1   Introduction

This project report documents a work-in-progress version of what is termed in the literature as a "fully empirical" (Caverzasi and Godin, 2014) stock-flow consistent (SFC) model, calibrated to the Austrian economy. In fully empirical SFC models, not only are the model parameters estimated from empirical data, they are also used to predict variations of endogenous model variables in a scenario analysis. We follow this approach by both deriving a business as usual (BAU) scenario from national accounting data and by conducting exploratory scenarios regarding changes in the Austrian tax system and government expenditures.

This model is the first of its kind for Austria, and among few empirical SFC models internationally. Specifically, Caverzasi and Godin (2014) restrict research in this area to two groups that work with this kind of fully empirical SFC models: one set of authors at the Levy institute, who constructed fully empirical models for the U.S. (Papadimitriou et al., 2011) and Greek economies (Papadimitriou et al., 2013). The other group can be found at the University of Limerick, see Kinsella and Tiou-Tagba Aliti (2012), where an empirical model of the Irish economy is still work in progress.

One of the main strengths of SFC models in general is their explicit depiction of heterogeneous aggregated agents interacting in a financial economy featuring several asset classes and their different rates of return. These interactions usually involve portfolio choice of agents between these assets, endogenous creation of money in the financial system, and a system of endogenous nominal flows constituting economic relations in a consistent accounting framework. These flows are related both to behavioural decisions of agents within a period, but also to their holdings of assets and liabilities and the implied flows of revenues and payments.

Empirical SFC models in specific have the decisive property that they can incorporate dynamics of the economy based on empirical evidence, and not necessarily presuppose a steady state growth path. Especially, our model is designed to project trends that we take from sectoral national accounting data into the future for the BAU scenario. In this framework, we can incorporate policy simulations leading to a new development of the economy. The economic effect of the policy measure is obtained by comparison of this new development due to the policy measure to the BAU scenario. This model, while yet preliminary in nature, is an extended and improved version of the empirical SFC model for Austria put forth in Schmelzer (2015). We have concentrated on the following issues:

1. The inclusion of several asset classes and types of financial corporations to reach a better depiction of the Austrian financial system.

2. A clear connection of the non-financial within-period flows in the economy between different agents and the resulting effects on the accumulation of financial assets/liabilities.

3. A simple mechanism of portfolio choice determining the composition of agents' balance sheets.

4. Inclusion of a detailed depiction of the Austrian tax system, including taxes on wages, mixed income of self-employed, firm income (profit), products, production, and capital, and a basic depiction of the government transfer system (government consumption, social and other transfers).

5. Several exploratory scenarios to test the properties of the model.

The inclusion of several asset classes was primarily motivated by the fact that by implementing a more detailed financial structure in our model from the first stages of model building onwards,

we can cater to the specific strength of SFC models in the comprehensive depiction of the financial system. While we are aware that many of the behavioural equations, as well as the projections of the multitude of parameters and (exogenous or endogenous) variables still deserve a closer look and comprehensive empirical work, we believe that the basic logic of this model can offer a convincing case for the possibilities this framework is able to open up for future applications. Especially, the effects of different policy measures on growth and distribution - but also the composition and length of agents' balance sheets as well as on rates of return to different asset classes - can be effectively evaluated with empirical SFC models. Fiscal and monetary policy can be evaluated separately, but also jointly and in mutual interaction - especially in later, more developed versions of the model. By using standardised national accounting data from Eurostat - based on the framework put forth in Eurostat (2013) - and implementing the construction of our underlying datasets in computer code, we can potentially replicate this framework for several countries of the European Union (given sufficient time and resources).

The structure of this report is as follows: Firstly, the reader is introduced into the underlying data framework in section 2. After a preliminary exposition of principles of the National Annual Sectoral Accounts (NASA) data in section 2.1, we set out how we constructed the stock-flow consistent matrices for the model in section 2.2. This involves the compilation of a transaction flow matrix (TFM), section 2.2.1, a balance sheet matrix (BSM), section 2.2.2, as well as a flow-of-funds and a revaluation account, section 2.2.3. We describe some important aspects of the data structure and how the data are compiled, and relate to the main aggregations and disaggregations of flows, assets, and liabilities we undertook. Then we illustrate how we achieved consistency in these data sets individually, and elaborate how they interlink in the SFC framework. Some trends in balance sheet data are shown in section 2.2.4

Secondly, we describe the structure of our model in section 3. The model is composed of two major blocks, the first of which regards non-financial transaction (NFTR) flows, section 3.1, the second relates to financial transaction (FTR) flows, section 3.2. Each of these blocks features endogenous behavioural decisions of agents, exogenous variables forecast according to trends in the data, 'implied' stock-flow relations, and primary outcomes due to the interaction of these different flows. NFTR depict economic flows within an accounting period between agents resulting from various economic activities, while FTR show the accumulation of financial assets/and liabilities, and the transition of balance sheets from one year to the next. One major focus of the model extension set forth in this report is to achieve a link between the NFTR and FTR block of the model. Selected past developments as well as projections of both parameters and variables in the model are shown in this section to illustrate the endogenous dynamics - still preliminary in nature - implemented in this model to constitute the BAU scenario.

Thirdly, we demonstrate the functionality of this model by implementing selected exploratory scenarios in section 5. There, we simulate changes in various tax rates (wage tax, capital tax, firm income tax), as well as different changes in government expenditure (government consumption or social transfers), often in combination with each other. We show the results of these scenarios regarding main economic variables such as GDP, consumption, household income, investment, and operating surplus. Furthermore, we derive multipliers for each scenario to enable consistent comparison between them.

Lastly, section 6 concludes and offers an outlook on further extensions, possible work and improvements of the modelling framework.

As the model described and applied below is still a preliminary work in progress, this project report is intended to show the basic logic of the modelling framework, forming a base for discussion. Points that are especially open for further discussion are labelled by (to be discussed), and might deserve special attention regarding future work on the model.