportion in population: 90 per cent) while despite the progressive tax system capitalists are able to receive a larger share of the extra after-tax income ($20/73.3 = 27$ per cent) compared to their contribution to the extra initial spending (10 per cent). Thus our qualitative results are robust to changes in parameter values, as long as pre-existing inequalities are sufficiently high. A very high tax rate on the income of capitalists, for instance, would change the outcome.

Second, we think our results may be conservative. Indeed, in reality, wealthy people generally own high-quality equipment goods which have longer lifetimes and are less subject to obsolescence, although this is more the case for physical durability than for the fashion and software-related dimensions of obsolescence. As a result, the increase in forced expenditures could be lower for capitalists than for workers. Levels of inequality could increase even more.

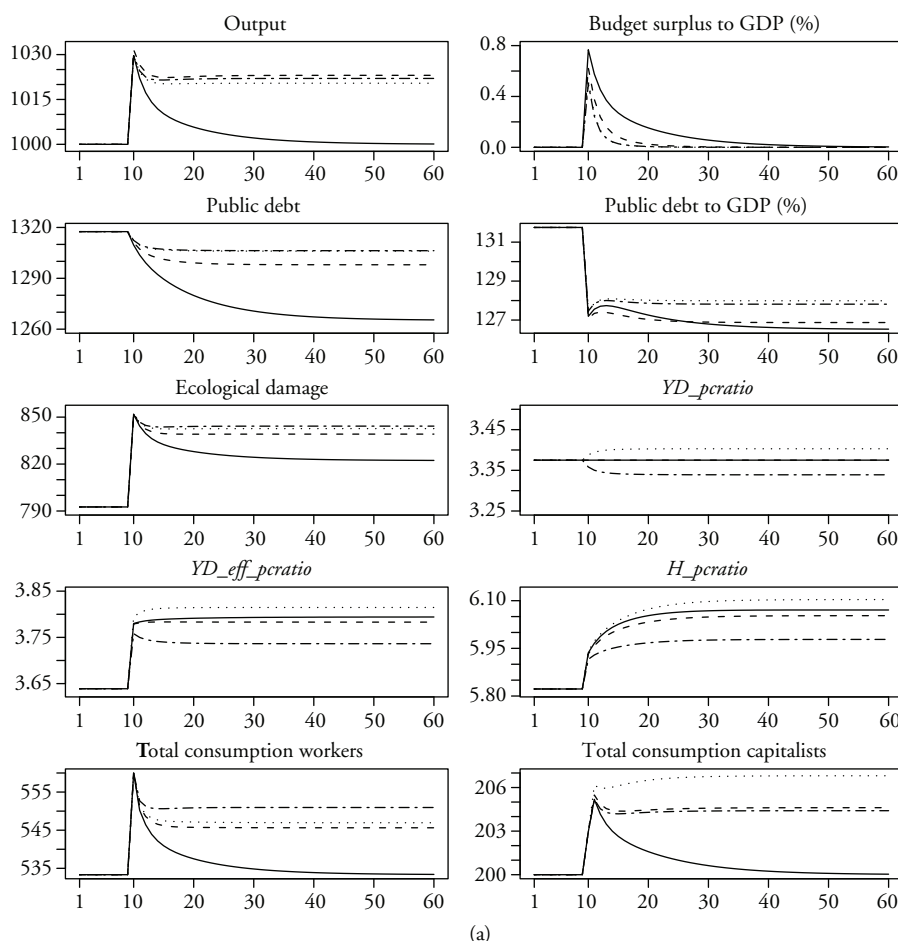


Figure 2 Evolution of key variables after an acceleration of obsolescence in different scenarios: no government response (solid lines), increase in government spending (dashed lines), tax cuts on both classes (dotted lines) and tax cuts on workers only (dotted-and-dashed lines)

4.1.2 The short and the medium run

While the ‘very short run’ described the moment of acceleration of obsolescence, we understand the short run as the couple of periods that follow (fewer than ten periods) and the medium run as the rest of the simulation periods.

