



Hochschule für
Wirtschaft und Recht Berlin
Berlin School of Economics and Law

Institute for International Political Economy Berlin

Interactive Macroeconomics – A Pluralist Simulator

Authors: Franz J. Prante, Alessandro Barmucci, Eckhard Hein, Achim Truger

Working Paper, No. 117/2019

Editors:

Sigrid Betzelt, Eckhard Hein (lead editor), Martina Metzger, Jennifer Pedussel Wu,
Martina Sproll, Christina Teipen, Achim Truger, Markus Wissen, Reingard Zimmer

Interactive Macroeconomics – A Pluralist Simulator

Franz J. Prante, Alessandro Bramucci*, Eckhard Hein*, Achim Truger**

Abstract:

The aim of our contribution is to present an innovative instrument to teach macroeconomics at the undergraduate and master level. We develop a digital learning platform to present and explore some controversies at the very foundations of macroeconomic theory. For this purpose, we explicitly present two competing paradigms, the new-Keynesian and the post-Keynesian one. Several interactive scenarios are made available where the user can take control over different economic policy instruments and is guided through a set of problems that require appropriate actions in the context of the different approaches.

JEL code: A22, A23, E12, E17, E60

Keywords: macroeconomics teaching, simulations, pluralism, new Keynesian macroeconomics, post-Keynesian macroeconomics

Acknowledgements: We are indebted to Johannes Buchner for his help in initializing the project. We would also like to thank Luke Neal for helpful comments and editing assistance. All remaining errors are of course our own.

* Berlin School of Economics and Law, Institute for International Political Economy (IPE),
Corresponding author: Franz J. Prante, franz.prante@hwr-berlin.de

1. Introduction

Economic policy decisions affect socio-political and socio-economic processes, in particular the level of economic activity and the distribution of income. In a democratic and participatory society, the economic policy discourse is expected to be accessible to a broad audience. In reality, the opposite is often the case. The debate over macroeconomic issues is conducted in a highly technical language and among a group of specialists, most of them following some mainstream approach. This does not only move the broader public away from the debate but can also convey the misleading impression that there is only one viable solution for the issue at hand. This may have alarming consequences: the negation of economic policy alternatives despite continuing crises and stagnation tendencies has prompted a growing part of the European population to seek answers in populist movements associated with nationalist ideologies.

The academic environment, particularly in Germany, has been supporting such tendencies. Economic doctrines that do not conform to the mainstream view based on neoclassical economics have been marginalized if not completely excluded from teaching programs and research positions. This does no justice to the principal of pluralism in economics, nor to economics as a social science which is characterized by a variety of partially contradictory as well as partially complementary sets of theories (McClosky 1983, Rothschild 1988, 1999). In the aftermath of the financial crisis, economics has been publicly criticized for placing too much emphasis on neoclassical theories and methods, while ignoring alternative approaches. This one-sided and often myopic view of mainstream economics has contributed to a growing disagreement within the discipline. Students associations from all around the world have started demanding a substantial change, pushing for the inclusion and teaching of alternative schools of thought (Cambridge Society for Economic Pluralism 2014, Dimmelmeier et al., 2017, Harvard Political Review 2011, ISIPE 2014).

This criticism has had little effect so far. The neoclassical dominance in economic research has been persistent and ultimately difficult to overcome due to structural and institutional factors and the resulting path dependencies (Dobusch and Kapeller 2009). Even the financial and economic crisis that hit the world economy from 2007-09 has not prompted any significant change in the output of academic literature (Aigner et al., 2018). This contrasts with the change in macroeconomics through the rise of Keynesian economic thinking following the Great Depression of the early 1930s. Even with timid openings towards alternative theories and with partial admission of the limits of the dominant vision, the orthodox interpretation remains firmly at the center of both the debate and the academic literature.¹

¹ See for example Vines D. and Wills, S. (2018).

Similar developments are found in the contents of the most influential economics textbooks. Complex time, space and institution contingent economic interactions are often represented as simple universal and objective laws, and scientific and social controversies are systematically ignored (van Treeck and Urban 2017). Introductory macroeconomic textbooks almost exclusively promote an understanding of the economy based on the free market ideology which is then reflected in the models presented, which usually start from the labour market, move to aggregate supply and then to the determination of income and growth. Keynesian approaches are considered to be relevant only in the short run, whereas the long-run development of the economy is assumed to depend exclusively on supply-side factors.²

At the same time, the use of digital tools in macroeconomics education has significantly increased. Computer games, online simulations and other similar platforms have been developed as promising tools for teaching economics. A number of interactive applications have been produced by universities, central banks, publishers and other institutions. On such platforms, users are asked to play an active role in economic decision-making where the outcome and the consequence of their actions are immediately portrayed in terms of curve shifting, line charts and numerical outputs. The direct simulation of the consequences of macroeconomic choices facilitates the learning process and offers a practical representation of the discipline, of its tools and its objectives. However, the macroeconomic simulators so far available reflect the problems of the current discourse in economics. The lack of pluralism dominating in academic research and textbooks is reproduced within the modelling approaches of the available economic games and simulators, too.

