RESEARCH PAPER

ENGENDERING FISCAL SPACE:

MODELLING ALTERNATIVE METHODS OF FINANCING INVESTMENTS FOR GENDER EQUALITY

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APRIL 2025
UN Women

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ECONOMIC EMPOWERMENT SECTION
UN WOMEN
New York, April 2025

UN WOMEN

ACKNOWLEDGEMENTS

Engendering Fiscal Space: Modelling Alternative Methods of Financing Investments for Gender Equality is a background paper for Anuradha Seth. 2025. *Engendering Fiscal Space: A Policy Framework for Financing Gender Equality*. New York: UN Women. The paper was informed by experts and feminist economists who provided invaluable feedback during two Expert Group Meetings (EGM), one held in January 2023, hosted by the Istanbul Technical University (ITÜ), and a second one, held virtually in July 2024.

The early stages of this work were supported by the UN Women–ILO Joint Programme on *Promoting Decent Employment for Women through Inclusive Growth Policies and Investments in the Care Economy,* a 2019–2023 programme funded by the Swiss Agency for Development and Cooperation (SDC). The aim of the programme was to build a political consensus for the adoption of macro-level economic policies that promote gender equality, and to assist in the identification of sectoral and industrial policies that tackle occupational and sectoral segregation and enhance women's access to decent employment opportunities. The programme's goal was to ensure that adequate funding goes to the care sector both as a way to promote women's access to employment and to redistribute care work between men and women within the household, as well as between the household and the state.

Upon completion of the above-named programme, the work now continues under UN Women's programme on *Transformative Approaches to Recognize, Reduce, and Redistribute Unpaid Care Work in Women's Economic Empowerment Programming in Rwanda and Senegal,* a 2023–2025 programme funded by the German Federal Ministry for Economic Cooperation and Development (BMZ). The overarching goal of the programme is to remove the structural barriers to women's full and equal participation in the economy by recognizing, reducing and redistributing unpaid care work.

The authors are grateful to Anuradha Seth, Maria Nikolaidi, Ozlem Onaran and the participants of the 2024 IAFFE Conference for their valuable comments on previous drafts.

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Editor: Andy Quan. *The report has been edited according to the UN Editorial Manual and the UN Women Style Guide.*

Design: Oliver Gantner

Recommended citation: A. Zacharias, G. Zezza and T. Masterson. 2025. *Engendering Fiscal Space: Modelling Alternative Methods of Financing Investments for Gender Equality.* New York: UN Women.

TABLE OF CONTENTS

SUMMARY

Using a framework to analyse the macroeconomic and microeconomic impacts of policies aimed at enhancing gender equality, we propose an alternative model of financing investments for gender equality. The policy initiatives are distinguished by their specific goals and methods of financing. A fully articulated stock-flow consistent post-Keynesian macroeconomic model is sketched to track the changes in flows of income and expenditures as well as changes in assets and liabilities. Our model is multisectoral (e.g. it can include capitalist mining and non-capitalist agriculture) and encompasses major institutions of the economy, such as businesses and households. The microeconomic impacts of the changes in macroeconomic conditions are captured via a microsimulation model that does not rely on assumptions of utility-maximizing behaviour.

Individual outcomes are determined via a computational method ("hot-decking") that uses a representative sample of the entire population (rather than a few representative agents). The model delivers the statistically most likely results based on the diverse constraints and opportunities of the individuals. In addition to labour market effects, we also model the impacts on unpaid household production activities. Distributional outcomes for population subgroups (including intra and intergroup inequality) can be assessed with the model using standard measures such as earnings and family income. Because we model household production, the impacts on measures of economic well-being and poverty that incorporate household production can also be evaluated.

1.
INTRODUCTION

Alternative policies to promote gender equality are likely to have different effects on the various metrics of gender equality such as differentials in employment rate, wages and unpaid care work. Further, these effects are prone to vary across social groups. For instance, gender inequality in employment rates may rise at the bottom rungs of the income distribution but fall in the middle rungs. Alternative policies are also, for the same amount of investment, expected to create different impacts on macroeconomic aggregates such as the trade balance or tax revenues. As an example, consider providing greater government subsidies to small farmers. In many parts of sub-Saharan Africa, such a measure would probably impart a disproportionate boost to rural women's income in cash and in kind. Now suppose that a similar-sized expenditure is made toward the public provisioning of childcare services in urban areas. Given the relatively high labour-intensity of childcare provisioning (particularly of female labour), the investment would result in a greater stimulus to women's wage income. However, the import requirements of the two interventions are likely to be different, partly because of the technological differences between the two sectors and between the sectors in their respective supply chains. Further, the impact on tax revenues would also be different because, e.g., the share of purchases of goods and services that fall outside the orbit of tax authorities will be greater in rural than urban areas. Admittedly, substantial differences in distributional and macroeconomic outcomes are bound to stem from "what" and "for whom" the policies are formulated and government expenditures are incurred.

In addition to the questions regarding for what and for whom, there is also the question of "how", i.e., the impacts of how the policies are financed (e.g. via additional taxation or foreign borrowing). We believe that alternative initiatives should be analysed by considering alternative financing methods as well. Such an evaluation is necessary because the macroeconomic impacts of alternative forms of financing are different in theory (see, e.g., Godley and Lavoie 2012, especially Chapter 6 and Chapter 12), particularly concerning debt sustainability (an example is discussed below in Section 3.2.4). Hence, the microeconomic impacts are also likely to be different. For example, financing via external borrowing may necessitate boosting the tradable sector that in general would have a different demographic composition of workers and earnings distribution. On the other hand, if the intervention is financed via domestic borrowing, it is possible that the tradable sector may not experience a similar expansion compared to financing via external borrowing. Thus, employment growth under domestic financing may occur among workers drawn from different portions of the earnings distribution and with different shares of demographic groups.

Our goal is to develop a macro-micro policy model to conduct impact assessment arising from what, for whom and how aspects of several potential interventions. The model is specified in rather general terms. Inevitably, the form it would take for a specific country and period would depend on the institutional context and data availability. The model proposed here builds on our earlier work modelling the macroeconomic and microeconomic implications of policy interventions that aim to enhance gender equality (Antonopoulos et al. 2010; Zacharias et al. 2019; İlkkaracan et al. 2021).

The impacts generated by the alternative methods of financing are analytically distinct from what may be called the direct and indirect impacts of the policy interventions. Consider, e.g., the impacts of expanding

early childhood education (ECE), an example that we will use recurrently in this paper. We expect the addition of childcare services to reduce the unpaid work time of caregivers, increase the employment of childcare workers, and generate a set of associated effects at the level of the individual (e.g. higher earnings) and household (e.g. changes in the intrahousehold division of labour in household production and higher additional income). These may be described as direct effects. Further, ECE expansion would require supplies of intermediate inputs from other industries, generating additional labour demand and driving another set of individual and household-level changes.[1] Typically, we describe such effects as indirect effects. We can often ascertain the magnitude of the direct and indirect effects using an appropriately modified Leontief inverse combined with a microsimulation model (e.g. İlkkaracan et al. 2021). We do not expect the effects to depend on the source of financing the ECE expansion unless certain strings are attached by the financing body (e.g. the conditionality of using imported intermediate inputs associated with a foreign grant or loan).

The effects due to the chosen method of financing will make themselves visible through exclusively macroeconomic channels, which, in turn, will have gendered and distributional effects. For example, we expect the impacts to differ between foreign and domestic borrowing. We outline a generic post-Keynesian stock-flow consistent (SFC) framework to account for the macroeconomic channels. We will contrast our model with the mainstream approach (i.e. marginalist approach) that combines Social Accounting Matrices (SAMs) and general equilibrium theory. Our critical review will also cover alternative heterodox models that combine post-Keynesian macroeconomics with a highly aggregate specification of the household sector, such as the labour supply or the (marginal) consumption expenditure propensities differentiated by gender or households categorized by recipiency of different types of income (e.g. capital income versus labour income) or other characteristics (e.g. rural households versus urban households). We will compare and contrast this approach with our favoured approach of representing households and individuals using nationally representative samples.

The rest of the paper is structured as follows. We begin with a schematic overview of the model and its potential uses (Section 2). Next (Section 3), we turn to the macroeconomic block and outline the structure of the SFC model. We also discuss some macroeconomic adjustment mechanisms we propose incorporating in the model. These are post-Keynesian and distinct from the usual marginalist macroeconomic theory that underpins most "gendered" CGE models (e.g. Lofgren and Cicowiez 2021).[2] In the subsequent section, we address the issue that the aggregate effects have implications for individual and household economic well-being as well as economic inequalities, including those based on gender (Section 4). While our model can deal with a few channels that transmit the impacts of the changes in macro variables to micro-outcomes such as the wealth effects[3] on household consumption, here, we focus primarily on changes triggered by the employment channel.

To analyse these micro-level changes, we adopt an intersectional view that considers men and women in the context of their diverse constraints and opportunities, governed by factors including social class, race/ethnicity/caste, religion, family type, composition and size, and responding to economic changes according to procedural rationality.[4] In contrast to the neoclassical theory of the household adopted in several gendered CGE models (see, e.g., Fontana and Wood 2000),[5] we do not adopt the framework of utility-maximizing individual behaviour. Our focus is on outcomes rather than behaviour. Our microsimulation model seeks to identify the persons and households most likely affected by the changes in employment and the resulting changes in individual and household economic well-being. The identification relies on computational and non-parametric methods rather than parametric stochastic modelling, though we use the latter as a tool in our modelling.

