A Hybrid AB-SFC Macroeconomic Model with an explicit distribution of income and wealth

Working Notes

Michele Ciruzzi*

9th March 2023

1 Introduction

1.1 Aims

The long-term goal of this model is to highlight the macroeconomic and distributional effects of some welfare policies. The focus is put in particular on some (recent) policies yet unapplied in the real world as Universal Basic Income, Job Guarantee schemes, or the presence of only cooperative firms.

Enhancement: Foundational Economy − 1

To better characterize the differences in behaviour among low- and high-income households it is possible to refer to the theoretical framework provided by Foundational Economy (Arcidiacono et al. 2018). It suggests that a significant part of the economic activities are instrumental not to the extraction of rents from capital, but to addressing essential needs and to building up shared infrastructures

> "It argues that the well-being of Europe's citizens depends less on individual consumption and more on their social consumption of essential goods and services – from water and retail banking, to schools and care homes – in what we call the foundational economy. Individual consumption depends on market income, while foundational consumption depends on infrastructure and delivery systems of networks and branches, which are neither created nor renewed automatically, even as incomes increase. The distinctive, primary role of public policy should therefore be to secure the supply of basic services for all citizens. If the aim is citizen well-being and flourishing for the many not the few, then European politics at regional, national and EU level needs to be refocused on foundational consumption and securing universal minimum access and quality." (Arcidiacono et al. 2018)

An updated version of this paper and all the source code and the instructions required to replicate the paper are available at `https://github.com/TnTo/FE/`

Highlighted parts of the text indicate substantial choices to be taken.

*mciruzzi@uninsubria.it - `https://orcid.org/0000-0003-1485-1204`

1

> **Enhancement: Welfare policies**
> The first version of the model will be as simple as possible to create a robust baseline. Subsequent iterations of the model will explore different welfare policies and how to model them.

2 General Hypothesis

2.1 Time

The timescale of the first version of the model should be relevant to calibrate the model on real data.

An adaptive approach for the agents' behaviour may work better using a higher frequency model that covers a shorter timespan (e.g. one month per tick, 15 years length, 180 time steps in total), because of the smaller variations expected at each tick.

Moreover, in a future version of the model, the simulation's timespan has to be long enough to observe the effects of introducing a policy. But, at the same time, it is unreasonable to keep the simulation running over 5-10 years after the policy's introduction because, in any real-world context, a government can tune or revert the policy afterwards.

2.2 Close Economy

The assumption of a close economy strongly reduces the complexity of the model but prevents observing some economic phenomena like export-led growth (such as for Italy or Germany) or the offshoring of labour-intensive productions. Nevertheless, this is a common hypothesis which is used also in this model.

> **Enhancement: Multi-Country Model**
> A compromise for future development is to model in an AB-SFC setting the main economy of the model while keeping aggregated (SFC only) the other economies.

2.3 Sectors

The model includes the core sector of most SFC models (Nikiforos and Zezza 2017). Of those, three (Banks (B), Government (G) and Central Bank (C)) are represented by a single agent because unique in the model or described as an aggregate sector, while the remaining two (Households (H) and Firms (F)) are disaggregated and constitute the Agent-Based part of the model.

Firms are considered as different sectors in the model matrices depending on the goods produced.

2.4 Real Assets

The model comprises two kinds of real assets: Capital Goods (K) and Consumption Goods (G). Only Capital Goods are durable.

> **Enhancement: Foundational Economy − 2**

In order to model the idea of a Foundational Economy the single representative Consumption Good can be split into a representative Foundational Consumption Good and another kind of non-Foundational Consumption Goods. The intuition which can be followed is that each Household aims to consume a certain amount of Foundational Goods before to start consuming the other Goods. Additionally, the non-monetary transfers by the Government should comprise only Foundational Goods.