The current state of economic policy discourse and macroeconomic teaching require some fundamental changes. It is necessary to bring pluralism back to the center of the economic discussion. Our project points in exactly this direction. We develop an online-based and freely accessible interactive interface that is located at the intersection of macroeconomic research, teaching and the economic policy recommendations. We aim at presenting explicitly the controversies in the economic policy debate through an interactive simulation that shows in a transparent way the alternative policy suggestions resulting from different assumptions of different macroeconomic models. The users will assume the roles of different policy-making institutions or of socially relevant groups. In this way, conflicts of objectives and possible solutions become evident. By doing so, we hope to contribute to pluralism in the public debate of macroeconomic issues and to highlight those economic ideas too often marginalized in the mainstream debate and education.

The rest of the paper is organized as follows. Section 2 offers an overview of existing macroeconomic simulators, emphasizing their strengths and weaknesses in terms of

² For one-sidedness in economic research and teaching in different countries see also Aigner et al. 2018, Beckenbach et al. 2016, Cambridge Society for Economic Pluralism 2014, PEPS Economie 2014, Thornton 2012, Wigstrom 2010.

theoretical transparency, interactivity, modelling approach (static, dynamic) and clarity. This will serve as a starting point for the definition of the features we want to incorporate into our project. In Section 3, we present and describe our project. We offer an overview of the two macroeconomic models that we are able to simulate emphasizing their differences both in terms of structural assumptions and economic policy suggestions. Section 4 concludes.

2. Economic education in the era of digitalization

In recent years, the use of computer simulators for teaching economics has considerably increased. Many institutions, including central banks, foundations, universities as well as commercial firms around the world, have developed digital platforms to present and disseminate economic ideas. Internationally adopted economics textbooks have also begun to include companion computer simulators in order to allow the reader to simulate the models and the exercises proposed in the book. The spectrum of products and platforms available is broad and variegated with respect to the contents, the methodology of use and the level of difficulty.

In this section, we present a limited selection of simulators from which we then proceed to present our own platform. We focus on a broad categorization and on what we consider to be the most relevant and representative examples. Three categories of simulators can be distinguished:

- 1) Model simulators as supplementary material for economic textbooks
- 2) Computer-aided economic planning games and macroeconomic computer games
- 3) Interactive simulations of scientific macroeconomic models

Model simulators as supplementary material for economic textbooks

This first group of simulators comes along with some of the most adopted economics textbooks. The book by Blanchard and Illing (2014) is supplemented by a Java-based macroeconomic simulator. This simulator allows students to replicate some of the models presented in the text, changing for example the values of some coefficients, shifting curves and observing the effects on the calculation of equilibrium values. Bofinger (2015) and Burda and Wyplosz (2012) include Excel files for the simulation of micro- and macroeconomic models. A similar approach is followed by Barreto (2016) who reproduces some of the most famous models of the neoclassical synthesis (AD-AS, IS-LM, Solow growth model) in Excel. Similar simulations are provided by the internet platform Aplia (2018) which offers a variety of micro- and macroeconomic simulations in Adobe Flash.

Some common features and limitations are immediately evident. These textbooks and the accompanying simulators do not engage in a pluralist teaching of economics, much in line with the findings in the contributions to van Treeck and Urban (2017). Furthermore, they are

predominantly of a comparative-static nature and are thus not suitable for a dynamic scenario and policy simulation. Furthermore, the level of interactivity is often limited to the control over few parameters. An explanation or contextualization is almost completely absent. The only example that allows for a dynamic simulation is the Excel-based simulator of the textbook by Carlin and Soskice (2015). To the best of our knowledge, this is the only textbook based simulator that allows the user to explicitly assume the role of the policymaker and that allows for a dynamic simulation of the model over several periods. However, even if some exercises are suggested in the book, a detailed explanation of the model dynamics as well as accurate comments on the simulated results is missing. The simulator for Carlin and Soskice (2015) clearly stands out with regard to the many possibilities offered in terms of scenarios (closed and open economy, flexible and fixed exchange rates) and options available (multiple shocks, varying levels of difficulty, and even optional hysteresis effects). However, much like the other textbook simulators it fails to provide a pluralist approach to economic teaching, as it only presents the new-Keynesian mainstream framework.

Computer-aided economic planning games and macroeconomic computer games

There are numerous computer-aided games covering economics topics.³ Some of these games are developed for commercial purposes and are not freely available. An example is “Econland”, a macroeconomics simulation game developed for high schools (Rogmans 2018). Another example is “TOPSIM - Applied Economics”, a multiplayer business simulation used in university rooms and in corporate training (TATA Interactive Systems 2016). Other examples include the Economic Policy Simulator (IE Business School 2004), the macroeconomic simulation platform Rolesia.com (Rolesia.com 2016a) and the macroeconomic simulator of Angelov and Vasilev (2016a, 2016b). The models used in these games are quite complex, but from a theoretical point of view they are often completely in-transparent and untraceable for beginners.⁴ The best-known and most widespread macroeconomic simulation game developed for the school system in the German-speaking area is the Excel-based macroeconomic simulation game “MACRO” of the *Aktionsgemeinschaft sozial Marktwirtschaft* (ASM 2016). In this game, two open economies “play against each other”, as stated on the website. Again, despite the complexity of the model, a detailed explanation of the theoretical foundations is missing. References to macroeconomic theory or additional literature are lacking as well, as in most of these games. In addition, the objectives of the games are often one-sided and in some cases questionable. In TOPSIM and MACRO, for example, the main objective of the simulation is to keep the economy “competitive” and to control price stability by keeping the central bank’s money supply under control, despite the fact that such a monetary policy strategy is no longer applied by modern central banks, even according to their own statements (Haltom 2013). Another example for a non-

³ For a comprehensive but incomplete overview of computer-based games in political, economic and business education addressed to the German-speaking school system, see Bundeszentrale für Politische Bildung (2016).