After outlining the macro and micro blocks of the model in some detail, we give a preliminary overview of the data available to implement our model in Section 5. We focus on three countries – Kenya, Rwanda and Senegal – before the conclusion.

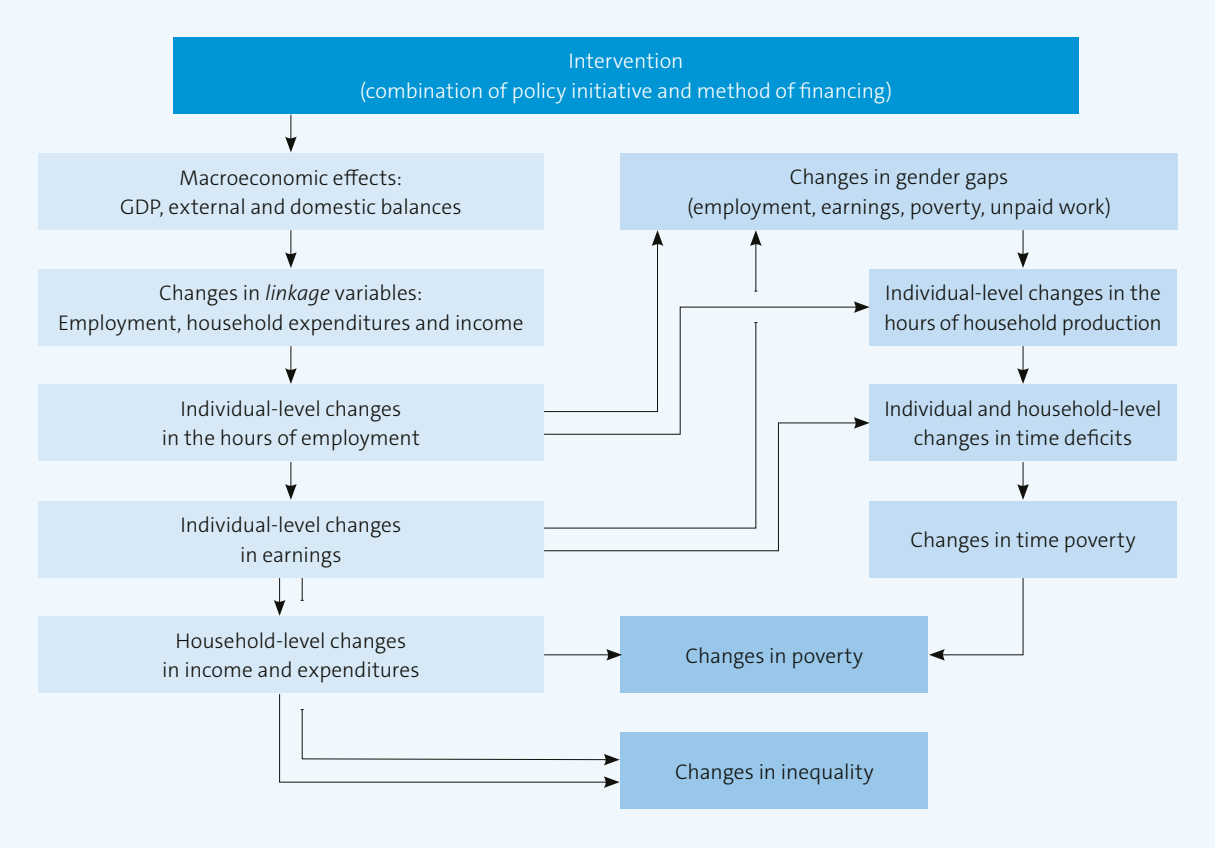
2.

OVERVIEW

Our model can be described as a top-down, macro-micro simulation model. The top-down aspect of the model refers to ruling out feedback effects from the micro-level to the macro-level (for a typology of macro-micro models, see Cockburn et al. 2015). For example, a macroeconomic policy intervention that creates employment may have an impact on the gender division of unpaid work. Our model attempts to quantify the gendered effects of the intervention on employment and unpaid work. However, we do not capture the potential impact of the changes in the division of unpaid work on macroeconomic variables such as the government deficit. The same applies to changes in poverty or inequality generated by the intervention, as will be discussed later in the paper. Modelling such feedback loops is rather difficult mainly because of theoretical reasons. For example, no theory tells us how an increase in poverty would affect GDP growth. Further, we should consider the time dimension involved in the simulations. They are, at best, thought of as simulations of effects that would occur with a given stock of means of production, technology, labour force, and institutional and social norms. That is, our model is not a model of long-run capital accumulation and growth.

FIGURE 1

Model overview



The overall nature of the simulation model is summarized in Figure 1. A simulation run begins with specifying the policy intervention, i.e. its purpose, design, scale and method of financing. The first block on the left-hand side estimates the macroeconomic effects, the impact on GDP and its components, aggregate employment, and the financial balances of the government, domestic private sector and external sector. The next block extracts the so-called linkage variables that link the macro and micro sides of the model. Our primary interest here is on changes in employment. From here, we are in the micro domain. Individual-level changes in the hours of employment are modelled next, followed by the changes in individual earnings. Adding up changes in earnings for individuals within each household yields, after some adjustments, the change in each household's income. From here, we can estimate the changes in the spending of individual households. Individual earnings, household income and expenditures may be used to measure the change in inequality due to the policy intervention. Household expenditures are generally employed to assign poverty status in the Global South. Finally, our simulation can provide an assessment of the intervention's impact on poverty.

We have shown on the right-hand side a set of changes triggered by changes in employment. Depending on the nature of job creation (mainly its industrial and occupational distribution), we may see differential changes in men's and women's employment rates. Further, the associated effects on individual earnings can alter the gender disparity in earnings. The changes in the hours of employment affect the time available to individuals to provide unpaid domestic and care services ("household production"). Changes in the employment status and earnings of the individual can also alter the intrahousehold division of household production responsibilities. Combined with the potential shift in household expenditures (e.g. greater purchases of prepared meals), the changes in employment-related gender disparities can generate changes in the individual's household production hours. Our measure of time deficits captures the extent to which an individual is deprived of the required provision of household production, given their personal care needs, employment commitments and intrahousehold division of labour. In turn, we also recognize that such time deficits have an impoverishing impact because maintaining a minimum (poverty-level) standard of living presupposes a definite level of household production. Consequently, households with time deficits would need to purchase market substitutes to compensate for the shortfall in household production, reducing the resources available to acquire other basic requirements such as food and clothing.

As typical with this type of modelling, a certain degree of flexibility exists to adapt to the research questions and data availability. For example, the macro model we deploy contains several productive sectors. Still, the list of productive sectors can be varied (e.g. including the own-account agricultural sector or synthetic early childhood education) in line with the modelling purpose. From the data availability perspective, consider a country that has not collected information on time use. In that case, the micro impacts we trace in the model will have to exclude changes in household production and time deficits. The model's flexibility may also be seen in the range of questions it can address. A familiar exercise simulates a fiscal stimulus for the care sector (e.g. expansion of adult care services) and its distributional consequences, including gendered impacts.

Less studied from a heterodox perspective are monetary policy interventions. For example, consider a loan guarantee scheme that reduces borrowing costs for own-account women producers. Given sufficient information on household assets and liabilities, the micro part of the model could simulate the participation rate of households in the scheme and the resulting reduction in borrowing costs. The rise in net income from own-account employment can generate more consumption demand. Once the latter is estimated from the microdata, the results can be fed into the macro part of the model to derive the macro and micro impacts of the additional consumption demand and reduction in borrowing costs (including the reaction of the banking sector at the macro level). This example illustrates that the top-down feature of the model does not prevent us from using it to examine the impact of measures with initial effects, mainly in the microsphere, but generates nontrivial bottom-up effects (i.e. from micro changes to macro changes).[6]

TABLE 1

An example of the evaluation matrix with two policy initiatives, A and B, both worth $1 million

Financing of US$1 mil. in:	Initiative A								
	GDP	Fiscal deficit	Ext. deficit	Employment ♂	Employment ♀	Poverty ♂	Poverty ♀	Unpaid work ♂	Unpaid work ♀
Domestic borrowing									
Taxes									
External borrowing									
Grants									
Combo									

Financing of US$1 mil. in:	Initiative B								
	GDP	Fiscal deficit	Ext. deficit	Employment ♂	Employment ♀	Poverty ♂	Poverty ♀	Unpaid work ♂	Unpaid work ♀
Domestic borrowing									
Taxes									
External borrowing									
Grants									
Combo									

The assessments from our model can be schematically presented in various ways. An example is the evaluation of two policy initiatives to reduce gender inequality, as shown in Table 1. We label them A and B. We also assume that both incur expenditures worth US$1 million. The interventions may be funded by domestic borrowing, raising taxes, external financing or foreign grants (the rows of the matrix). A specific combination of various sources may also provide the requisite funding. The solution of the model for each initiative and financing method will yield estimates to fill in the columns of the outcome variables displayed in the table. Macro variables are the percentage increase in GDP and percentage-point increases in the fiscal and external deficits, both expressed as percentages of GDP. The micro outcome variables shown provide information

regarding the percentage increase in employment and hours of unpaid work (household production), which are differentiated by gender. We may also include the change in the incidence of poverty by gender among the outcomes to be considered.