2.5 Financial Assets

The model includes five different financial assets. Bank Deposits (D) of Households and Firms, which are not interest-bearing. Loans (L) issued by the Banks to Firms, which interest rate is Firm-specific and fixed by the Bank. Bank Bonds (S, like shares) held by Households, which interest rate is fixed each period by the Bank. Banks Reserves and Government Account at the Central Bank (R), which are not interest-bearing. Government Bonds (T, like treasure bonds) hold by Bank and Central Bank, and which interest rate is fixed by the Central Bank.

3 Matrices

3.1 Balance Sheet Matrix

	H	F_C	F_K	B	G	C	Tot.
D	$+D_H$	$+D_{F_C}$	$+D_{F_K}$	$-D$			0
S	$+S_H$			$-S$			0
L		$-L^{F_C}$	$-L^{F_K}$	$+L$			0
T				$+T_B$	$-T$	$+T_C$	0
R				$+R_B$	$+R_G$	$-R$	0
K		$+pK_{F_C}$	$+pK_{F_K}$				$+pK$
Tot.	$+V_H$	$+V_{F_C}$	$+V_{F_K}$	$+V_B$	$+V_G$	$+V_C$	$+pK$

V is the Net Worth of the sector.

3.2 Transactions Matrix

	H	F_C	F_K	B	G	C	Tot.
Consumption	$-pG_H$	$+pG$				$-pG_G$	0
Investment		$-pK_{F_C}$	$+p(K - K_{F_K})$				0
Wages	$+W$	$-W^{F_C}$	$-W^{F_K}$				0
Taxes	$-T$				$+T$		0
Transfers	$+M$				$-M$		0
F Profits		$-\Pi^{F_C}$	$-\Pi^{F_K}$	$+\Pi$			0
C Profits					$+\Pi$	$-\Pi$	0
S Interests	$+rS$			$-rS$			0
L Interests		$-rL^{F_C}$	$-rL^{F_K}$	$+rL$			0
T Interests				$+rT_B$	$-rT$	$+rT_C$	0

4 Sectors

4.1 Households

In this model, the core agents (consumer, worker, capitalist) represent a household rather than a single individual. This is a very common approximation in economics and I think it is reasonable as long as we are not going into modelling education paths and care work, where the gender asymmetries become very relevant.

Each agent is characterized by an education level assigned when it enters the simulation replacing a retired agent inheriting their wealth, and gains experience when working in the same sector (Capital/Essential/Other) without an employment gap. The education level is assigned with a probability related to the inherited wealth and provides the starting skill level. Skills s evolve like in Dosi et al. (2018), which means $s_t = (1 + \phi)^\delta s_{t-1}$ where $\delta = 1$ if the household is employed in the same sector of the previous time step, $\delta = 0$ if the household is still employed but in a different sector, $\delta = -1$ if the household is unemployed.

Enhancement: Training

Two factors in the development of the skills can be introduced.

One on the welfare policies side is the possibility for the government to organize training programs for the unemployed to prevent the loss of skills on even increase them.

The second one relates to the actual job done: it is reasonable to assume that it is easier to learn new skills if the skills required for the job are closer to the skill level, while demoted and overqualified workers have lower chances to learn new skills. This can be included in the model making $\phi \propto (s - \sigma)^{-1}$, where σ is the minimum skill level required to operate the machinery assigned to the worker in the time step.

Households face two choices: if work and which proportion of their income they should consume.

Households flows' balance is $I = W + M + rS = C + T + \Delta S + \Delta D$. I assume, as a heuristic, that Taxes (T) and Transfers (M) can be approximated as constant from the previous period. Additionally, I assume that desired Deposits (D) at the end of the period are a fraction of the desired consumption ($C = \langle p_G \rangle G$) as insurance against unexpected increases in prices or unemployment[1] ($D = \rho C$, $\rho > 0$). Subtracting two consecutive periods and ignoring second-order differences, the in-flow income becomes $\Delta I = \Delta W + \Delta r S + r \Delta S$, and calling η the marginal propensity to consume it becomes $\eta \Delta C \approx \Delta W + \Delta r S + r \Delta S$. Fixed the income level I we can write $0 = \Delta C + \Delta D + \Delta S = (1 + \rho) \Delta C + \Delta S$ to express the choice the household faces between consumption and saving. Putting these together we find $\eta \Delta C \approx \Delta W + \Delta r S - r(1 + \rho) \Delta C$ and so $\Delta C \approx \frac{\Delta W + \Delta r S}{\eta + r(1 + \rho)}$, which provides an adaptive rule for monetary consumption.