⁴ Rolesia emphasizes that the underlying model is not scientifically sound (Rolesia.com 2016b, p. 5).

transparent game with a one-sided focus is “The Fiscal Ship” (Fiscalship 2018), which is freely accessible online. In this game, the user takes control over public spending and taxation. The main goal here is to lower US government debt relative to GDP and thereby to save a little boat from sinking, a not too hidden metaphor of the government drowning in debt. However, only the direct impact of fiscal measures on revenue and expenditure is presented. Macroeconomic theory is not discussed in this game. In the simulation, there seems to be no impact on other important economic indicators, although they would be important for financial sustainability.

Of particular interest are those simulators developed by central banks and available on their websites. The European Central Bank (ECB), the US Federal Reserve (Fed) and the Finnish Central Bank (Bank of Finland) offer monetary policy games (ECB 2016a, ECB 2016b, Fed 2018, Bank of Finland Museum 2018). The aim of “Inflation Island” (ECB 2016a), for example, is to show with short texts and videos how deflation, inflation and hyperinflation affect the economy. Keeping inflation under control is presented as the sole criterion to define the economic well-being and economic success of a country. In “€conomia” (ECB 2016b), the only goal of the game is to keep inflation close but under 2% over a period of several years. The only parameter that the user can control is the interest rate. Even though simulated data on unemployment, output and money supply growth are reported, they play no role in the final evaluation of the player’s performance and the objective of low inflation can be achieved independently from the level of unemployment and economic growth. Other important indicators, such as income distribution, play no role at all in the simulation. Similarly, in the game developed by the Bank of Finland (Bank of Finland Museum 2018), the main goal of the user is to keep inflation under control. The only other economic indicators are money and output growth. In Fed (2018), at least unemployment plays a central role in the evaluation of the player’s performance. However, the game uses the theoretically and empirically controversial concept of the “natural rate of unemployment”, which is assumed to be exogenous and cannot be influenced, nor is it the object of any additional explanation.⁵ In general, theoretical explanations are missing from the three central bank simulators and the underlying model cannot be changed. Theoretical transparency and economic pluralism are completely absent.

In summary, the narrow scope of this group of simulators is again immediately evident. None of the three games provides a rigorous representation of the simulated economic model and no mention of alternative economic theories is done. Important indicators such as income distribution are not discussed. Game objectives are often one-sided, conveying a questionable understanding of economic policy objectives. The one-sidedness of the macroeconomic discourse described above is thus reproduced by these simulators.

⁵ For a current critical discussion and relevant literature on the natural rate see e.g. Stirati and Meloni (2018).

Interactive simulations of scientific macroeconomic models

Another category consists of online simulations of macroeconomic models used in research. Here we want to present three simulators representing three different economic modelling approaches deriving from separate and opposing camps in the macroeconomic discipline.

The Dutch Central Bank (DNB) has produced a simulator of the Dutch economy based on a time-series macroeconometric model developed in the neoclassical and new-Keynesian tradition (DELFI 2018a, DELFI 2018b). Various scenarios can be run in which one or more selected variables can be shocked. The simulation of the model runs over eight years and puts together, for comparative purposes, the visualization of a baseline scenario together with the simulated one. For example, when compared to the baseline scenario, a decrease in wages would be followed by a decline in unemployment and an increase in gross domestic product (GDP). The Dutch economy is thus presented as profit-led, meaning that a decrease in the wage share has an expansionary effect on the overall economy. However, this is a matter of debate in the relevant literature, as econometric studies in the post-Keynesian tradition produce the opposite results (e.g. Onaran and Obst 2016). In addition, austerity policies would have a long-term advantage for the assumed economy: a reduction in government expenditures compared to the baseline scenario would initially lead to a lower GDP growth rate and lower employment, but both variables recover in the long run and ultimately turn higher than in the baseline scenario. However, the positive effects of austerity policy are highly controversial, and many empirical studies point in the opposite direction (e.g. Ball 2014, Gechert et al. 2016).

Another simulator developed in the neoclassical/new-Keynesian tradition is the interactive simulation by Ellis (2016a, 2016b) who presents an influential dynamic stochastic general equilibrium (DSGE) model developed for the Eurozone (Smets and Wouters 2003). DSGE models are highly controversial macroeconomic models that rely on general equilibrium theory and optimization microeconomic foundations. In recent time DSGE models have been object of strong criticism among mainstream (e.g. Stiglitz 2018) and heterodox economists (e.g. Dullien 2017), in particular because of very limiting and unrealistic assumptions. The simulator by Ellis, developed in the programming language “R”, allows the user to take control over a number of parameters and to see the consequences for the model behaviour through the reaction of impulse-response functions. Here again, an increase in wages leads to a long-term fall in GDP.