The solid lines in Figures 2a and 2b show how key variables evolve over time in this first scenario. We have explained why, when obsolescence accelerates in period 11, effective disposable income and wealth diminish for workers and rise for capitalists. Thus, in period 12, workers decide to reduce their consumption of good 2 while capitalists are able to step it up (recall equation (5)). Importantly, the decrease in $C_{2,w}$ is larger than the increase in $C_{2,c}$.⁸ Overall consumption of good 2 starts going down, along with total

8. This result does not rely upon our assumption that the propensity to consume $\alpha_{yde,w}$ is larger than $\alpha_{yde,c}$. It holds also in the case where $\alpha_{yde,w}$ and $\alpha_{yde,c}$ are equal.

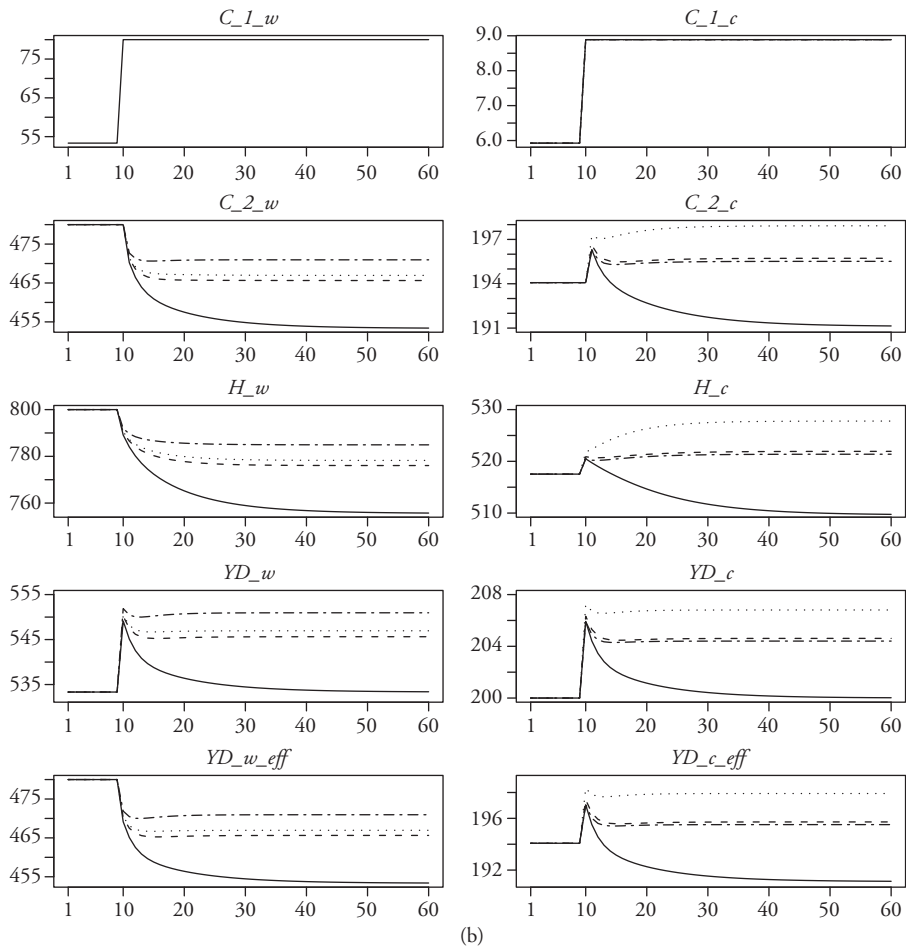


Figure 2 (continued)

output and the budget surplus. This contractionary effect reduces both wage and profit income. Thus the trend for primary incomes, which spiked in period 11, is reversed in period 12. On one side, the situation of workers, whose effective disposable income and wealth had already started to diminish, worsens period after period. They are forced to continue both reducing consumption $C_{2,w}$ and drawing upon their dwindling savings H_w . Note that the increase in $C_{2,c}$ in period 12, and thereby the additional wage revenues it generates, is not sufficient to prevent $C_{2,w}$ from continuing to fall. On the other side, capitalists see their initial upward trend in consumption of good 2 and in wealth accumulation being reversed. Yet in the short run $C_{2,c}$ and H_c remain higher than their initial levels.