To translate this in material terms I introduce the material consumption of consumption goods G. We have $\Delta C = \Delta(pG) \approx \Delta(p)G + p\Delta G \approx p(\pi G + \Delta G)$. We can finally rewrite $\Delta G = \frac{\Delta W + \Delta r S}{p(\eta + r(1 + \rho))} - \pi G$

ΔW can be approximated by $w W_{t-1}$ where w is the average rate at which wages for the given skill level are increased in the last year[2]. Δr is communicated by the Bank before the agent has to choose between consumption and saving. η is calibrated from empirical data as an exponential or Pareto distribution as $\eta(\frac{S}{p}, \frac{W}{p})$, where the price is used to get a-dimensional values (Fisher et al. 2020; Carroll et al. 2017).

---

[1] It is possible to assume that deposits are used only in case of increase in prices, which allows setting ρ smaller than one, assuming that in case of unexpected unemployment a mix of public subsidies and cashing out from Bank Bonds, without getting interests paid, is pursued. Otherwise, if deposits are used also as insurance against unemployment ρ as to be greater than 1.

[2] Or 0 assuming that salaries increase only changing employer which is an unexpected event.

From this relation, we can model the two choices.

First, a household exits from the labour market if the loss of the wage can anyway grant an increase in consumption, i.e. $\Delta rS - p\pi(\eta + r(1+\rho))G > W$. Similarly, it re-enters the labour market if the expected salary (i.e. the average salary given the skill level) prevents a loss of consumption, i.e. if $\Delta rS - p\pi(\eta + r(1+\rho))G < 0$ and $W + \Delta rS - p\pi(\eta + r(1+\rho))G > 0$.

Second, each household sets the desired total consumption as $\mathbb{E}(G) = G + \Delta G$ (using G from the previous period). From which follows $\mathbb{E}(C) = p(1+\pi)\mathbb{E}(G)$, $\mathbb{E}(D) = \rho p(1+\pi)\mathbb{E}(G)$ and $\Delta S = D + (1+w)W + M - (1+\rho)\mathbb{E}(C)$, where D is the value of the deposit at the end of the previous time step.

Enhancement: Gender, Care work and Feminist Economics

Approximating individuals as household invisibilizes gender differences and the (hidden) work made mostly by women inside the family (childcare, elder care, housekeeping, ...). Gender is an important factor in creating inequalities: for example, unemployment and wages show a strong gender effect (which in both cases penalizes women).

Adding a gender perspective will be an improvement in the model (with relevant policy implications) and will require explicitly modelling education and childcare (which in this first draft is only sketched), the complete life cycle of an agent (here reduced to the working age) and family choices (marriage, pregnancy, ...).

4.2 Firms

Firms are characterized by their position in the supply chain (either Capital or Consumption).

In the case of rationed credit, Firms first pay the salaries of workers, then they pay the salaries of researchers, then they acquire new machinery and finally repay the Bank of the Loans contracted.

4.2.1 Consumption Firms

Noted S the number of goods sold in the previous period, each Firm sets the desired production as $\mathbb{E}(G) = k(1+g+\pi)S$, where g is the GDP growth rate.