Since our model will imply dynamic effects of a given policy on different aggregates, such as productive capital and public and private debt which have effects on future spending decisions, the model will be able to produce estimates of the effect of the policy over different time horizons.

The model will typically project the values of key variables in a Business As Usual (BAU) baseline, and then compare the elements of Table 1 for each policy against the BAU scenario.

3.
MACRO MODELLING BLOCK

The state-of-the-art tool for assessing the impact of given policies, or shocks, on gender equality is a Computable General Equilibrium (CGE) model based on a Social Accounting Matrix (SAM).[7] However, the fact that CGE models typically follow the neoclassical approach of separating the analysis of production and expenditure decisions from the analysis of the consequences on financial markets of the accumulation of debts (or wealth) has generated a growing dissatisfaction with this approach, especially after the Great Recession of 2007 to 2009. When CGE models assume that the economy is running at full capacity, another layer of unrealistic outcome is added since a stimulus—say—to increase the output of a given industry has to imply a reduction in production of some other industry, which may not be adequate when studying countries with substantial open or hidden unemployment and underemployment, or a large share of the working-age population in non-market activities.

Alternatives have been proposed, which are still based on the SAM-CGE framework but dropping the assumption that resources are fully utilized to adopt a more Keynesian approach that suggests that production will depend on demand (Zacharias et al., 2019). Most of these studies address gender issues by explicitly considering the care sector, possibly separating non-market activities and urban households from rural households, which have a strong impact on employment by gender and on gender wage gaps. When available, macroeconomic data are analysed jointly with survey data on time use to evaluate the effects of policies on time poverty by gender.

Another approach has been pursued by Ozlem Onaran and her co-authors, who adopt a Keynesian/Kaleckian framework rather than a CGE model (Onaran et al., 2022a, 2022b). In a recent contribution, they have also connected the analysis of the sources of funding to gender policies, albeit without considering a full stock-flow consistent approach (Onaran et al., 2023). Our theoretical background is the same as adopted by Onaran and her co-authors. However, we believe that framing the analysis in a general framework which encompass both real and financial markets, as well as the distributional outcomes, would allow for a more comprehensive evaluation of gender-oriented policies that their work captures only in part.

3.1.
A core stock-flow consistent model

The macro-micro approach adopted in the stock-flow consistent (SFC) model aims to integrate the analysis of real and financial markets in a way that is perfectly aligned with the System of National Accounts (SNA) 2008 (EC et al. 2009) and flexible enough to accommodate alternative approaches to assessing alternative policies, gendered and distributional impacts. The novelty of the macro modelling block relies on a consistent view of both transactions connected to the generation of income, expenditure and more, and the building up of credits and debts, with their implications on the dynamics of budget constraints for households and on the other institutional sectors of the economy.

SFC models were initially proposed to address financial stability and policy alternatives at the macroeconomic level, with a high order of aggregation. The approach began to gain popularity for its effectiveness at predicting economic crises (Godley 1999; Godley and Zezza 2006) and after Godley and Lavoie's publication (2007), which showed in detail how the approach allowed a study of the behaviour of both real and financial markets, it has been widely adopted in the post-Keynesian macro-economic literature (see, e.g., a survey at Nikiforos and Zezza (2017)).

Macroeconomic models built on the SFC approach have been estimated by the research group led by Godley in the United Kingdom first and at the Levy Economics Institute in the United States later. The effectiveness of the approach later led central banks and government institutions to adopt the same methodology (see Burgess et al. (2016) for the United Kingdom and Hermitte et al. (2023) for Italy). More recently, the SFC approach—which, following the Keynesian approach, is centred on the determination of aggregate demand—has been extended to address problems requiring a disaggregated, sectorial representation of production and demand, such as climate change as well as other environmental issues (see, e.g., Dafermos et al. (2017)). To this end, the SFC architecture is complemented by a supply-side structure according to the input-output approach. This latter version of the SFC modelling approach is what we deploy for the macro block of the model proposed here.

3.2. The accounting structure

SFC models all have a skeleton based on four accounting matrices, which respect the principles of national accounting recommended in the System of National Accounts 2008 (EC et al. 2009) adopted worldwide, albeit with different degrees of implementation, conditional on the availability of resources and data. All matrices refer to the institutional sectors of the economy: household as well as non-profit institutions serving households (NPISH); non-financial businesses, sometimes split between corporate and non-corporate; financial businesses, sometimes split between the central bank, other monetary institutions and financial institutions; government, usually divided between central and local institutions; and the rest of the world.

The first set of accounting identities is organized to respect the first principle of stock-flow consistency: for every payment taking place in the economy, there must be an entry debiting the sector making the payment and an entry crediting the sector receiving the payment. These accounts can be organized in either a Transaction Matrix (TM) or a Social Accounting Matrix (SAM).

A simplified TM is shown in Table 2. In this case, each type of transaction is recorded on one row of the table, reporting the value with a plus sign in the column of the sector receiving the payment and a minus sign in the column of the sector making the payment. Accounting consistency requires that the sum of all cells in each row be zero. The example starts with the payments connected to the components of GDP from the demand and income sides. Notice that accounting consistency implies as well that the sum of the first column for production is equal to zero.

The non-financial side of the TM can be arranged to present the data in the same sequence adopted in the national accounts of institutional sectors: determination of primary income, determination of disposable income, current expenditure, capital expenditure and saving formation. However, the modeller will need to address the problem that the payee and payer will not necessarily be matched for each type of payment. The financial side of the TM, which has a direct relationship to flow-of-fund matrices, will include the payments related to the purchase, sale of financial assets and liabilities, which we will discuss after a brief discussion of Social Accounting Matrices. The SAM approach is usually more familiar to researchers who adopt input-output techniques or Computable General Equilibrium models. In this case, payments/receipts are arranged in a table where payments are recorded in the columns and receipts are recorded in the rows, as in the example of Table 3.

Photo: UN Women / Nicholas Axelrod

TABLE 2

An example of a Transaction Matrix

	Prod.	HH	NFB	FB	GG	RoW	Tot
Compensation of employees	-CE	+CEd				+CEw	0
Net indirect taxes	-NIT				+NIT		0
Gross operating surplus	-GOS	+GOSh	+GOSn	+GOSf	+GOSg		0
Compensation of employees from the Rest of the World		+CEFW				-CEFW	0
Household consumption	+CON	-CON					0
Government consumption	+G				-G		0
Gross capital formation	+GCF	-GCFh	-GCFn	-GCFf	-GCFg		0
Net exports	+NE					-NE	0
Interest on foreign loans			-iFLn	-iFLf	-iFLg	+iFL	0
Interest on domestic loans		-iDLh	-iDLn	+iDL	-iDLg		0
Dividends			-DIV		+DIVg	+DIVw	0
Taxes		-Th	-Tn	-Tf	+T		0
Transfers from the government		+TRgh	+TRgn		-TRg		0
Remittances		+TRwh				-TRwh	
Increase in financial assets		-DFAh	-DFAn	-DFAf	-DFAg	-DFAw	0
Increase in financial liabilities		+DFLh	+DFLn	+DFLf	+DFLg	+DFLw	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**

In the SAM, each cell will include all payments on the current account made from one sector (in the column) to another (in the row). The consistency principle requires that the sum of the elements in a row (money obtained) be equal to the sum of the elements in the corresponding column (money spent plus saving/net acquisition of financial assets). In both the TM and the SAM tables, imports can be assumed to be purchased by domestic firms and, therefore, appear as a cost of total production.

When data are available, imports can also be decomposed between intermediate goods and final goods, allowing for a better representation of the economy's supply side, and of the impact on the balance of trade of increases in production for given industries. In a similar vein, institutional sectors can also be disaggregated depending on the availability of data and research goals, e.g. central and subnational levels of government.

TABLE 3

Structure of a Social Accounting Matrix

	Production	Households	Non-fin. business	Financial business	Govt.	ROW	Capital account	Total
Production	IP	CON			G	EXP	GCF	**Q**
Households	WBh + GOSh	TRANSFER MATRIX					GCFh	**Yh**
Non-financial Business	GOSn						GCFn	**Yn**
Financial business	GOSf						GCFb	**Yf**
Government	GOSg + NIT						GCFg	**Yg**
ROW	IMP							**Yw**
Capital account		SAVh	SAVn	SAVf	SAVg	SAVw		**SAV**
Total	**Q**	**Yh**	**Yn**	**Yf**	**Yg**	**Yw**	**GCF**	

From the point of view of the accounting structure of an economy, the TM and SAM approaches both fulfil the consistency requirements we have discussed. From a modelling perspective, the SAM is usually better suited to address questions using a single year of data, and with minimal behavioural assumptions, SAM-based models permit solutions via matrix algebra. The TM approach, on the other hand, has been used more often with data available for many periods as time series, frequently with non-linear model closures that make the adoption of matrix algebra less feasible and require numerical methods. As is well-known, numerical methods are needed to solve static and dynamic neoclassical CGE models because the behavioural equations are generally non-linear.