As time passes the fall in overall consumption of good 2 continues, along with its negative impacts on incomes, consumption and wealth described above. This recessionary loop goes on until the level of output Y is brought back to its initial stationary-state level. The composition of output has changed though: the increase in consumption of equipment goods due to the acceleration of obsolescence has forced an equivalent reduction in

consumption of other goods. Hence, given our assumptions regarding the relative intensities of ecological damage and the economic well-being (or ‘usefulness’) associated with the consumption of goods 1 and 2, the final stationary state is worse both for the environment and for economic well-being. Due to the budget surplus during the transitional phase, the final level of the public debt is lower than the initial level; the counterpart is that total private wealth is lower than it was initially.

Here we shall stress that, whereas in the short run capitalists could enjoy an increase in their effective disposable income and wealth, this does not hold in the medium run. Importantly, it is the decrease in consumption of good 2 by workers that forces the income of capitalists downwards and eventually brings YD_c^{eff} and H_c to values below their initial levels.

4.1.3 Further remarks

It is worth emphasising one key aspect of our results. When reflecting about accelerated obsolescence one could think that, even if the useless nature of consumption of replacement or renewal is acknowledged, the extra income generated by this spending allows for increases in consumption of goods and services that improve economic well-being. In other words, obsolescence would have a bad side (its environmental impacts) and a good side (its economic impacts). In this first scenario, in which the government does not react to a budget surplus, our macroeconomic analysis shows quite the contrary. In the short run, the extra income generated is not sufficient to provoke an overall increase in ‘useful’ consumption. If any economic benefits are to be expected, capitalist households, not workers, would receive them. In the medium run, the increase in national income vanishes and economic well-being worsens for both classes.

Finally, through our analysis we can demonstrate how important it is to look at inequalities with the right indicators. Figure 2a shows that by only looking at the ratio $YD_{peratio}$ one could believe that the pace of obsolescence has no impact on inequality. The levels of disposable income YD_w and YD_c (in Figure 2b) are even more misleading since they reveal no change in inequality but also seem to indicate that the economic situation of both workers and capitalists improves momentarily. The ratio of per-capita effective disposable income $YD_{peratio}^{eff}$, however, makes it clear that inequality – understood in terms of income effectively at the disposal of households after having carried out constrained expenditures – increases when obsolescence accelerates. Importantly, wealth inequality also rises (see $H_{peratio}$). Moreover, looking at the levels YD_w^{eff} and YD_c^{eff} complements the analysis made with the ratio $YD_{peratio}^{eff}$ because it makes it possible to distinguish absolute from relative evolutions in inequality. In Figure 2b we can see that in the short run effective income inequality increases in absolute terms (YD_w^{eff} falls while YD_c^{eff} rises), whereas in the medium run it increases only in relative terms (both YD_w^{eff} and YD_c^{eff} go down, but the drop is stronger for workers (per capita) than for capitalists). Ultimately the relative increase in inequality of effective disposable income comes from the fact that the expenditures on equipment goods represent a larger share of income for worker households than for capitalist households, which in turn is linked to pre-existing inequality.

4.2 With government responses (scenarios 2 and 3)

In this sub-section, we investigate how the results obtained in the previous scenario may change when the government decides to respond to the rise of a budget surplus either by increasing public spending or by cutting taxes.

4.2.1 Increase in public spending (scenario 2)

For this scenario the parameter η_G is set equal to 1.2. It represents the pace at which the government will increase its public spending in response to the budget surplus.⁹ The simulation results are shown by the dashed lines in Figures 2a and 2b.

The main difference from the previous scenario is that, by boosting aggregate demand and therefore wage and profit income, the government is able to break the recessionary loop described in Section 4.1.2. Effective disposable income, after falling for workers and rising for capitalists just when obsolescence accelerates, does not decrease as much as in the first scenario, thanks to the government stimulus. The decrease does take place, but it is rapidly stopped. Accordingly, consumption of good 2 is not forced downwards as much either. Overall the inequality indicators $YD_{peratio}^{eff}$ and $H_{peratio}$ increase slightly less than in scenario 1.