The maximum output of the available machinery is defined as $B = \sum_{k \in K} \beta_k$. Each Firm set a desired potential output $\mathbb{E}(B) = \frac{1}{u^*}\mathbb{E}(G) + \delta B$, where δ is the depreciation rate of capital and u^* is the target capacity utilization rate. From this follows that $\Delta B = \max(\frac{\mathbb{E}(G)}{u^*} - (1-\delta)B, 0)$ and the expected investment in monetary units is $\mathbb{E}(I) = p_K \frac{\Delta B}{\langle \beta \rangle}$.

The expected expense for salaries is $\mathbb{E}(W) = \frac{\mathbb{E}(G)}{\langle \beta \rangle}\langle w \rangle$, where w are the individual salaries paid.

Loans are required for an amount equal to $\mathbb{E}(L) = \max(\mathbb{E}(I) + \mathbb{E}(W) - D, 0)$.

The markup is set equal to $\mu = \mu_{t-1}(1 + \theta\frac{S_{t-1}}{G})$ after that the production happened.

Called U the balance of flows in the period before distributing profits and D the amount of deposits in the same moment, each firm distributes profits $\Pi = kU\frac{D}{C}$, where $C = I + W$ in the period.

4.2.2 Capital Firms

Capital Firms produce their own machinery, creating a system of two simultaneous equations to determine the desired output. We avoid the problem approximating $\mathbb{E}(B) = \frac{k(1+g-\pi)}{u^*}S + \delta B$, and $\mathbb{E}(K) = k(1+g-\pi)S + \Delta B - K$, where K are the unsold capital goods from the previous period. The machinery produced for own use is kept separate from those to be sold.

Additionally, Capital Firms perform research to improve the machinery they sell. They aim to employ a number of researchers $\mathbb{E}(R) = R(1 + \frac{k}{S}\frac{\Pi}{\langle w_R \rangle})$ where $\langle w_R \rangle$ is the average salaries of the employees with $\sigma \geq \sigma^*$.

Finally, we note that $I = 0$ and so $C = W$.

Enhancement: Firms' governance

In a future version, different models of governance can be introduced, particularly regarding the property (not tradeable shares, shares available on the stock market, cooperative ownership, ...), the choice rules (mostly what is the goal of the Firm, like dividend maximization, share values maximization, market share maximisation, wages maximization, top manager retribution maximization, ...) and the expected profit rate required by the owners.

Enhancement: Public Firms

The recent literature has highlighted the important role of the state in technological innovation. Additionally, civil servant wages help to set, particularly when public employment share is relevant, an economy-wide reserve wage. To keep the model simple all the firms are owned by the Bank and the government sustains demand in a way similar to public procurement. It is possible to create an additional kind of Capital Firm, which performs publicly sponsored research and development, and of Consumption Firm, which represent the direct role of the government in the economy (which mostly provides infrastructures and services).

4.3 Bank

Bank agent represents the aggregate banking sector.

Bank is required to maintain both a liquidity ($\Lambda = \frac{R}{D}$) and a capital ratio ($\Gamma = \frac{V}{L}$).

Liquidity is obtained, in case of necessity, by selling Government's Bonds to the Central Bank.

Bank fixes the interest rates on Bank Bonds as $r_S = (1 - \tau_S)(i + \lambda(\Gamma - \Gamma^*))$, where i is the Central Bank interest rate and τ_S is the constant tax rate on financial income. In this model the Bank does not distribute profits and can access all the needed liquidity from the Central Bank, making the liquidity requirement a tautology and needed a way to avoid excessive capitalization. So, it is not possible to have $r_S(\Lambda)$ (because it will be constant) and to make $r_S(\Gamma)$ approximate a profit distribution, without in a bond-like market (rather than a stock-like ownership model).

Enhancement: Competitive credit market

There are difficulties in setting the Bank Bonds interest rate because there is no competition in the credit market for Household savings, and Central Bank provides free from interest liquidity. The first possibility is to disaggregate the sector and to make interest rates on Bank Bonds a tool of competition among banks. The other is to allow Central Bank to ration the access to liquidity, charging an interest rate on Advances (adding a financial stock in the model).