The third example is an ecological-macroeconomic model developed in the post-Keynesian tradition analyzing the link between the ecological system and the macro-economy (Dafermos et al., 2018). The ecological module of the overall model can be interactively simulated via an R-Shiny web app (DEFINE 2018). The model simulates how different

constellations of GDP growth, energy intensity, CO₂ emissions and the share of renewable energy lead to different paths of ecological and economic development. The theoretical foundations of the model are different from DELFI (2018a) and Ellis (2016a), thus leading to different economic policy. In DEFINE (2018), the economy can be wage-led, so that a wage increase can have a long-term positive effect on economic growth.⁶

An interactive simulation of scientific models as in these three examples is to be welcomed since it can promote the transmission of scientific knowledge. However, such a transmission quickly reaches its limits in the three interactive simulations mentioned above. In particular, the simulations lack interactive explanations and contextualization. Unexperienced users, and even trained economists who do not know the exact models, can at best guess the underlying processes taking place in the simulation. At the same time, the models do not present their results in comparison to models with different theoretical and empirical bases.

As an overall summary we can state that, even though we recognize the technical and scientific value of the simulators analyzed above, we could not find a satisfactory simulator that combines clarity, pluralism and academic soundness. While some simulations are theoretically transparent, they do not provide interactive scenario analysis and do not convey the pluralism of economic ideas (Aplia 2018, Blanchard and Illing 2014, Bofinger 2015, Burda and Wyplosz 2012). Others that provide interactive scenarios do not even introduce nor discuss the theoretical foundations of the underlying economic model (ASM 2016, ECB 2016a, ECB 2016b, Fed 2018, Bank of Finland Museum 2018, Fiscalship 2018, Rogmans 2018, TATA Interactive Systems 2016, Angelov and Vasilev 2016a, 2016b, IE Business School 2004, Rolesia.com 2016a). Even the few simulations that make their theoretical basis transparent and are suitable for scenario analysis (Carlin and Soskice 2015, DELFI 2018b, DEFINE 2018, Ellis 2016a) are in our view hardly suitable for an open and widely accessible economic policy debate. Appropriate explanations and/or critical discussions of their theoretical foundations are missing, and this obscures the pluralist nature intrinsic to economics as a social science. The discussed simulators instead reproduce an argumentative one-sidedness that has shaped the public economic discourse in society narrowly.

We argue for a theoretically transparent and pluralist macroeconomic simulator that offers an open view on important economic policy discussion. Such simulator requires simplified intermediate step models in which causal relationship and structural interdependencies among macroeconomic variables can be reproduced and analyzed in isolation. This would also enable a critical and comparative discussion of the theoretical assumptions, which would serve a pluralist understanding of macroeconomics. In light of the deficits of existing simulators, our platform attempts to meet the following criteria:

⁶ This does not become clear in the available web interface, where only a limited version of the model can be simulated.

- theoretical transparency and pluralism,
- coverage of a broad spectrum of relevant economic policy issues,
- a high degree of interactivity with dynamic explanations and contextualization,
- suitability for comparative dynamic scenario analysis,
- interactive presentation of simulated and empirical data, and
- accessibility through simplified versions.

3. A new tool for understanding macroeconomics

In an attempt at meeting our criteria sketched above, we are developing an online platform for teaching macroeconomics in a project funded by the Research Institute for Social Development (*Forschungsinstitut für gesellschaftliche Weiterentwicklung*) in Düsseldorf.⁷ Our aim is to develop a freely accessible online simulator that is able to communicate fundamental macroeconomic concepts at the bachelor and master levels in an intuitive but academically rigorous fashion, with particular attention paid to a pluralist understanding of the subject. The project is composed of two building blocks. First, the interactive macroeconomic simulator(s) are accessible through the project website. The simulator offers two basic macroeconomic models of a closed economy from two competing paradigms: the mainstream new-Keynesian perspective, and the post-Keynesian alternative, which represents one of the largest heterodox schools of thought in economics.⁸ The focus here lies on economic policy suggestions deriving from the different model assumptions of the two opposing paradigms, but also on the differences and the similarities and compatibilities of the two modelling approaches. We present the models both in terms of curves and of equilibrium values over time (presented in rounds). In this way, the user has the possibility to perform the standard simulations of comparative statics but also to appreciate the comparative dynamics of the economy through several rounds.

Second, the simulator is accompanied by online and freely accessible resources in which we explain in detail the theoretical bases of the simulated models. After introducing key macroeconomic variables and the main concepts of national income accounting, we present the theoretical foundations of the two main models, the new-Keynesian and post-Keynesian one. Along with the theoretical discussion, we present selected components of the full models in isolation (e.g. the consumption function, the Phillips curve, etc.). Several interactive scenarios are also available in which the user can take control over different economic policy instruments and, thanks to dynamic explanations, is guided through a set of problems that require appropriate actions.

⁷ A work-in-progress version of the project is available at www.mgwk.de.

⁸ See Lavoie (2014, Chapter 1) for a comparison of mainstream and heterodox schools of thought.