Given our model specification (equations (7) and (8)), public spending continues to step up until the budget surplus is brought to zero, and its level is maintained thereafter. As a result the economy reaches a new stationary state in which output stabilises at a higher level than in the initial stationary state (recall $Y^* = G^*/\tau^*$). As in the case without government response, the public debt stabilises below its initial level, but due to the rise in public spending the budget surplus disappears more quickly and the final debt level is higher than in scenario 1. Since output is higher, though, the public-debt-to-GDP ratio stabilises at a value close to the case of scenario 1.

These results may appear all positive at first sight. However, some elements need to be underlined. Admittedly, workers are not forced to cut their consumption of good 2 as much after the increase in their constrained expenditures. Yet they do need to reduce it and they still see their effective disposable income and their savings dwindling. Conversely, part of the initial increase in the effective disposable income of capitalists is maintained. These households can keep consuming more of good 2 compared to their situation before the acceleration of obsolescence, while at the same time being able to accumulate more wealth. Clearly their economic well-being improves. Therefore, contrary to scenario 1 in which absolute increases in inequalities quickly transformed into relative increases (both classes were losing out, but workers more so than capitalists), here absolute increases are maintained in the new stationary state. On top of this, as final aggregate output is higher than in scenario 1, so is ecological damage.

Summing up, despite the partial reduction in workers' losses when compared to scenario 1, the following must be considered: the increases in inequality are comparable to scenario 1 in relative terms, but in this case they remain absolute increases, not just relative ones. Ecological damage rises more than without the reaction from the government. Arguably, the increase in public spending considered here does not solve the problems created by the acceleration of obsolescence.

4.2.2 Tax cuts (scenario 3)

In this last scenario of accelerated obsolescence, the government takes the apparition of a budget surplus as an opportunity to cut taxes. We explore the cases of tax cuts for workers

9. Our model is a toy model designed to explain some mechanisms qualitatively, not quantitatively. Thus the parameter η_G is simply calibrated so that the simulation graphs illustrate these mechanisms clearly. Our qualitative results are robust to changes in the value of η_G . Only one of them is altered when the pace of government response is too slow, as explained in Section 4.2.3.

and for capitalists ($\eta_{\tau_w} = \eta_{\tau_c} = 1.8$) and of tax cuts for workers only ($\eta_{\tau_w} = 4$, $\eta_{\tau_c} = 0$). Comparing the simulation results quantitatively with scenario 2 would require the calibration of these parameter values so as to get an equivalent budget expansion. Here we only do a qualitative comparison.

The simulation results show that the outcome is similar to scenario 2 for almost all variables. For instance, aggregate output and ecological damage stabilise above their initial values. Since fiscal policy can affect one class more than the other, one clear difference with scenarios 1 and 2 is the possibility for inequality of disposable income to evolve (not only the effective, also the usual measure of it).

The dotted-and-dashed lines in Figures 2a and 2b show a remarkable result: even when tax cuts target only workers and not capitalists, inequalities of effective disposable income and of wealth rise. Moreover, this is an absolute increase (workers lose out while capitalists are better off). The explanation for this is twofold. On the one hand, although the tax cut prevents the effective disposable income of workers from continuing to fall after the initial drop, the situation of workers remains worse after the acceleration of obsolescence than before it. On the other hand, as the tax cut breaks the recessionary loop described in Section 4.1.2, the effective disposable income of capitalists is not pushed downwards and its initial increase is mostly maintained.

This quick analysis demonstrates that cutting taxes is not a satisfactory response to an acceleration of obsolescence either. There might be no satisfactory response apart from preventing obsolescence itself.

4.2.3 Further remarks

First, we tested for different values for the parameters η_G , η_{τ_w} and η_{τ_c} that represent the responsiveness of the government to budget deficits or surpluses. When the reactions are too small and too slow, only part of the results described above can be observed. The final level of output is still higher than before the acceleration of obsolescence, but the increase is smaller than in the case of strong and fast reactions. More importantly, in the medium run the increases in inequalities of effective disposable income and of wealth are only relative (like in the scenario without government response), whereas they remain absolute increases when the reactions of the government are stronger.