Another consideration that favours using SAM as a starting point is the relative ease of incorporating industrial disaggregation. Based on the input-output table, the model disaggregates production into specific key sectors (usually less than 10). That is, for each sector, a column and row are added for intermediate purchases (IP). Corresponding disaggregation is also carried out for total wage bill (WBh), gross operating surplus (GOS) and net indirect taxes (NIT), as well as for domestic and foreign final demand. Valdecantos (2021) and Passarella (2023) discuss SFC models with an input-output structure.

3.3. Financial accounts: flow of funds

SFC adherents point out that the table is incomplete because it does not carry through the logical implication of the principle of double-entry accounting. For example, what form does the savings of the household sector take? How are budget deficits financed? (Godley and Lavoie 2012: 8). These considerations lead to the flow of funds (FoF) matrix, which displays the sources of funds and the uses of funds for each institutional sector. The standard disaggregation of these flows is again detailed in the SNA, which suggests reporting the acquisition of assets and incurrence of liabilities distinguishing, for each institutional sector, among:

- Monetary gold and Special Drawing Rights (SDRs)
- Currency and deposits
- Debt securities
- Loans
- Shares
- Insurance, pension and standardized guarantees
- Financial derivatives
- Other

The estimates of these flows in each period, which may appear both in the assets and liability side of a given sector, are usually estimated and published by central banks. Stock-flow consistency requires that, for each financial asset/liability, the value of—say—new bank deposits made by households are reported as an increase in the value of financial assets of the household sector and an increase of financial liabilities of the financial sector for the same amount so that creditors and debtors can be matched. Several countries publish these financial data matching creditors to debtors. For those that lack such data, a matching procedure will need to be conducted in the modelling stage with appropriate hypotheses.

The last equation says that capital expenditure **(*GCFn*)** must be funded either through internal funds **(*SAVn*)** or through an increase in liabilities **(Δ*Ln*)** or a reduction in financial assets **(Δ*An*)**. Applying the same analysis to the other sectors helps to clarify the sources and uses of funds both at the sectoral level and for the country. In other words, the sum for each column of the TM will provide the budget constraint for a specific sector. The macroeconomic effects of alternative methods of financing interventions for gender equality would begin by describing the financing modalities within this framework.

The accounting identities implied in the TM (or the SAM) and those in the FoF provide a fundamental identity for each institutional sector and the national economy as a whole. In summary, equations 1 to 5 are:

$$\textit{Income less current expenditure = Saving (SAV)} \tag{1}$$

$$\textit{SAV less gross capital formation (GCF) = Net acquisition of financial assets (NAFA)} \tag{2}$$

$$\textit{NAFA = Net acquisition of assets (}\Delta\textit{A) less Net incurrence of liabilities (}\Delta\textit{L)} \tag{3}$$

Applying the fundamental identity to the non-financial business sector, for instance, results in:

$$\textit{NAFAn = SAVn – GCFn = }\Delta\textit{An – }\Delta\textit{Ln} \tag{4}$$

and rearranging leads to:

$$\textit{GCFn = SAVn + }\Delta\textit{Ln (–}\Delta\textit{An)} \tag{5}$$

3.4. The revaluation matrix

The logical question once the flow of funds is considered is this: what are the results of these flows? Where are they going? To complete the macro picture, stocks (i.e. stocks of assets and liabilities) need to be brought into the picture explicitly. Borrowing and lending need to be linked—and, more generally, all entries in the FoF—to the stocks of the nation's assets and liabilities and individual institutional sectors. In doing so, the change in the market value of real and financial assets due to changes in their market price ("revaluation") needs to be considered. The revaluation matrix displays for each institutional sector (rows) the amount of capital gains or losses for each asset and liability (columns) between two periods.

For instance, the value in the domestic currency of foreign loans at the end of the next period (FL_{t+1}) will be given by the value in US$ at the end of the period $(FL\$_{t+1})$ at the new exchange rate (e_{t+1}). In general, the value of an asset/liability i at the end of period $t+1$, can be written as:

$$A_{i,t+1} = A_{i,t} + I_{i,t} + \dot{p}_{i,t+1} \dot{A}_{i,t} \qquad (6)$$

where $\dot{p}_{i,t+1}$ is the percentage change in price and I_i is the new acquisition in period t.

The value of FL will evolve because of (a) new loans being obtained, less reimbursement of existing loans and (b) changes to the exchange rate.[8] The latter generates capital gains/losses, which may be very large and volatile. Net capital gains have played a significant role in the last two booms that ended in recessions: the stock-market boom of the second half of the 1990s (the "dot-com bubble") and the housing market boom of the first half of the 2000s, which ended with the 2007 Great Recession. Therefore, any macroeconomic model must incorporate net capital gains and allow for feedback from speculative movements in housing and financial markets on the real economy and the balance sheet of institutional sectors.

3.5. The balance sheet matrix

A matrix represents the balance sheet of the economy. Table 4 illustrates 10 asset/liability categories and 6 institutional sectors. Apart from real capital, other categories are all financial assets and liabilities. Domestic and foreign components of loans, shares and securities are distinguished below. Also, except for real capital, the row sum of each category adds up to zero because each financial asset of an institution is the liability of another institution and vice versa.

The inclusion in the model of the stocks of assets and debt allows for tracking the implications for expenditure and saving decisions, as well as for endogenizing the income transfers generated by interest payments on existing debt. For example, as discussed below, we model household consumption expenditures as a function of disposable income and wealth. Flow-of-fund data, together with net capital gains, can then be utilized to construct the evolution of the balance sheet of institutional sectors over time, with the obvious (but too often forgotten) principle that each debt of a sector is a credit of some other sector.

Photo: UN Women / Joe Saade

TABLE 4

A balance sheet matrix

	Household and NPISH	Non-financial business	Central Bank	Other financial institutions	Government	ROW	Total
Real capital	+Kh	+Kn			+Kg		**+K**
Gold and SDRs			+CBA			-CBA	**0**
High powered money	+HPh		-HP	+HPb	+HPg		**0**
Bank deposits	+DEPh	+DEPn		-DEP	+DEPg		**0**
Gov. securities	+Bh	+Bn	+Bcb	+Bb	-B	+Bw	**0**
Domestic loans	-Lh	-Ln		+L	-Lg		**0**
Foreign loans		-LWn		-LWb	-LWg	+LW	**0**
Domestic shares	+EQh	-EQ			+EQg	+EQw	**0**
Foreign shares	+EWh	+EWn		+EWb		-EW	**0**
Foreign securities		+Fn	+Fcb	+Fb		-F	**0**
Total	**+Vh**	**+Vn**	**0**	**0**	**+Vg**	**+Vw**	**+K**

3.6. Sources and uses of funds at the industry level

One of the problems that arises when expanding the production side of a standard SFC model to include an input-output table is how to model the sources and uses of funds for each industry. It is currently recommended in the SNA manual to publish flow-of-fund and balance sheets for the institutional sectors of the economy, but to our knowledge there are no standardized publications of, say, the net increase in loans by industry, or the net emission of equities.

Input-output tables, provide sufficient information, however, to evaluate the determinants of net lending by industry, i.e. the difference between the value of sales, and the sources (and uses) of funds by industry will have to be estimated using additional data sources, when available. For example, statistics on bank loans by industry are collected by some central banks and data on foreign direct investment are also often available. Lacking such data, the analysis of flows of funds will have to be done by institutional sector: non-financial corporations, financial institutions, central and local governments, and households.

3.7. Model closures

The accounting framework of an SFC model can be extended appropriately according to the research question to be addressed. So far, the structure of the model has followed the same principles adopted for producing macroeconomic data according to the SNA. Therefore, it will not be biased in one direction or another by the adoption of a given theory. Any consistent macroeconomic model should be coherent with this accounting structure and since most models have a much simpler structure, they implicitly assume that not explicitly representing some parts of economic processes—usually related to financial markets—will not imply severe distortions in their results. However, the experience of the last Great Recession has shown neglecting interactions between real and financial markets may imply completely wrong perceptions of the impact of shocks or policies. Therefore, explicitly or implicitly calibrated, a complete accounting structure is an essential requirement.

Once the accounting structure is complete and tested for consistency, the next step in model development requires the adoption of appropriate closures, i.e. assumptions about the direction of causality among model variables. So far, most, if not all, empirical SFC models in use are based on post-Keynesian closures. Such a position entails assuming that the level of real GDP is determined from the demand side, with real private expenditure depending on real disposable income and the real stock of (real and financial) wealth. Exports and imports are also carefully endogenized based on income and relative price determinants. This demand-led Keynesian approach has proven effective not only for developed economies but also for lower-income countries that may experience supply-side constraints.

The following section sketches the vital causal links among model modules at the aggregate level.

3.8. Aggregate demand

At the aggregate level, household domestic consumption in real terms is assumed to depend on real disposable income and the initial stock of wealth, with a specification that implies a stable wealth-to-income ratio in the long run, with short-run deviations that can originate from changes in the autonomous component of consumption, financed by borrowing. In developed economies, capital gains on real estate and financial assets also play a relevant role in determining deviations of consumption and saving decisions from what would imply a stable long-run wealth-to-income ratio.