It also chooses when granting loans to Firms (based on the balance sheet of the applicant) and fixes a different interest rate for each loan. The duration of Loans is fixed. Bank is willing to provide loans to a firm F up to $\hat{l} = \min(\chi_0(D^F + pK^F) - L^F, \max((\chi_1 N_F)^{-1}L(\frac{\Gamma}{\Gamma^*} - 1), 0))$, at a firm-specific interest rate $r_L^F = i + \gamma_1(\Gamma - \Gamma^*) + \gamma_2(\frac{L^F}{V^F}) - \gamma_3(\frac{\Pi^F}{L^F})$. These relations account for the fulfilment of the capital requirement for the Bank and the presence of sufficient collaterals on the Firm side.

4.4 Government

Government fixes the public expenditure. It additionally collects taxes and pays unemployment benefits. It determines the amount to be transferred to Households (both as monetary and non-monetary, as Essential Goods).

When liquidity is needed, Government emits Bonds and sells them at will to the Central Bank.

As an approximation, fiscal policy is kept constant during the simulation and taxes are collected only from the Household sector during the transactions. Particularly, the model includes four taxes: a VAT on the purchase of consumption goods (τ_G); a flat financial income tax on distributed interests on Bank Bonds (τ_S); a progressive income tax computed as $T_W(W) = W \max(\tau_M \tanh(\tau_F(\frac{W}{p} - \tau_T)), 0)$; an inheritance tax on wealth with a constant rate (τ_I).

Fixed unemployment benefit $U_{t+1} = \gamma \max W, U$ is paid to those who have not exited the job market and are not employed.

Each period government buys Consumption goods which distribute to the Households. Particularly each Household receives an amount of Consumption goods equal to $G^G = ((1 - q_0) + q_0 e^{-q_1 \frac{V}{p}})\hat{G}$.

We define g as the growth rate of the GDP (measured as Government and Households consumptions, including VAT, plus the variation in Capital stock, noted as Y) in the previous periods, $M = \sum_H U$ and $G = \sum_H G^G$.

Assuming a Maastricht-like scenario in which Government has a target deficit δ to achieve, the expected balance of the next period can be written as $\delta Y(1 + g) = (1 + \pi)(\mathbb{E}(G) + M) + iT_B(1 + \frac{1}{T^G}\delta Y) - (1 + g)(1 + \pi)T$ where it is assumed that expenses for unemployment benefits are approximately constant, T are the taxes raised, T_B the stock of Government bonds held by the Bank and T^G is the total stock of Government Bonds.

Then, $\mathbb{E}(G) = (1 + g)T + \frac{1+g}{1+\pi}(1 - i\frac{T_B}{T^G})\delta Y - \frac{i}{1+\pi}T_B - M$, from which it is possible to write an adaptive rule for Government demand which aims to match the target deficit as $\Delta\hat{G} = q_2 \frac{\mathbb{E}(G) - G}{pN^H}$, where N^H is the number of Households agents.

4.5 Central Bank

In the model the role of the Central Bank is to fix the Government's Bonds interest rate according to a Taylor rule $i = \pi + \alpha_1(\pi - \pi^*) + \alpha_2(c - c^*) - \alpha_3(u - u^*)$, where π is the inflation rate, c is the capacity utilization measured as the fraction of capital goods used in production, u is the unemployment rate computed among those who have not voluntarily exited the job market, and starred variables are the targets.

Additionally, it passively buys and sells Government Bonds on request to the Bank and the Government. Reserves do not grant interests.

In other words, the Central Bank is a lender of last resort for the Government, which then has no accounting limits to spending.

5 Real Assets

5.1 Consumption Goods

Consumption Goods represent all the consumption (goods and services) of Households and are homogeneous and non-durable.