Second, we stress that the increase in economic activity observed in scenarios 2 and 3 means an increase in total hours worked. Economists generally consider this to be a positive outcome, because of its effect on employment. In fact, more time is dedicated to the production of soon-to-be obsolete goods, while the production of other goods diminishes. Overall, this means that more time is devoted to production and less to non-commodified activities. Only a minority of people benefit from this situation. The rest simply work more and have access to less non-obsolescence-related goods. Such a society is dysfunctional and it should reverse the dynamics as shown in Section 5.

5 A POTENTIAL FOR DEGROWTH

The analysis conducted above can be symmetrically transposed to the case of a slowdown of obsolescence. This opens an interesting potential for a transition in line with the degrowth paradigm, provided obsolescence can indeed be curbed. In our opinion, slowing down obsolescence requires the implementation of regulatory measures. These can include the obligation for manufacturers to make products repairable by design and to ensure

spare parts are available for many years, as well as the obligation for technological firms to continue updating software for long periods of time. Advertising should be strongly limited, and secondhand markets should be facilitated. One could also think of changes in pricing schemes, for instance to prevent hiding the high price of smartphones in the prices of phone contracts. However, the existing research on the behaviour of consumers with respect to the replacement of durable goods is insufficient (Gultinan 2009). A proper analysis of how obsolescence could be curbed would require a transdisciplinary approach and is beyond the scope of this article.

In this section we assume that obsolescence can be slowed down, and we use our model to simulate the economic and environmental effects of it. Let us briefly outline the key features of such a transition.

As the rate of depreciation δ is brought from 20 per cent down to 10 per cent, the flow of consumption of equipment goods is reduced both for worker and for capitalist households.¹⁰ The simulation results are shown in Figures 3a and 3b. Output drops and a budget deficit arises. Workers and capitalists see their disposable income falling, yet, for workers, effective disposable income goes up while for capitalists it diminishes, at least in the short run. Workers are able to both increase their consumption of other goods and accumulate wealth, whereas capitalists are forced to reduce their consumption $C_{2,c}$ and to draw on their stock of wealth. In the short run, society undergoes an absolute reduction in inequalities of effective disposable income and of wealth.

If the government does not react to the budget deficit (solid lines in Figures 3a and 3b), a ‘rebound effect’ takes place. Workers continue to increase their consumption of good 2; output grows as well as wage and profit income. The situation of capitalists, initially negatively impacted, quickly improves. These households can also increase their consumption of good 2 and the reduction in inequalities becomes relative rather than absolute (both classes are better off, but workers more so than capitalists). Eventually output is brought back to its initial level, the deficit is closed, and public debt stabilises above its initial level. Production has partly shifted from good 1 to good 2, thus despite the rebound effect ecological damage is slightly lower than in the initial state.¹¹

If the government decides to increase tax rates (dotted and dotted-and-dashed lines in Figures 3a and 3b),¹² the rebound effect can be tamed. Output does not grow back to its initial level, thus the reduction in ecological damage is offset less and the environmental situation improves more than it did without government response. Importantly, the reduction in inequalities remains absolute even in the medium run: the effective disposable income and wealth of capitalists is reduced whereas the contrary holds for workers. Even in the extreme case where tax increases are borne by workers only (dotted-and-dashed lines in Figures 3a and 3b), capitalists still lose out and workers are still able to increase both their consumption of good 2 and their stock of savings. All this holds despite

10. This has no impact on the stock of equipment goods that each household can enjoy at any period of time, which remains unchanged.

11. This result relies on our assumption that consuming good 2 pollutes less than consuming good 1. Yet if the substitution takes place with the most polluting components of good 2, such as airplane travel, the environmental situation could worsen instead of improving.

12. Here we rule out the case of a diminution of public spending, since it is less in line with the values of the degrowth paradigm.