3.1 New-Keynesian macroeconomics, interactively illustrated

The first model is the New Consensus Macroeconomics (NCM) model. The model is associated with the new-Keynesian school and is closely tied to the concepts of a non-accelerating inflation rate of unemployment (NAIRU) and of central bank inflation targeting. Inflation targeting aims at stable inflation through central bank interest rate policy (Arestis and Sawyer 2008). The NCM model has gained popularity thanks to its accessible adaptation to classroom work with three macroeconomic equations.⁹ The first equation is the IS curve, representing equilibrium aggregate demand for a closed economy as a function of the real rate of interest, putting together private consumption, investment and government expenditure. The IS curve negatively relates aggregate income at time t to the real interest rate at time $t-1$.

The second equation is a short-run Phillips Curve (PC), which is determined by the interplay between the price setting of firms in the goods market and the employees' nominal wage setting in the labour market. The PC curve relates the current inflation rate to inflation expectations (given by the previous period's inflation), productivity, a parameter that captures the conflict orientation of workers and the current employment gap. The employment gap captures the impact of the deviation of current employment from its long-run equilibrium. While aggregate demand and productivity determine current employment, long-run equilibrium employment is the level consistent with the NAIRU. In the long-run, we thus have a vertical Phillips curve at the NAIRU. The NAIRU solely depends on institutional and structural features of the economy, such as conditions of the labour market, the wage bargaining system, the social security systems and the mark-up in pricing of firms, and remains unaffected by changes in aggregate demand. If the unemployment rate falls below the NAIRU, accelerating nominal wage increases triggered by an improved bargaining position of employees are passed through into prices, resulting in wage-price-wage spirals. On the other hand, when unemployment is above the NAIRU, nominal wage increases are falling and inflation will start to decrease. Only at the NAIRU level are wage expectations of workers in line with firms' pricing decisions and inflation is kept at a constant rate. Whenever the economy is out of this equilibrium, the goal of the central bank is to bring employment and production back to the levels consistent with the NAIRU. The behaviour of the central bank is therefore determined by the third equation of the NCM, the so-called Monetary Rule (MR), representing the optimal rule for monetary policy based on the central bank's preferences for reaching inflation and employment targets.

Monetary policy is seen as the main macro-economic stabiliser as, in the NCM, the central bank is able to manage the macro-economy efficiently through symmetrical reactions and effects of its interest rate policy. By manipulating the short-run nominal interest rate, the CB

⁹ This is called the "three equations model". Our algebraic representation of the NCM model is similar to the one proposed by well-known new-Keynesian authors, for example Carlin and Soskice (2010, 2015). In this paper, we only present the three core equations of the model.

is able to influence the real interest rate, aggregate spending and ultimately the rate of inflation – at the NAIRU level of economic activity. The latter, however, can only be improved by supply-side policies, mainly in the labour market.

Our simulator and the accompanying online resource can be used to understand this model and its economic policy implications. The user can take on the role of the central bank aiming at achieving the best possible adjustment path towards the NAIRU equilibrium in response to a supply or to a demand shock. In order to reach this optimal path, the user must be able to understand how an optimal decision-making process of the central bank works. However, this adjustment process only applies under “normal” circumstances, i.e. only when demand shocks are relatively small. If a strongly negative aggregate demand shock triggers a deep economic crisis, the user will experience that the central bank no longer has the necessary policy instruments to stimulate the economy. This case is illustrated in a zero-lower-bound scenario where the optimal interest rate that the central bank should set in order to respond to a severe aggregate demand shock is in fact negative and cannot be achieved by the monetary authority.

The user realizes here that the NAIRU equilibrium can be achieved only with support of an expansionary fiscal policy. After a sufficient fiscal stimulus, the optimal interest rate of the central bank will be positive again and monetary policy will become effective. The user will learn that, according to new-Keynesian view, in the short-term and under normal circumstances, monetary policy is an effective means for the stabilization of the economy and only needs to be supported by fiscal policy in exceptional cases. It also emerges that in the long-run, expansionary fiscal policy is not an efficient way to lower unemployment below the NAIRU level. A demand-driven increase in employment will lead to increasing inflation, thus to a reaction of the CB aimed at reducing aggregate demand to a level consistent with the NAIRU. Fiscal policy is therefore downgraded to a secondary role. Fiscal authorities should usually refrain from actively managing the macro-economy in order to help the monetary authority to keep inflation under control.

3.2 Changing the macroeconomic paradigm – assumption by assumption

What happens if we change one or more of the basic assumptions in this model? Can we possibly derive a completely different economic policy mix by slightly changing some of the peculiar assumptions of the model? Our simulator can be used to apply such a step-by-step modification of the NCM model. With the full combination of the changed assumptions, the users will obtain a different model, in line with post-Keynesian macroeconomics and featuring a completely revised set of policy implications.¹⁰

¹⁰ For a full post-Keynesian model see Hein and Stockhammer (2011) and Arestis (2013). For the essentials of post-Keynesian macroeconomics and its development over the last two decades, see the overview in Hein (2017).

Assuming that the interest rate influences investment and the mark-up over unit variable costs, monetary policy can become less effective. Interest payment is a major component of fixed costs. Firms try to cover higher interest rate using their mark-up pricing power. In the long-run the mark-up can become sensitive to changes in the interest rate. In the case of high inflation, for instance, restrictive monetary policy with the effect of raising the real interest rate will then lead to a higher NAIRU. Monetary policy will thus become less effective compared to the NCM model, exerting a real effect on the economy which is also felt in the long-run. According to the new setting, relying on interest rate policies to fine-tune the economy is no longer warranted. The corresponding scenario is available in our simulator.