Enhancement: Foundational Economy $-$ **3**

The exact definition of Foundational good (and service) is not easy to give. An intuition can be provided by the Foundational Economy approach (Arcidiacono et al. 2018):

> The sphere of the foundational was then demarcated by three criteria: these goods and services were necessary to everyday life; were consumed daily by all citizens regardless of income; and were distributed according to population through branches and networks. They were partly non-market, generally sheltered and one way or another politically franchised.

Operationally, we can imagine the essential goods in a future model as the ones included in the basket used by national statistics offices to determine the poverty line. In this sense, it is a set of goods which continuously mutate to adapt to new life needs.

Enhancement: Housing

Among essential goods, one should require ad hoc modelling: houses. Houses are special for three reasons.

First, they are very heterogeneous in prices and quality, and both are strongly related to the position. In other words, including houses requires (quite always) making the model spatially explicit.

Second, the expenses for housing, in form of rent or mortgage, account for a significant part of monthly consumptions for poor individuals (up to one-half).

Third, real estate properties are an important form of rent extraction and an important tool of investment, and so another important channel of redistribution.

Enhancement: Diversified Goods

A subsequent version of the model can include different (abstract) goods to be produced and consumed. This will create two different innovation processes (better technology for existing goods, or technology for new goods) and will account for the empirical fact that the higher the income more diversified the consumptions are (cfr. Di Domenico and Russo 2022, §2).

5.2 Capital Goods

Capital goods are characterized by their productivity β and the minimum skill level required to operate them σ. The production happens according to a Leontieff-like function in which one worker with at least σ skill can operate a single capital good getting β goods as output[3]. Each period they have a fixed probability to break and disappear from the model, equal to $\delta = \langle N \rangle^{-1}$, where $\langle N \rangle$ is the expected life of the machinery.

6 Financial Assets

6.1 Deposits

Deposits represent liquidity for Households and Firms and are not interest-bearing. Bank satisfies any transaction as long as the balance of the account remains positive.

---

[3]It is possible that to balance the model, the output needs to be β consumption goods or $b\beta$ capital goods.

6.2 Bank Bonds

Bank Bonds are sold and bought at their nominal value and do not expire. Bank satisfies every transaction, as long as the accounts remain positive. Households can buy or sell Bank Bonds only at the beginning of each period. At the end of each period, interests are paid, according to the rate fixed by the Bank at the beginning of the period.

6.3 Loans

Loans are issued by the Bank to a specific Firm. They have a fixed duration during which an equal share of capital is repaid plus the interest on the remaining debt. Interests are fixed by the Bank at a different value for each Firm at the time of emission.

6.4 Government Bonds

Government Bonds are sold and bought at their nominal value and do not expire. Central Bank satisfies every transaction. Bank can buy Government Bonds only at the beginning of each period. At the end of each period, interests are paid only to the Bank, according to the rate fixed by the Central Bank at the time beginning of the period.

6.5 Reserves

Reserves represent liquidity for Bank and Government and are not interest-bearing. Central Bank satisfies any transaction as long as the balance of the account remains positive.

7 Dynamics

7.1 Consumption Goods market

Each Household sees χ_C Consumption Firms χ_C times, each time it buys $\frac{\mathbb{E}(G)-G^G}{\chi_C}$ at the lowest possible price until it matches the desired consumption or ends liquidity.

7.2 Capital Goods market

Each Consumption Firm sees χ_K Capital Firms χ_K times (including the last one from which it has bought), each time it buys $\frac{\Delta B}{\chi_C}$ machineries choosing the one with the lowest value of $\beta p_C - \langle w_\sigma \rangle - \frac{p_K}{\langle N \rangle}$ until it matches the desired quantity or ends liquidity.

7.3 Labour market

Households are employed by a Firm until they are fired, they chose to exit the job market or they accept an offer from another Firm.

Firms can fire workers only when profits turn negative. In that case, Firms fire workers until the number of workers reaches u^*K. Additionally, in the case the Firm is not able to pay a worker, they is fired. In both cases, Firms start to fire those with lower skills.