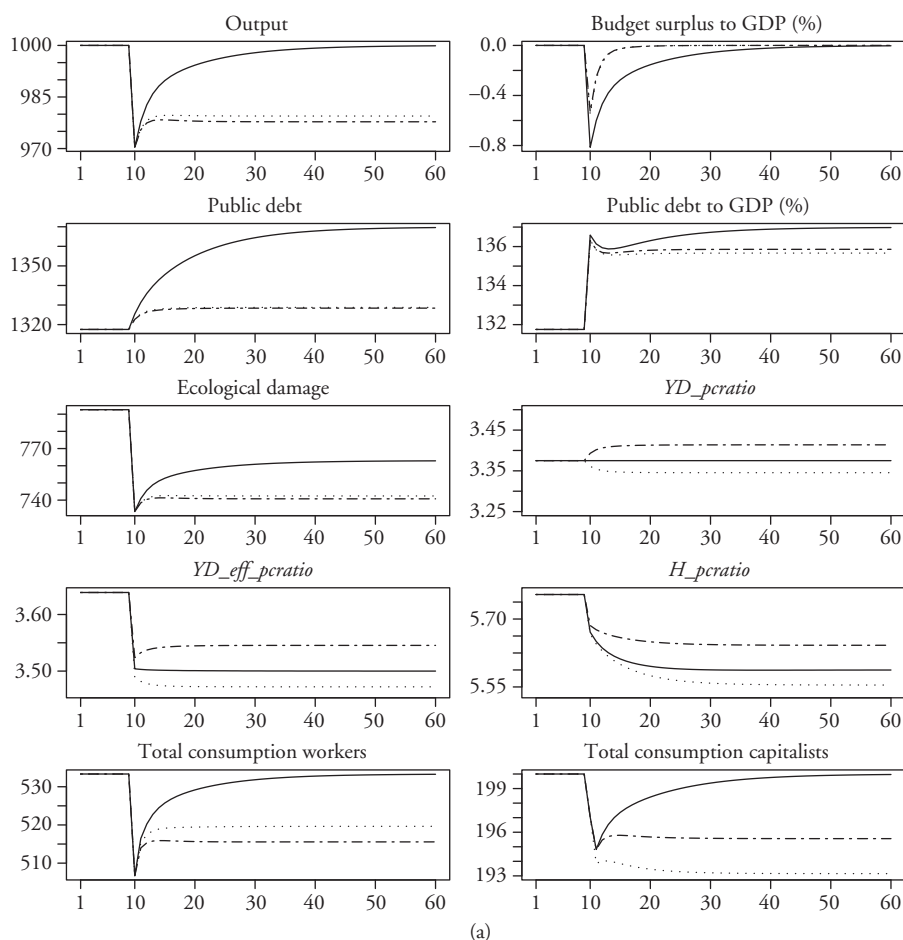


Figure 3 Evolution of key variables after a slowdown of obsolescence in different scenarios: no government response (solid lines), tax increases on both classes (dotted lines), and tax increases on workers only (dotted-and-dashed lines)

the fact that the primary (that is, before-tax) income of workers shrinks due to the reduction in aggregate output. The working-time reduction scheme ensures that the diminution of the collective workload benefits every worker instead of creating unemployment. Overall, and despite higher tax rates, workers can increase their discretionary consumption slightly, enjoy more time outside paid work, *and* benefit from a less damaged environment. The crucial element making this possible is the reduction in the needs of people, which occurred in the first place from the slowdown of obsolescence.

This scenario shows that fighting against accelerated obsolescence does not necessarily lead to an opposition between economic and environmental objectives (Guiltinan's 2009 'social dilemma'), provided we accept that the accumulation of wealth for capitalists is not part of these objectives.