If we change the assumption regarding wage formation, we obtain a fundamental change in the in the relevant policy mix. For example, we can assume that effective coordination of wage bargaining at macroeconomic level may internalise the inflation effects which have been external to the wage bargaining process as perceived in the NCM. Within a certain “normal” range of employment in line with effective wage bargaining coordination, the employees’ real wage targets will correspond to the attainable real wage implied by price setting of firms, thus taming workers’ nominal wage setting. Neither inflation nor disinflation surges will occur when employment will change within this interval. Graphically, this is represented by a horizontal element in the short-run PC where a constant rate of inflation is compatible with different employment rates. The NAIRU is no longer a single value but rather a range of values. This opens up the possibility for the central bank to tolerate lower unemployment rates than in the standard model (see for example Lavoie 2010, Hein and Stockhammer 2010).

The changes in the assumptions of the model have profound implications for the suggested macroeconomic policy mix. While in the NCM model the reduction of labour market rigidities – the fragmentation and decentralisation of wage bargaining, the dismantling of workers’ rights and of the social security systems, etc. – are a central element to fight long-run unemployment and to bring the NAIRU down, the post-Keynesian model makes alternative measures available. In this model, the effective coordination of wage bargaining appears to be a superior policy tool when it comes to curbing inflation in the upswing of the economic cycle. In addition, effective wage bargaining coordination also allows stabilizing the economy during a downturn, preventing harmful disinflation and deflation processes. This provides the grounds for aggregate demand management to attain a permanent task for achieving high levels of non-inflationary employment, with a clear focus on fiscal policy to take over this role. Monetary policy targeting low real interest rates can contribute to reducing the NAIRU, thus providing more leeway for expansionary fiscal policy. If, in addition, we assume a negative effect of income inequality on consumption demand of private households, a reduction of inequality in disposable income via fiscal, labour market and income policies, e.g. minimum wages, can be used to stabilise employment at a higher level. This macroeconomic policy mix can also be simulated on our platform.

With these and similar examples, our simulator can be used to clarify the crucial differences between macroeconomic paradigms and policy assignments. An otherwise new-Keynesian model can be gradually transformed into a post-Keynesian one by varying the model assumptions. Our simulator therefore promotes openness in thinking about economic theories and models. The combination of ideas from different economic paradigms can contribute to a broader, more open and hopefully better understanding of economics, which is necessary for a democratic economic policy debate.

4. Conclusions

An accessible and open economic policy debate is part of the democratic life of a society. Over the last decades, economic theory and economics teaching has drifted away from pluralism. The dominant orthodox theory is presented as the only basis for the available reference model in guiding economic policy. At the same time, the simulation of theoretical models in simple and intuitive ways has become more important for teaching macroeconomics. Foundations, universities, commercial developers and central banks have developed a number of simulators, games and online platforms for the communication and dissemination of macroeconomic principles. Even here, however, the limits of the economic debate are immediately evident. A large number of simulators are not transparent, in the sense that they do not devote sufficient attention to the discussion of the theoretical foundations of the underlying model. Other simulators lack the necessary explanations to make the economic dynamics clear even to the specialized audience. Our work tries to fill this gap. We have tried to develop an online freely accessible macroeconomic simulator with an accompanying online textbook following a pluralist approach. Our simulator proposes two models of different and competing economic theories. However, rather than comparing the two in isolation, our simulator shows that by changing the assumptions of a basic new-Keynesian model, it is possible to come to different economic policy suggestions in line with a post-Keynesian perspective. In doing so, we hope to contribute to increasing economic education in a pluralistic sense and to making economic debate more open-minded.