Investment is usually modelled more effectively when it can be studied separately for residential and non-residential expenditures, since the former usually relies more on the conditions of finance than the latter. Empirical analysis has shown that models based on a target output–capital ratio usually imply realistic results.[9] This investment specification introduces another path dependence to the model in addition to the consumption –savings–wealth nexus.

SFC models explicitly link the target expenditure for productive investment to the availability of internal funds (undistributed after-tax profits), the demand for new loans (conditional on an evaluation of loans' profitability from financial businesses) or the sales of new equities, which may take the form of foreign direct investment. In this way, the dynamics of investment and accumulation of real assets are linked to the dynamics of debt and foreign ownership of productive assets.

Exports and imports are determined based on an indicator of the real disposable income of the buyer and a measure of the real exchange rate, usually decomposed in the determinants of domestic and foreign inflation, as well as of the nominal exchange rate. The balance of trade, along with net property income flows, will imply a change in the net external investment position of the country, which in turn will affect the availability of funds and possibly the exchange rate.

Since this macro model disaggregates demand into a few productive sectors, the components of aggregate demand need to be allocated across the productive sectors. As in SAM-based CGE and structuralist models (see, e.g., Taylor 1983: 68), survey data on household expenditures can be used to estimate the changes in the sectoral shares of domestic private consumption in response to a policy intervention. The cost of borrowing may also be relevant to household expenditure decisions, particularly for some categories of goods and services. This consideration can also be incorporated into the sectoral decomposition of private domestic consumption. Similarly, relatively simple techniques can be deployed on the data available from the input-output table or SAM to allocate imports and exports across the productive sectors.

3.9. The labour market

In a model of the economy that assumes that output is driven by demand, the level of employment is usually determined by the demand for labour, considering the determinants of labour productivity. Once the change in demand for each industry as a result of the policy intervention has been determined, this will impact the demand for labour. Labour supply in a post-Keynesian model is usually projected to grow following demographic determinants and considered to be sufficient to meet the additional demand, especially in the context of the Global South. Gaps between labour demand and supply will determine the unemployment rate, which may influence, at least to some degree, real wages. Price determination will have to be evaluated at the sectoral level, with movements in the average price index influenced by labour cost, and the cost of imported goods, with modalities that will need to be specified according to individual countries' specificities.

3.10. The financial sector

The behaviour of the financial sector is usually based on the hypothesis that it will accommodate the requests for funding coming from other sectors, conditional on these operations being profitable. For instance, loans will be provided to the non-financial sector on demand, at an interest rate given by a markup over the cost of borrowing for the lending institution, where the markup will vary with the riskiness of the borrower, which at the aggregate level can be proxied by the ratio of outstanding debt to income, or a similar indicator.

The cost of borrowing for lending institutions typically depends on monetary policy decisions from the central bank. In small open economies, the demand for liquidity may often rely on the demand for foreign currency to pay for imports or other obligations with foreign institutions. In such cases, the central bank may not be able to lend at rates lower than those prevailing in international financial markets. These considerations can be directly incorporated into this model. Another factor to consider in the specification of the financial sector in some countries is the role of microcredit. Where relevant, it should be treated explicitly in the model whenever data—on the size and the cost of such credit—have been collected and published.

3.11. Fiscal policy

SFC models usually pay great attention to endogenizing all the components of government revenues and of the expenditures that depend on the business cycle. These will include different types of taxes and contributions, as well as transfers such as unemployment benefits and pension payments. For these variables, fiscal policy will imply, for instance, changes in specific tax rates. The model will specify the sources of funds for government expenditures and consider the possible implications of "excessive" debt burdens in terms of interest payments to foreign creditors, as well as the possible impact of higher debt-to-GDP ratios on the cost of borrowing.

3.12. Macroeconomic closures

SFC models are fully compatible with a structuralist approach to modelling a developing economy in the spirit of Taylor (1983). Contrary to most CGE models, however, macroeconomic closure does not constrain investment to be determined by aggregate saving. Convergence towards macroeconomic equilibrium will typically be achieved with one or more sectors being out

of equilibrium and one or more institutions reacting to prevent imbalances from cumulating over a desired threshold. As an example, consider the net wealth of the main institutional sectors of the economy, where the subscripts ***h***, ***i***, ***f***, ***g*** and ***w*** identify the household, business, financial, government and rest of the world sectors, respectively. Consider a stable, sustainable initial condition where the end-of-period stocks of net financial assets are:

$$B_h = -B_i - B_g \qquad (7)$$

In other words, household net financial wealth comprises claims on domestic businesses (which will be holding productive capital) and government debt, with the net wealth of the financial sector being zero and no foreign debt or foreign assets. In countries where bank loans finance government expenditure, this situation will be determined by the financial sector lending to the government, thus creating liquidity that the government uses to pay businesses and workers in the private sector so that the amount of outstanding government debt will equal the amount of liquidity which are the assets of private institutions. As long as the government can roll over its debt that comes to maturity, such a configuration will be stable, and therefore the stock of government debt will match the stock of liquid assets desired by the private sector.

Consider the effects of a policy to increase government expenditure to reduce gender imbalances, e.g. by expanding early childhood care and education services. As discussed previously, this intervention will require an increase in employment in this sector and a corresponding increase in the compensation of employees (with a one-to-one increase in GDP). This stimulus to aggregate demand will imply the usual Keynesian effects on consumption and possibly on investment if the impact on the capital utilization rate is sufficiently large, as well as the multiplier effects that transmit the increase in demand from one industry to another.

Suppose the country can collect the value-added tax and income taxes effectively. In this case, part of the increase in government expenditure will be automatically financed by the rise in tax revenues. The remaining part will need to be financed, if the financial system will fulfil the demand for credit and that the increase in demand will not be large enough to generate an increase in the average costs of production and, therefore, inflation. The only problem in a small, open economy is that a considerable part of the additional demand will be for imports, so an increase in government deficit will translate into a balance of payment deficit. Of course, the macroeconomic outcomes will be different if the financing needs are met via increased taxation of high-income groups. Similarly, forgiveness of some external debt or reduced payments to service external debt can also offset the impact on the balance of payments.

SFC models also explicitly consider that debt implies future interest payments, so an increase in government deficit and a balance of payments deficit will generate an increase in future transfers of interest payments to the creditors, possibly increasing the size of both deficits. Usually, it is assumed that a central bank reaction function exists to ensure that the level of international reserves remains at appropriate levels, either through movements in the exchange rate or through other monetary policy instruments.

The same exercise to evaluate the impact of expanding ECE services would have, in a traditional CGE model, a different outcome. Consider the World Bank's Maquette for MDG Simulations (MAMS), discussed in Lofgren & Diaz Bonilla (2010). This model is the only one (we are aware of) that explicitly introduces different sources of finance for government expenditure, while the standard CGE closure simply assumes that aggregate investment is financed by aggregate saving. In this model, as in most traditional CGE models, output is considered to be determined by the amount of available resources, which are assumed to be allocated according to optimal choices so that the existence of involuntary unemployment and idle capital is ruled out.

In this version of MAMS, additional expenditure by the government must be financed by new taxation, foreign grants or loans, or sales of bonds to the private sector. The model allows for money to be created by a central bank but only in order to accommodate a preference for liquidity against bonds for the private sector. Under these assumptions, an increase in the supply of government bonds will crowd-out savings, which would have been allocated to private investment, and the impact on GDP would be smaller than in the model we outlined.

3.13. Micro modelling block

In so-called gender-aware CGE models, the standard approach of assessing distributional outcomes operates along two axes (e.g. Fontana and Wood (2000) and Cicoweiz and Lofgren (2023)). First, it distinguishes between different types of labour "factors" (e.g. female versus male labour). The second axis differentiates household characteristics (e.g. employed households with children, elderly households). The representative households in these models supply labour to various sectors of the economy, produce services such as childcare or cooking for their own consumption, and engage in leisure activities according to the principles of the utility-maximizing unitary household. A great deal of criticism has been levelled against this conceptualization of the household by feminist economists (see, e.g., Bergman (1996) and Ferber (2003)). While we also share several views of the critics, our focus here is on the representative household or worker methodology.

Bourguignon et al. (2005) provide a cogent argument regarding the limitations of the methodology of representative households if the analytical focus is on inequality and poverty. The critical limitation regarding household income inequality is that the methodology cannot account for within-group inequality. Most macro-economic changes will generally generate changes in between-group and within-group inequality. The latter is often the larger of the two components of overall inequality. Thus, using the representative-household methodology would be tantamount to ignoring what, in many instances, would be the more sizeable force behind changes in income inequality.

Further, estimating changes in the average income of subgroups of households will, in general, not allow us to derive the impact on poverty in terms of incidence and depth. In sum, if we want to capture the effects of initiatives for gender equality on household income inequality and poverty, it is necessary to go beyond the representative household methodology. Bourguignon et al. (2005) advocate replacing representative households with a representative sample of both households and individuals. We follow their method below. However, our approach to estimating employment effects is distinct from theirs because we employ non-parametric matching methods.