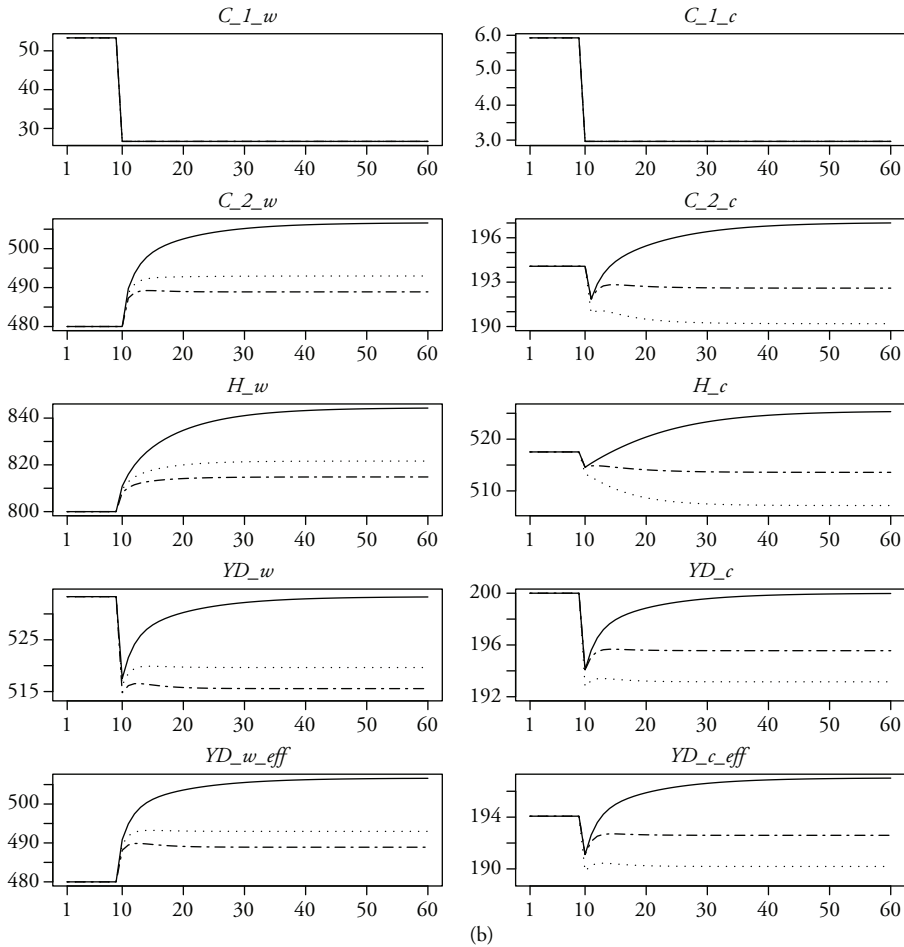


Figure 3 (continued)

6 CONCLUSION

This article establishes a theoretical link between accelerated obsolescence and interpersonal inequality of effective disposable income and of wealth between workers and capitalists. Thanks to this link we show that fighting against accelerated obsolescence does not necessarily lead to an opposition between economic and environmental objectives, provided we accept that the accumulation of wealth for capitalists is not part of these objectives.

These results are obtained and illustrated with the help of a simple stock–flow consistent macroeconomic model, with which we simulate an acceleration and a slowdown of obsolescence in different budgetary and fiscal policy scenarios. Our conclusions can be summarised as follows.

First, we challenge the idea that by boosting economic activity, faster obsolescence could increase economic well-being for workers. In fact the increase in workers' income

is insufficient to compensate extra constrained expenditure. Workers see their effective disposable income dwindling, and are forced to draw on their savings and to reduce discretionary consumption.

Second, capitalists are either hit less badly relative to workers or they benefit from faster obsolescence. As a result, an acceleration of obsolescence exacerbates pre-existing inequalities of income and of wealth between workers and capitalists. Importantly, identifying these dynamics requires us to look at inequality with the right indicators. Traditional measures based on after-tax disposable income show no impact of the pace of obsolescence on inequality, and are even more misleading as they indicate that the economic situation of workers improves in absolute terms. When needs evolve, using measures based on effective disposable income is crucial.

Finally, our scenario of slowing down obsolescence draws positive prospects for a degrowth transition. Inequality of effective disposable income and of wealth can be reduced and at the same time the environmental situation can improve. If tax increases are implemented, the rebound effect can be tamed and environmental gains can be higher than without fiscal reaction. Following the reduction in aggregate output, a working-time reduction scheme ensures that the diminution of the collective workload benefits every worker instead of creating unemployment. Despite higher tax rates, workers can increase their discretionary consumption slightly, enjoy more time outside paid work, and benefit from a less damaged environment. Capitalists, on the other side, are the only losers in such a transition. Therefore putting an end to the socially and environmentally wasteful dynamics of accelerated obsolescence means going against their interests, and may require changing the capitalist system at its roots.