References

- Aigner, E., Aistleitner, M., Glötzl, F. and Kapeller, J. (2018): The Focus of Academic Economics: Before and After the Crisis. Institute for New Economic Thinking, Working Paper No. 75.
- Angelov, A. and Vasilev, A. (2016a): Using Computer Simulators for Teaching Macroeconomics at the Undergraduate Level. *Journal of Research in Educational Sciences*, Vol. 7(9), pp. 5-8.
- Angelov, A. and Vasilev, A. (2016b): A Simulator for Teaching Macroeconomics at Undergraduate Level, https://www.economicsnetwork.ac.uk/showcase/angelov_simulator#top (Retrieved: 17.12.2018).
- Aplia (2018): Aplia Economics. CENGAGE Learning, <https://www.aplia.com/economics/> (Retrieved: 17.12. 2018).
- Arestis, P. (2013): Economic Theory and Policy: a Coherent post-Keynesian Approach. *European Journal of Economics and Economic Policies: Intervention*, Vol. 10(2), pp. 243-255.
- Arestis, P. and Sawyer, M. (2008): New Consensus Macroeconomics and Inflation Targeting: Keynesian Critique. *Economia e Societade*, Vol. 17, pp. 631-655.
- ASM - Aktionsgemeinschaft soziale Marktwirtschaft (2016): Planspiel zur makroökonomischen Simulation MACRO, http://www.asm-ev.de/Pro_Macro_Planspiel_SI.html (Retrieved: 17.12. 2018).
- Ball, L. (2014): Long-Term Damage from the Great Recession in OECD Countries. *European Journal of Economics and Economic Policies: Intervention*, Vol. 11(2), pp. 149-160.
- Bank of Finland Museum (2018): Monetary Policy Game. Bank of Finland Museum, <http://www.rahamuseo.fi/en/games-and-multimedia/monetary-policy-game/> (Retrieved: 17.12.2018).
- Bargawi, H., Cozzi, G. and Himmelweit, S. (Eds.) (2017): *Economics and Austerity in Europe - Gendered Impacts and Sustainable Alternatives*. London: Routledge.
- Beckenbach, F., Daskalakis, M. and Hofman, D. (2016): *Zur Pluralität der volkswirtschaftlichen Lehre in Deutschland: Eine empirische Untersuchung des Lehrangebotes in den Grundlagenfächern und der Einstellung der Lehrenden*. Marburg: Metropolis.
- Blanchard, O.J. and Illing, G. (2014): *Makroökonomie*. 6., aktualisierte Auflage, Hallbergmoos: Pearson.
- Bofinger, P. (2015): *Grundzüge der Volkswirtschaftslehre*. 4., aktualisierte Auflage, Hallbergmoos: Pearson.
- Bundeszentrale für Politische Bildung (2016): Planspiel Datenbank, <http://www.bpb.de/lernen/formate/planspiele/65585/planspiel-datenbank> (Retrieved: 17.12. 2018).
- Burda, M. and Wyplosz, C. (2012): *Macroeconomics: A European Text*. 6th Edition, Oxford: Oxford University Press.

- Cambridge Society for Economic Pluralism Report (2014): CSEP Survey of Economics Students: Is it Time for Change at Cambridge?
http://www.cambridgepluralism.org/uploads/1/7/4/9/17499733/report_v14_w.appendix.pdf (Retrieved: 17.12.2018).
- Carlin, W. and Soskice, D. (2010): Teaching Macroeconomics Using the 3-Equation Model. In: Fontana, G. and Setterfield, M. (Eds.) (2010): *Macroeconomic Theory and Macroeconomic Pedagogy*. Basingstoke, UK: Palgrave Macmillan.
- Carlin, W. and Soskice, D. (2015): *Macroeconomics: Institutions, Instability, and the Financial System*. Oxford: Oxford University Press.
- Dafermos, Y., Nikolaidi, M. and Galanis, G. (2018): Climate Change, Financial Stability and Monetary Policy, *Ecological Economics*, Vol. 152, pp. 219-234.
- DEFINE (2018): Web Interface, <https://define-model.org/web-interface/> (Retrieved: 17.12.2018).
- DELFI (2018a): DELFI 2.0, DNB's Macroeconomic Policy Model of the Netherlands. De Nederlandsche Bank, Occasional Studies, Vol. 15-6.
- DELFI (2018b): Web Interface, <http://delfi.dnb.nl/> (Retrieved: 17.12.2018).
- Dimmelmeier, A., Heussner, F., Pürckhauer, A. and Urban, J. (2017): Making the Incommensurable Comparable: a Comparative Approach to Pluralist Economics Education. *European Journal of Economics and Economic Policies: Intervention*. Vol. 14(2), pp. 250-66.
- Dobusch, L. and Kapeller, J. (2009): Why is Economics not an Evolutionary Science? New Answers to Veblen's old Question. *Journal of Economic Issues*, Vol. 43(4), pp.867-898.
- Dullien, S. (2017): How to Promote Alternative Macroeconomic Ideas: are there Limits to Running with the (Mainstream) Pack? *European Journal of Economics and Economic Policies: Intervention*, Vol. 14(2), pp. 238-249.
- Ellis, P. (2016a): Dynamic Stochastic General Equilibrium Model (demonstration), <https://ellisp.shinyapps.io/0031-shiny/> (Retrieved: 17.12.2018).
- Ellis, P. (2016b): *Dynamic Stochastic General Equilibrium Models Made (Relatively) Easy with R*. R-Bloggers, <https://www.r-bloggers.com/dynamic-stochastic-general-equilibrium-models-made-relatively-easy-with-r/> (Retrieved: 17.12.2018).
- EZB – Europäische Zentralbank (2016a): Inflation Island.
<https://www.ecb.europa.eu/ecb/educational/educational-games/inflationisland/html/inflationisland.en.html> (Retrieved: 17.12. 2018).
- EZB – Europäische Zentralbank (2016b): €conomia.
<https://www.ecb.europa.eu/ecb/educational/educational-games/economia/html/economia.en.html> (Retrieved: 17.12. 2018).
- Fed (2018): Chair the Fed: A Monetary Policy Game. Federal Reserve Bank of San Francisco, <https://sffed-education.org/chairthefed/> (Retrieved: 19.11.2018).
- Fiscalship (2018): The Fiscal Ship, <https://fiscalship.org/> (Retrieved: 17.12.2018).
- Gechert, S., Hallett, A.H. and Rannenberg, A. (2016): Fiscal Multipliers in Downturns and the Effects of Euro Area Consolidation. *Applied Economics Letters*, 23:16, pp. 1138-1140.