In the overview of the model (Section 3), we pointed out that we focus on the changes in employment as the key variable linking the macro and micro blocks of the model (see Figure 1). In turn, the changes in employment generate changes in individual earnings, family income and expenditures. We want to describe how inequality along the three dimensions changes due to particular policy interventions. In addition to metrics for the overall changes (e.g. the Gini coefficient of individual earnings), it is also desirable to examine the changes among population subgroups (e.g. earnings of highly educated women versus less-educated women) and, especially, along the gender axis.

Because we consider the gender disparity in the division of household production responsibilities as a crucial determinant of gender inequality in various domains, we model the likely impact of changes in employment on the hours allocated to home production. In our modelling, we consider that in multi-person households, the change in an individual's employment status may lead to changes in the intrahousehold allocation of home production, even though the employment status of the other adults in the household may remain unchanged. This is consistent with the view that employment status is critical in shaping intrahousehold power relations and gender norms, and which exerts powerful influences on household production allocation (see, e.g., Sen (1987), Agarwal (1997) and Kabeer (2008)).

Keeping track of changes in household production generated by the policy interventions is also important for poverty evaluation. As has been argued, poverty thresholds do not recognize that survival with a poverty level of income presupposes a certain amount of household production (Vickery 1977, Zacharias 2023). Consequently, conventional poverty thresholds are misleading for families without sufficient time to allocate toward household production. The Levy Institute Measure of Time and Income Poverty (LIMTIP) overcomes the bias in the official measures. It is proposed, data permitting, that the impact assessment on poverty employs the official measure and LIMTIP.

Below, the model's main features for evaluating micro-outcomes are described. They have been described elsewhere (see, e.g., Zacharias et al. (2019), Appendix C), and we liberally draw from our previous work in the following exposition. The data required to implement the model are usually collected in a typical household income or consumption expenditures survey that gathers a wide variety of information, including demographics, economic activity and labour market characteristics, and education, of each adult person in the household; details regarding own-account farm and non-farm employment; and household characteristics such as the number of children and adults, place of residence (urban versus rural), household income and consumption expenditures. For assessments using the LIMTIP, information on time allocation, preferably collected via a time-use survey, is also required. Typically, the operations described below are carried out using a synthetic data file that combines a household income or expenditure survey with a time-use survey via statistical matching based on propensity scores (Kum and Masterson 2010).

3.14. Changes in employment and household production

The execution of the macro block of the model yields the estimates of new employment by sector. Since it is assumed that technology remains unchanged, it can also be assumed that the occupational distribution of new employment is the same as that of existing employment in each sector. A further premise is that, within each sector, new employment is like existing employment in terms of hours of employment and earnings. The simulation assigns each newly employed person the hours and earnings of an already employed person who is statistically most like them in the sector. It is also assumed that enough willing and able workers are available to take up the newly available jobs at the going rates of remuneration. Of course, the modelling can detect labour supply bottlenecks, i.e. the sectors and occupations likely to experience labour shortages.

The procedure for judging statistical similarity considers the constraints and opportunities which individuals face. The constraints are mainly reflected in their living arrangements (e.g. single, female head versus a member of a joint family), responsibilities (e.g. mother of young children versus women with no responsibility for young children), location (e.g. urban versus rural) and other similar variables. Economic opportunities available to individuals are then assumed to be shaped by their demographic characteristics (e.g. social class, gender, age, ethnicity), labour market attributes (e.g. educational attainment, experience), family wealth (e.g. ownership of real estate or liquid assets) and a related set of variables. The constraints and opportunities, as well as their effects, tend to be different for men and women—a reflection of pervasive gender disparities.

The first step estimating the set of joint probabilities of being employed in each combination of sector and occupation for each potential job recipient. Actual job assignments may be limited to a subset of sectors according to the specific research question. These estimated probabilities are used in assigning jobs created in various policy scenarios to individuals by beginning with the highest joint probability and assigning jobs to those with progressively lower joint probabilities until the new jobs are exhausted. To estimate the set of joint probabilities, three statistical models are used: a probit model for being employed; a multinomial probit model for sector that is conditional on employment; and a multinomial probit model for occupation that is conditional on being employed. Then, we assign the predicted probabilities of being employed, employed in each sector and employed in each occupation to each job recipient. And then, the product of the predicted probability of employment and each combination of the predicted probability of being employed in a sector and of being employed in an occupation as the joint probability for each combination of sector and occupation are taken.

$$emp = G(\beta X + \varepsilon) \quad (8)$$

$$ind = G(\gamma Z + \mu) \quad (9)$$

$$occ = G(\delta Z + \upsilon) \quad (10)$$

$$\widehat{emp}^{io} = Pr^{emp}(\hat{\beta}X) \cdot Pr^{i}(\hat{\gamma}Z|emp = 1) \cdot Pr^{o}(\hat{\delta}Z|emp = 1) \quad (11)$$

The first model (Equation 8) is estimated using all potential job recipients and all those who are employed. The set of independent variables, $\boldsymbol{X}$ is chosen to reflect the constraints on an individual's entry into employment. It includes variables such as age, sex and educational attainment, as well as household-level variables such as other household income, the number of children in the household and geographic identifiers. Because the industry and occupation of employment are known only for employed persons, the second (Equation 9) and third (Equation 10) models for that subsample only are estimated. The dependent variable is the probability of being employed in one of the sectors or occupations and the independent variables are those chosen to reflect the individual's constraints and opportunities. In sum, in the first step, a ranking of the likeliest industry and occupation combinations for recipients is constructed.

In the next step, the earnings and hours of employment to all are imputed using a three-stage Heckit procedure (Berndt 1996: 627). These imputations are usually carried out separately for men and women classified into various age groups to account for parameter heterogeneity.[10] The first stage is a probit estimation of labour force participation:

$$lf_i = \alpha_0 + \beta_j X_i + e_i \quad (12)$$

where lf_i is a dummy variable that takes a value of 1 if the person is in the labour force, X_i is the set of j characteristics of person i and e_i is the normal error term that (hopefully) captures the effect of unobserved factors that impinge upon labour force participation. Based on the results of the probit regression, we estimate the inverse Mills ratio (λ) to be used to account for selection bias (Heckman 1979).[11] In the second stage, we run an OLS regression to model the log of hourly earnings for the subpopulation of those with positive earnings:

$$\ln w_i = \alpha_1 + \gamma_k Z_i + \theta_1 \lambda_i + \epsilon_i \quad (13)$$

where w_i is the hourly earnings of person i, Z_i is the list of k characteristics of person i and ϵ is a Gaussian error term. We then predict the earnings of all with the OLS equation. The list of explanatory variables includes the actual industry and actual occupation for employed people, while the imputed pair of likeliest industry and likeliest occupation are used for the recipients. Among the variables included in the regression is also the inverse Mills ratio. The final step is the estimation of (weekly) hours of employment for those with positive earnings:

$$h_i = \alpha_2 + \psi_k Z_i + \theta_2 \lambda_i + \omega \ln \tilde{w}_i + \mu_i \quad (14)$$

where h_i is the weekly hours of employment of person i and μ_i is a Gaussian error term. Note that the imputed wage predicted in the second stage $(\tilde{w}_i)$ and the inverse Mills ratio calculated in the first stage are included. Imputed hours per week are predicted for donors and recipients using the regression results, replacing the latter's likeliest industry and occupation.

With the imputed information described above and observed characteristics, we assign jobs to recipients using a variant of the standard hot-decking method (Andridge and Little 2010). Beginning with the potential recipient with the highest joint likelihood of being employed in an industry-occupation combination, we identify a pool of individuals actually employed in that

sector-occupation combination that most resemble the recipient. The degree of resemblance between each potential recipient and the pool of potential donors is assessed using affinity scores (see Crammer and Gill 2013: 435). Our affinity score is a weighted sum of matched characteristics. For example, suppose a donor and the recipient have exactly the same value for characteristics such as imputed wage or area of residence that are considered relevant. In that case, we add the preassigned weight for that characteristic to the affinity score for that donor with respect to the recipient in question. For categorical matching variables, exact matches are used. However, for continuous variables, a fraction is used (usually ½) of the standard deviation of that characteristic as a range within which the difference between the donor and recipient values must fall. To ensure that the donor's job is in the appropriate industry and occupation, these are weighted very highly so that only donors with that combination of employment characteristics can be matched.

We randomly draw from the group of donors with the highest affinity score (and thus, most similar to the recipient) and assign the job (industry, occupation, earnings and hours of employment) to the recipient. We draw more than once if we are producing a multiply-imputed employment simulation. We then subtract the sample weight of the recipients from the number of new jobs available for that industry and occupation combination. Those assigned jobs are removed from the remaining recipient pool, and the process continues with the individual with the next highest joint probability of employment. If jobs remain to be assigned with that combination of industry and occupation, we will proceed as above with the hot-decking procedure. If not, we move on to the next highest joint probability, and so on. We terminate the process after all newly created jobs are assigned to potential job recipients.

As noted earlier, the change in employment status can potentially change the newly employed person's time allocated to household production. Such changes may be triggered by the reduced time available for unpaid work, the ability to afford more market substitutes because of additional income from employment (e.g. restaurant meals instead of home-cooked meals), a combination of the two , and other factors. For the newly employed who live with other adults, the possibility of reshuffling household responsibilities should be considered. Reshuffling may occur because of reduced time availability of the newly employed, higher family income, change in the intrahousehold power relations governing the distribution of household production, or a combination of these factors.