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REFERENCES

- Bakker, C., Wang, F., Huisman, J., Den Hollander, M. (2014): Products that go round: exploring product life extension through design, in: *Journal of Cleaner Production*, 69, 10–16.
- Berthe, A., Elie, L. (2015): Mechanisms explaining the impact of economic inequality on environmental deterioration, in: *Ecological Economics*, 116, 191–200.
- Blonigen, B.A., Knittel, C.R., Soderbery, A. (2017): Keeping it fresh: strategic product redesigns and welfare, in: *International Journal of Industrial Organization*, 53, 170–214.
- Bulow, J. (1986): An economic theory of planned obsolescence, in: *The Quarterly Journal of Economics*, 101(4), 729–749.
- Butt, T.E., Camilleri, M., Paul, P., Jones, K. (2015): Obsolescence types and the built environment: definitions and implications, in: *International Journal of Environment and Sustainable Development*, 14(1), 20–39.
- Ederer, S., Rehm, M. (2020): Will wealth become more concentrated in Europe? Evidence from a calibrated post-Keynesian model, in: *Cambridge Journal of Economics*, 44(1), 55–72.
- Galbraith, J.K. (1958): *The Affluent Society*, Boston: Houghton Mifflin.
- Godley, W., Lavoie, M. (2012): *Monetary Economics: An Integrated Approach to Credit, Money, Income, Production and Wealth*, Basingstoke, UK: Palgrave Macmillan.

- Guiltinan, J. (2009): Creative destruction and destructive creations: environmental ethics and planned obsolescence, in: *Journal of Business Ethics*, 89(1), 19–28.
- Hein, E., Vogel, L. (2008): Distribution and growth reconsidered: empirical results for six OECD countries, in: *Cambridge Journal of Economics*, 32(3), 479–511.
- Huisman, J., Van der Maesen, M., Eijsbouts, R.J.J., Wang, F., Baldé, C.P., Wielenga, C.A. (2012): The Dutch WEEE flows, United Nations University, ISP–SCYCLE, Bonn, Germany.
- Hundy, B.B. (1976): The durability of automobiles, in: *Resources Policy*, 2(3), 179–192.
- Jackson, T., Victor, P.A. (2016): Does slow growth lead to rising inequality? Some theoretical reflections and numerical simulations, in: *Ecological Economics*, 121, 206–219.
- Kaldor, N. (1955): Alternative theories of distribution, in: *The Review of Economic Studies*, 23(2), 83–100.
- Kalecki, M. (1971): *Selected Essays on the Dynamics of the Capitalist Economy 1933–1970*, Cambridge, UK: CUP Archive.
- Kurz, R. (2015): Quality, obsolescence and unsustainable innovation, in: *Review of Contemporary Business, Entrepreneurship and Economic Issues*, 28(2), 511–522.
- London, B. (1932): *Ending the Depression Through Planned Obsolescence*, self-published text.
- Onaran, O., Obst, T. (2016): Wage-led growth in the EU15 member-states: the effects of income distribution on growth, investment, trade balance and inflation, in: *Cambridge Journal of Economics*, 40(6), 1517–1551.
- Pasinetti, L.L. (1962): Rate of profit and income distribution in relation to the rate of economic growth, in: *The Review of Economic Studies*, 29(4), 267–279.
- Piketty, T. (2013): *Le capital au XXI^e siècle*, Paris: Editions du Seuil.
- Satyro, W.C., Sacomano, J.B., Contador, J.C., Telles, R. (2018): Planned obsolescence or planned resource depletion? A sustainable approach, in: *Journal of Cleaner Production*, 195, 744–752.
- Slade, G. (2007): *Made to Break: Technology and Obsolescence in America*, Cambridge, MA: Harvard University Press.
- Stratford, B. (2020): The threat of rent extraction in a resource-constrained future, in: *Ecological Economics*, 169, No 106524.
- Waldman, M. (1993): A new perspective on planned obsolescence, in: *The Quarterly Journal of Economics*, 108(1), 273–283.
- Wang, F., Huisman, J., Stevels, A., Baldé, C.P. (2013): Enhancing e-waste estimates: improving data quality by multivariate Input–Output analysis, in: *Waste Management*, 33(11), 2397–2407.
- Wieser, H. (2017): Ever-faster, ever-shorter? Replacement cycles of durable goods in historical perspective, in: Bakker, C., Mugge, R. (eds), *Product Lifetimes and the Environment*, Conference Proceedings, Delft: Delft University of Technology and IOS Press, 426–431 (published online).