Firms match each employed worker with the most productive machinery they can use, starting with those with higher skills. For this purpose, a researcher is treated like a worker assigned to a machinery with productivity σ^*. Then the current potential output (as the sum of the productivity of the used machinery) is computed and vacancies are filled starting from the most productive unused machinery. All research vacancies are filled if possible. For each vacancy, the Firm sees χ_L workers which have the required skills and earn less than the average salary in the model for the skill level. The Firm employs the one with the higher skills offering the average salary in the model for the skill level.

Each vacancy is filled once and new vacancies are not filled.

7.4 Retirement and inheritance

When a Household reaches a certain age it is considered retired and is replaced by a new agent in the model which inherits their (taxed) wealth and enters the simulation with a random skill level proportional to the inherited wealth, and a random age proportional to the skill level.

7.5 Non Performing Loans

In the case a Firm is unable to repay the principal of a loan or to pay the interest, the unpaid sum is added to the import of the loan and the duration is increased by one period. Additionally, the loan is marked as non-performing.

7.6 Bankrupt

Once the net value of a Firm becomes negative the Firm declares bankruptcy, fires all the employed households and loose all the financial assets (loans and deposits). It is "replaced" by a new firm which inherits the capital stock.

7.7 Innovation

Each Capital Firm can achieve an innovation each period with a probability $p = e^{-\xi R}$ where R is the number of employed workers not assigned to a Capital Good with skills at least $sigma^*$.

If the innovation is achieved the Capital Goods produced by the Firm increase its productivity $\Delta\beta \propto \text{Beta}(1, b_1)$ and modify the required skills as $\Delta\sigma \propto (\Delta\beta - k\text{Beta}(1, b_2))$.

8 Model steps

(1)

9 Equations

10 Parameters

References

Arcidiacono, Davide et al. (2018). *Foundational Economy: The Infrastructure of Everyday Life.* The Manchester Capitalism Book Series. Manchester: Manchester University Press. 176 pp. ISBN: 978-1-5261-3400-4 978-1-5261-3399-1.

Carroll, Christopher et al. (2017). "The Distribution of Wealth and the Marginal Propensity to Consume". In: *Quantitative Economics* 8.3, pp. 977–1020. ISSN: 1759-7331. DOI: 10.3982/QE694. URL: https://onlinelibrary.wiley.com/doi/abs/10.3982/QE694 (visited on 23/02/2023).

Di Domenico, Jacopo and Alberto Russo (2022). "The Influence of Productivity Gains, Their Distribution, and Market Structure on Economic Growth in a Sraffian Supermultiplier Model. Short-, Medium-, Long-Term Trends and Secular Tendencies". In: p. 142.

Dosi, Giovanni et al. (1st Dec. 2018). "Causes and Consequences of Hysteresis: Aggregate Demand, Productivity, and Employment". In: *Industrial and Corporate Change* 27.6, pp. 1015–1044. ISSN: 0960-6491. DOI: 10.1093/icc/dty010. URL: https://doi.org/10.1093/icc/dty010 (visited on 08/06/2022).

Fisher, Jonathan D. et al. (1st Sept. 2020). "Estimating the Marginal Propensity to Consume Using the Distributions of Income, Consumption, and Wealth". In: *Journal of Macroeconomics* 65, p. 103218. ISSN: 0164-0704. DOI: 10.1016/j.jmacro.2020.103218. URL: https://www.sciencedirect.com/science/article/pii/S0164070420301440 (visited on 23/02/2023).

Nikiforos, Michalis and Gennaro Zezza (Dec. 2017). "STOCK-FLOW CONSISTENT MACROECONOMIC MODELS: A SURVEY: STOCK-FLOW CONSISTENT MACROECONOMIC MODELS". In: *Journal of Economic Surveys* 31.5, pp. 1204–1239. ISSN: 09500804. DOI: 10.1111/joes.12221. URL: https://onlinelibrary.wiley.com/doi/10.1111/joes.12221 (visited on 18/05/2022).