A second round of imputations is thus needed. In this round, the recipient pool consists of all those for whom time-use information is available in a household that contains at least one job recipient. The donor pool consists of everyone in the survey. The change in the allocation of time use hinges on the change in the number of workers in the household, so for this round of hot-deck matching based on affinity scores, the number of male and female workers is weighted as heavily as the number of adults and the number of children in the household in assessing similarity between recipients and donors. In this case, individuals are matched within groups of individuals with the same sex, age category and educational attainment. Once the imputations are done, the post-intervention aggregate household hours of household production is constructed by adding up the post-intervention individual hours of household production in households with at least one job recipient.

Naturally, the change in the employment status of previously non-employed persons in the household would lead to a change in family income. It is expected, therefore, that household consumption expenditures will also change. The change in aggregate consumption expenditures has already been determined in the macro block of the model. Hence, the percentage change in aggregate consumption expenditures in the household survey data is constrained to be the same as that generated by the macro model. We also recognize that the marginal propensity to consume (MPC) will vary with household income as well as other characteristics. To control for the latter, we express the income of the household as a multiple of the household's poverty line and constrain the MPC to decline as the multiple increases according to the following equation:

$$\Delta c_i = \Delta y_i \left(1 - F(c_i/\tilde{y}_i)^{\alpha}\right) \quad (15)$$

where c represents expenditures, y income, $\tilde{y}$ the official poverty line (all for household i), $F(.)$ is the cumulative distribution function, and α is a parameter chosen to produce the increase in expenditures generated by the macro model.

3.15. Economic well-being and deprivation

The modelling described in the previous section 3.1 provides enough information to evaluate the impact of the intervention on gender disparities in employment and pay at a granular level within statistical limits imposed by the particular household survey sample. Similarly, comparing post-intervention and baseline household income distributions can help to understand the potential impacts on overall income inequality and inequality across demographic groups. It was also seen post-intervention household consumption expenditures consistent with the macro model's estimates can be constructed. Consumption expenditures are widely used as a gauge of household living standards. Moreover, the official poverty lines in most of the Global South are based on consumption expenditures (Deaton 2018). This model can support the standard analysis of changes in the poverty status of households generated by the policy intervention (Fontana and van der Meulen 2005).

As indicated, a more comprehensive assessment of gender disparities can be conducted for countries with time-use data. This allows introducing of the dimension of home production into the picture. Feminist scholars have long emphasized the importance of considering the changes in the amount and division of unpaid home production among individuals (primarily but not exclusively along gender lines) due to policy interventions being a crucial component of impact assessment (Elson 1995). Because it is based on microdata, this model allows such assessments from a rich intersectional perspective by taking into account, for example, ethnic and household income differences among men and women.

With the integration of time-use data into the micro database, a poverty-impact assessment can be conducted that avoids a vital pitfall of the official measure of poverty —the neglect of household production in sustaining minimum living standards. The LIMTIP has been designed to facilitate a more robust analysis of poverty. This measure conceptualizes time deficits at the individual and household level and abandons the treatment of time deficits as a purely household-level phenomenon in earlier works (e.g. Vickery 1977).

To elaborate the ideas, let us start with the definition of time balance for working-age individuals engaged in labour (defined to include unpaid work and employment):

$$X_{ij} = 168 - M - \alpha_{ij} R_j - D_{ij}^{0} (L_{ij} + T_{ij}) \quad (16)$$

where 168 is the number of hours in a week, M is the sum of personal care and non-substitutable household production requirements, while R_j is the substitutable household production requirements of household j, α_{ij} the share of individual i in the household production requirements of their household, D_{ij} the dummy variable that takes a value of 1 if the person is employed and zero otherwise, L_{ij} the hours of employment and, T_{ij} the hours of commuting. In assessing time poverty, we consider M, R_j, and $T_{ij}$to be thresholds. The first is assumed to be uniform across households. Household production requirements will vary across households due to several factors, most notably those related to the size and composition of the household. Conceptually, R_j is meant to reflect the time requirements for the household to reproduce itself as a unit (Bentson 2019: 6). Finally, commuting time requirements generally differ among the employed population which is based on their geographical location (e.g. urban versus rural) and length of the work week (full-time versus part-time workers).

The individual-level variables that can make a person's time balance negative or make her time poor thus depend on the intrahousehold division of domestic labour (α_{ij}) and hours of employment. Indeed, the person can be time-poor only due to long hours at the job, high demands of household production, or when the demands of employment and household production eat into personal care time. Unlike the pooling of household consumption or income, which is hard to observe, household members' time allocated to home production is observable.[12]

Therefore, we can allow the possibility of a time-non-poor person in a time-poor household by defining the household's time deficit as:

$$X_j = \sum_{i=1}^{n^j} min(0, X_{ij}) \quad (17)$$

where n^j is the number of working-age adults in the household. By this definition, a household is considered time-poor if at least one member is time-poor.

We assume that time deficits represent a shortfall in the household production requirements needed for the household to reproduce itself as a unit. While these requirements are not considered in the conventional assessment of poverty, we argue that they should be considered because setting aside a portion of the household outlays to purchase market substitutes would mean cutting back on other essential purchases of food, clothing, etc. One way to make this explicit is to adjust the poverty line using the monetized value of time deficits. The latter represents the notional cost of market replacements that would be required to make up for the shortfall in household production time requirements, R_j. If we let p_h represent the average unit price of the basket of market replacements, the monetized value of X_j is simply $p_h X_j$. Denoting the adjusted and unadjusted poverty lines as $(\bar{y_l})$ and $\bar{y_i}$, we can describe the relationship between the two as:

$$\bar{y_j} = \bar{y_j} - p_h X_j \quad (18)$$

For households with time deficits, the official poverty line understates the monetary requirements that are for maintaining a poverty-level standard of living. Some time-poor households may be classified as the "hidden poor" because their outlays exceed the conventional threshold while falling short of the adjusted threshold. For time-poor households below the official poverty line, their unmet needs (the difference between the adjusted poverty line and actual outlays) are understated if we ignore time deficits. In short, the incidence and depth of poverty would be understated by the conventional measures that ignore the household production needs of low- and moderate-income families. Our modelling framework can overcome this bias by estimating the LIMTIP in the baseline and post-intervention scenarios.

4.
IMPLEMENTATION

We now turn to a preliminary discussion of the data requirements to implement our model. For illustrative purposes, we will use three countries: Kenya, Rwanda and Senegal. Links to the information scanned to assess data availability are provided in the Appendix.

4.1. Macro data availability

As discussed in Section 3, a fully developed SFC model requires a rich set of financial and non-financial data for many periods, which may not be available regularly, or sometimes not at all, in a low-income country. In our experience, the logic of SFC models will help in such cases to construct a framework for the analysis of policies, which will be more robust than other approaches based on a partial representation of the economy.

All countries have reliable information on the main components of their balance of payments and their government's budget. Following the SFC principle that money spent by one sector is the income of other sectors, estimating the evolution of the stock of net financial assets for the private sector as a whole is usually feasible. Available data from household surveys can then be used to disaggregate these measures further while keeping overall consistency.

Many countries will also lack detailed statistics on financial assets and liabilities by institutional sectors. However, most if not all of them collect data on loans made to households and businesses and statistics on liquidity and bank deposits that can be used to estimate the dynamics of financial wealth and debt for the different components of the private sector. A complete SFC model built taking advantage of financial and non-financial information on all institutional sectors for a sufficient number of years will provide a very robust tool to assess the macroeconomic impact of policies or shocks to the economy in the short and the medium term.

Fairly recent social accounting matrices are available for all (2021 for Kenya and Rwanda; and 2018 for Senegal), estimated by the International Food Policy Research Institute (IFPRI) using the same methodology. These matrices provide useful information for allocating consumption among different products, allocating income and expenditure among rural and urban households, and for different quintiles. Labour is classified into three categories according to education level but not by gender.[13] All three countries have reasonably good time series for the main GDP components from both the value-added and demand sides.

Financial data are not available with a great level of detail for the private sector. However, the data from the flows in the balance of payments and the stocks from the international investment position are available to reconstruct time series for external assets and liabilities. Similarly, data on the government budget and debt (and assets) are available to rebuild the flow of funds and the balance sheet of this sector. We can construct the flows and stocks of assets and liabilities of the external and government sectors from the available data. Hence, by exploiting the accounting identities we discussed before (see Section 3.1), we can infer the flows and stocks of assets and liabilities of the private sector as a whole. The analysis of financial data reported by the central bank can be added to these aggregate measures to obtain time series for loans to households and businesses. However, the breakdown of private sector assets between the household and business sectors may be more problematic and depends on the availability of reasonably good data on household wealth.

4.2.
Data for microsimulation

We indicated in Section 3 that the main sources of information needed for the micro part of the model are household surveys of consumption expenditures or income and time-use surveys. Suppose the former does not contain enough detailed information regarding the labour force characteristics (e.g. weekly or usual hours of employment, earnings). In that case, we must also utilize an appropriate labour force survey for our modelling.