- Harvard Political Review (2011): An Open Letter to Greg Mankiw, 02.11.2011, <http://harvardpolitics.com/harvard/an-open-letter-to-greg-mankiw/> (Retrieved: 17.12.2018).
- Haltom, R. (2013): Does Money Still Matter for Monetary Policy? Richmond Fed Economic Brief, issue May, pp. 1-6.
- Hein, E. (2017): Post-Keynesian Macroeconomics since the mid-1990s – Main Developments. *European Journal of Economics and Economic Policies: Intervention*, Vol. 14(2), pp. 131-172.
- Hein, E. and Stockhammer, E. (2010): A Post Keynesian Alternative to the New Consensus Model. In: Setterfield, M. and Fontana, G. (Eds.) (2010): *Macroeconomic Theory and Macroeconomic Pedagogy*. Basingstoke, UK: Palgrave Macmillan.
- Hein, E., Stockhammer, E. (2011): A post-Keynesian Macroeconomic Model of Inflation, Distribution and Employment. In: Hein, E. and Stockhammer, E. (Eds.): *A Modern Guide to Keynesian Macroeconomics and Economic Policies*. Cheltenham: Edward Elgar.
- IE Business School (2004): Economic Policy Simulator, <http://mooc.ie.edu/countries/countries/portada.html> (Retrieved: 17.12.2018).
- ISIPE (2014): Open Letter of the International Students Initiative for Pluralism in Economics, <http://www.isipe.net/open-letter/> (Retrieved: 17.12.2018).
- Lavoie, M. (2010): Taming the New-Consensus: Hysteresis and some Other Post Keynesian Amendments. In: Setterfield, M. and Fontana, G. (Eds.) (2010): *Macroeconomic Theory and Macroeconomic Pedagogy*. Basingstoke, UK: Palgrave Macmillan.
- Lavoie, M. (2014): *Post-Keynesian Economics*. Cheltenham, UK, Northampton, MA, USA: Edward Elgar.
- McCloskey, D. (1983): The Rhetoric of Economics. *Journal of Economic Literature*, Vol. 21(2), pp. 481-517.
- Onaran, Ö. and Obst, T. (2016): Wage-Led Growth in the EU15 Member-States: the Effects of Income Distribution on Growth, Investment, Trade Balance and Inflation. *Cambridge Journal of Economics*, Vol. 40(1), pp. 1517-1551.
- PEPS Economie (2014): The Case for Pluralism: What French Undergraduate Economics Teaching is all about and how it can be improved. *International Journal of Pluralism and Economics Education*, Vol. 5(4), 385-400.
- Rogmans, T. (2018): Teaching Macroeconomics with the Econland Simulation Game and Learning Platform. *Journal of Economics Teaching*, Vol. 2(2), pp. 92-103.
- Rothschild, K.W. (1988): Micro-Foundations, Ad Hocery, and Keynesian Theory. *Atlantic Economic Journal*, Vol. 1(2), pp. 12-21.
- Rothschild, K.W. (1999): To Push and to be Pushed. *American Economist*, Vol. 43(1), pp. 1-8.
- Rolesia.com (2016a): Economy Modelling & Simulation Game, <https://www.rolesia.com/simulation.php> (Retrieved: 17.12. 2018).

- Rolesia.com (2016b): Corporate Simulator User Guide, www.rolesia.com/downloads/Rolesia.com%20V2.0%20-%20Corporate%20-%20Simulator%20Guide.pdf (Retrieved: 17.12. 2018).
- Smets, F. and Wouters, R. (2003): An Estimated Dynamic Stochastic General Equilibrium of the Euro-Area. *Journal of the European Economic Association*, Vol. 1(5), pp. 1123-1175.
- Stiglitz, J.E. (2018): Where Modern Macroeconomics Went Wrong. *Oxford Review of Economic Policy*, Vol. 34(1-2), pp. 70-106.
- Stirati, A. and Meloni, W.P. (2018): A Short Story of the Phillips Curve: from Phillips to Friedman... and Back? *Review of Keynesian Economics*, Vol. 6(4), pp. 493-516.
- TATA Interactive Systems (2016): TOPSIM - Applied Economics, <http://www.topsim.com/de/lightboxen/planspiele-beschreibungen/topsim-applied-economics.html> (Retrieved: 17.12. 2018).
- Thornton, T. (2012): The Economics Curriculum in Australian Universities 1980 to 2011. *Economic Papers: A Journal of Applied Economics and Policy*, Vol. 31(1), pp. 103-113.
- Wigstrom, C.W. (2010): A Survey of Undergraduate Economics Programmes in the UK. https://www.ineteconomics.org/uploads/downloads/existing_undergrad_econ_curriculum_UK.pdf (Retrieved: 17.12. 2018).
- van Treeck, T. and Urban, J. (Eds.) (2017): *Wirtschaft neu denken - Blinde Flecken der Lehrbuchökonomie*. Berlin: iRights.Media.
- Vines, D. and Wills, S. (2018): The Rebuilding Macroeconomic Theory Project: an Analytical Assessment. *Oxford Review of Economic Policy*, Vol. 34(1-2), pp. 1-42.