For Kenya and Rwanda, we have some recent household surveys on consumption expenditures (Kenya Continuous Household Survey 2021 and Rwanda Household Survey 2019/2020). However, Senegal's latest available household survey seems to be from 2011 (ESPS 2). All three countries have labour force surveys that correspond (or fall very close) to the years of the household surveys. This would allow for the imputation of relevant labour force characteristics if they happen to be missing from the household surveys. As for the time-use survey, both Kenya and Senegal completed nationally representative surveys in 2021. But, for Rwanda, only a baseline survey in 2022 seems to have been completed. This survey was not conducted for the whole nation. Thus, it appears that time-use simulations may not be possible for Rwanda.

5.

CONCLUSION

This paper's main aim is to contribute to developing a non-neoclassical policy model to assess gendered outcomes of investment. The existing policy models typically rely on general equilibrium theory, which, despite its dominance in academic curriculum and research, has been shown to be theoretically defective. Even in a simple model of exchange (without any production or financial markets), the theory is known to produce indeterminate outcomes, i.e. no unique equilibrium of quantities and prices, which led one of its foremost exponents, Kenneth Arrow, to comment devastatingly that "In the aggregate, the hypothesis of rational behaviour has in general no implications" (Arrow 1986: S389).[14]

In more complex models of exchange and production with produced means of production, the theory has been long known to be incapable of establishing a long-run equilibrium with equal rates of return on capital invested in different production activities (Garegnani 2012). The dynamic stochastic general equilibrium (DSGE) models that dominated macroeconomic training in the recent past have fallen into disrepute, especially after the Great Recession, with some observers arguing, justifiably in our view, that they should be put "once and for all, in the *Museum of Implausible Economic Models*" (Storm 2021). Structuralist models built on heterodox principles and enhanced by stock-flow consistency offer a sounder approach to policy analysis.

Analogously, the analysis of gender relations using the neoclassical theory of the household completely ignores the problem of indeterminacy and the lack of a meaningful, unique, long-period economy-wide equilibrium. There is no reason to expect, e.g., that the issue of indeterminacy in general equilibrium will not vanish because the range of optimal choice faced by the household is extended from commodities (acquired by the household via sales of their factor endowments) to household production and leisure. With its almost exclusive microeconomic focus, the Chicago school of "new home economics" could ignore the theoretical problems that arise in a general equilibrium setting. However, to do so in the context of a CGE model seems to have very little theoretical coherence. Of course, much work remains to be done in integrating household production in heterodox approaches, and disagreements exist among its practitioners (see, e.g., Jefferson and King 2001). Yet, we believe a firmer alternative theoretical foundation exists to confront these questions.

6.
APPENDIX

Resources by country

KENYA

- National Bureau of Statistics
- Central Bank of Kenya
  - The Central Bank publishes annual and quarterly GDP data.
  - Monetary and financial statistics are published by the Central Bank cover depository corporations.
- Annual Balance of Payment statistics are available from 2018.
- An input-output table is available for 2009, developed by the Kenya Institute for Public Policy Research and Analysis.
- Social accounting matrices
  - A SAM for 2017 is discussed here.
  - IFPRI has estimated a 2019 Social Accounting Matrix.
- Household income and expenditure survey
  - Kenya Continuous Household Survey (KCHS) 2021
  - Kenya Integrated Household Budget Survey 2015–2016
- Labour force survey
  - The Quarterly Labour Force Survey (QLFS) is a modular survey under the Kenya Continuous Household Survey Programme (KCHSP).
- Time use survey
  - 2021 Kenya Time Use Survey.

SENEGAL

- Agence Nationale de la Statistique et de la Démographie du Sénégal (ANSD) [National Bureau of Statistics]
- National Summary Data Page
- Accounts of institutional sectors (2014–2019)
- GDP data are available at quarterly frequency from 2008. The accounts of institutional sectors are available at annual frequency from ANSD for non-financial accounts.
- Social accounting matrices
  - Matrice de comptabilité sociale (MCS)
  - IFPRI has estimated a 2018 Social Accounting Matrix.
- Financial data are published by the Banque Centrale des Etats de l'Afrique de l'Ouest (BCEAO).
  - A complete set of financial accounts of the institutional sectors is not available, but detailed data on the current and financial accounts of the balance of payments are available from 1986 to present. Detailed data on flows and stocks for the general government are also available, so that aggregate financial indicators for the private sector can be estimated from these two sources.
  - Detailed data on bank activities are available, from which different sources of credit to the private sector can be estimated.
- Household income and expenditure survey
  - Enquête de suivi de la pauvreté au Sénégal (2010–2011)
  - See the documentation by the World Bank.
- Labour force survey
  - Enquête Nationale sur l'Emploi 2019
- Time use survey
  - 2021 Senegal Time Use Survey

RWANDA

- National Institute of Statistics
- National Summary Data Page
- Rwanda Data Portal
- SDGs of Rwanda
- GDP annual data are available from 1999. Quarterly data are available from 2006.
- General government data are available from 2014 to 2019 (complete non-financial accounts).
- Balance of payments data are available from 2017 at quarterly frequency and from 2000 at annual frequency.
- Financial data
  - Statistics on the financial sector are available from the Central Bank.
  - Quarterly data on balance sheets of banks are available from 2014.
  - Some statistics are available from the Depository Corporations Survey.
- Social accounting matrices
  - Input-output data are available for 2011 only.
  - IFPRI has estimated a 2021 Social Accounting Matrix.
- Household income and expenditure survey
  - Rwanda Household Survey 2019/2020. Description available here.
- Labour force survey
  - Rounds are available from 2016 to 2023.
- Time use survey: None are available yet.

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ENDNOTES

1. We leave aside the implications that stem from potentially higher imports of intermediate inputs here, because considering them would not change the thrust of our argument.
2. Consider, e.g., the following statements that describe the core analytical framework: "For the private sector, profit maximization drives decisions regarding factor employment, which determine the output level and intermediate demands." (p. 5); "After deducting net financing of the government and of changes in foreign reserves, household savings are used to finance private investment." (p. 6); "In the markets for private commodities, flexible prices ensure balance between demands for domestic output from domestic demanders and supplies to the domestic market from domestic suppliers." (p. 7) (Lofgren-Cicowiez 2021). Taken together, they display the neglect of the principle of effective demand, the consequent "crowding out" nature of government deficits and the supply–demand determination of prices and distribution. The macro part of the model is mainly what has been described as a "World Bank model". For an intuitive contrast between this model and a structuralist post-Keynesian model, see Gibson and Seventer (2000).
3. As explained later, our model accounts for asset revaluations and our consumption function includes household wealth, in addition to disposable income.
4. Simon (1978) provides an excellent discussion of the idea. Lavoie (2004) has argued that the concept of procedural rationality is a better framework to understand individual behaviour than the "rationality of the utility-maximizer – a pretty smart one at that." (Simon 1978: 2).
5. After citing some well-known caveats regarding the neoclassical approach, the authors state: "For our purposes, however, the neoclassical household model has the great advantages of being simple, well-known, and instantly compatible with the principles of a standard CGE model." (Fontana and Wood 2000: 1174–5).
6. In mainstream CGE modelling, the frequently considered case of bottom-up impacts belongs to those generated by interventions affecting individual labour supply. Because of the demand-supply explanation of distribution underpinning these models, the wage will vary in response to any change in labour supply to clear the labour market. Since we do not adopt the demand-supply explanation, interventions that presumably primarily impact labour supply need not lead to changes in the equilibrium level of employment.
7. See, e.g., Cicowiez and Lofgren, 2023; Fontana et al., 2020; and Lofgren and Cicowiez, 2021. For a model of the impact of a shock, see, for instance, Escalante and Maisonnave (2023). Blecker and Braunstein (2022) provide an overview of "Feminist perspectives on care and macroeconomic modeling" in their introduction to a special issue of *Feminist Economics* on this topic.
8. Nalin and Yajima (2022) discuss the balance-sheet effect of devaluation in the context of developments in Mexico during 2004–2019, a period of the boom-bust cycle in commodity prices. One of the major changes that took place during this period is the increasing role of foreign-currency denominated debt of non-financial businesses in several emerging economies.
9. See, for instance, Burgess et al. (2016) and Zezza and Zezza (2022).
10. In certain contexts, such as the US, we also estimate parameters separately based on race categories.
11. The inverse Mills ratio is calculated as $\lambda_i = \phi(\widetilde{lf}_i) / \Phi(\widetilde{lf}_i)$, where $\widetilde{lf}_i$ is the predicted probability of being in the labour force for person i, $\phi(.)$ the normal distribution function and $\Phi(.)$ the cumulative normal distribution function.
12. The difficulty in unequivocally attributing a definite portion of total consumption expenditures to each member of the household makes it impossible to define an individual-level measure of consumption poverty. Hence, if a household is deemed to be consumption-poor, every person in that household is also considered to be poor.
13. Senegal has also estimated Social Accounting Matrices for each year from 2014 to 2020.
14. Arrow is referring to utility-maximizing type of rationality here. For a discussion of the so-called SMD Theorem and its negative implications for constructing macro models with marginalist microfoundations, see Rizvi (1994).

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