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Microsimulation approaches to studying shocks and social protection in selected developing economies

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Abstract: This paper calculates automatic stabilization in Ghana, South Africa, and Ecuador to explain income cushioning amid income and demand shocks. Fiscal policies within these countries are also stress tested to gauge welfare contingencies and insurance. A discretionary action approach is adopted for Ghana as it fails shock resistance tests by introducing additional safety nets that improve welfare. For the three countries, income stabilization ranges from 1 to 22 per cent while demand stabilization ranges from 4 to 25 per cent. Ranging from nil to 46 per cent, a new concept of poverty stabilization is formalized to measure vulnerability. Results from the study reveal how the existing social policy structure cushions households.

Key words: developing countries, shocks, social protection, fiscal policy, microsimulation

JEL classification: H20, H31, H53, O12

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Note: As the research is part of the author's PhD thesis, he will hold copyright.

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1 Introduction

Crises in the short or long run affect both developed and transitioning economies. From the current state of the world, we might conclude that such shocks are likely to be the new normal, and concerted efforts in both theory and practice must be put in place when they strike (Kanbur 2010; Griffith-Jones et al. 2012). With causes ranging from political instability, extreme climatic conditions, an outbreak of infectious diseases, the collapse of a key sector of the economy, and the reverberations of global financial crises, such events, on one hand, have the potential to cripple any economy (Bernanke 2018; Olson and Zoubi 2017). On the other hand, aside from the uncertainty as to the type of economic crises, policy makers and governments alike are oblivious of the timing ex-ante. Crises are sudden, and we do not know how rapidly they will recede. This holds true for transitioning economies where, mostly due to uncertainty and unpreparedness, natural and other crises continue to cause havoc (Kasekende et al. 2009). Although research is ongoing, a good example is the outbreak and effects of COVID-19 in 2020.

This study concentrates on policy approaches that can be put in place to limit the impact of a systemic shock. I take as given the redistributive preferences of policy and try to ascertain how the poor are or will be protected when there is a shock. In reality, the main aim is to measure a household's exposure to risk when there is a crisis depending on the action or inaction of the policy maker, making references to automatic stabilization coefficients. The term automatic stabilizer, as defined by Dolls et al. (2012), refers to those indices in fiscal policy that extenuate output fluctuations without discretionary government effort. The absence of the latter does not arise because of lack of funds or personnel but mainly because of the inability to react quickly enough to a situation. The ability of an economy to absorb a shock and provide income insurance to households depends on how strong automatic stabilizers react.

Fiscal policy, which characterizes how much a government spends and receives, is earmarked to have a significant impact on household welfare (Sommer and Sullivan 2018). By establishing tax and benefit systems accurately, livelihoods are protected so that inequality among households can be reduced. Moreover, micro-units can be insured against risks depending on the nature of the fiscal policy in place. This policy by itself can control some aspects of the macroeconomy without any special efforts from the policy maker via its overarching macroeconomic effects. Unlike developed countries, where social protection policies have been in existence for some time to deal with shocks, most developing countries are currently expanding and extending the structure of their safety nets (Hoynes and Rothstein 2019). By such structures, reference is to those elements in public policy that aim to mitigate the adverse effects of household vulnerability and inequality. Social safety nets are finally gaining prominence in developing countries where the average population is vulnerable because of the increasing awareness of the detrimental effects of crises in these countries (Beegle et al. 2018). The notion that a developing country's budget cannot support social intervention is no more. Most of these developing countries are restructuring their development strategies to incorporate measures that can address extreme poverty and act as an insurance against shocks for households. Countries, such as Sierra Leone, South Africa, and Zambia, are the front runners that have introduced pro-poor policies to improve livelihoods and reduce inequality (Beegle et al. 2016). This urge for social protection reiterates the need to incorporate policies and reforms that have the potential to mitigate or limit the impacts of crises on agents. Such policies would be redundant if their goal was not to address a specific bottleneck in an institution caused by a crisis. These safety net policies should begin to show their effects not only in the short run but also in the long run.

On the main theme of this study where governments usually rely on the existing fiscal (tax-benefit) structure in place, I first discuss various types of shocks that affect developing economies and define the status of income, demand, and welfare automatic stabilizing coefficients when such shocks are simulated. There is then some comparison of magnitudes and composition of these automatic stabilization

coefficients between Ghana, South Africa, and Ecuador based on micro data estimates. Moreover, I analyse the impact of these automatic stabilizers using microsimulation models for the chosen countries. The microsimulation approach allows investigating the effects of different types of shocks on household disposable income, holding everything else constant in the bid to single out the exact role played by automatic stabilizers. Devoid of other constants changing, exogeneity is ensured (Bourguignon and Spadaro 2006). Ghana, South Africa, and Ecuador are excellent examples of lower- and middle-income countries that can be used as a yardstick to learn general lessons for such a group of countries that are understudied using microsimulation.

This leads to the second theme of this study where counterfactual policies are applied in the countries to exert some discretionary effort regarding their tax-benefit systems and examine how they improve household welfare. The study frames ways in which governments can formulate discretionary action as welfare contingencies against shocks. Moreover, safety nets or social protection are not limited to benefits alone but include taxes and social security contributions, which also have the potential to adjust given the state of households. Under this theme, the study using microsimulation techniques based on microsimulation models for Ghana, South Africa, and Ecuador conceptualizes existing and counterfactual social protection responses that can address the uncertainties in crisis type and timing. Before introducing these counterfactual responses, the paper first examines existing fiscal systems, then subsequently proceeds to counterfactual policies. The objective here is first to perceive social protection as an institution rather than a compartmentalized programme when there are shocks. Second is to examine the flexibility of existing tax-benefit policies capable of being expanded rapidly when there is a crisis and as well scaled down when the crisis recedes. Last is to think of more general ways through which safety nets can be formulated based on discretionary government action. The models GHAMOD, SAMOD, and ECUAMOD are selected primarily due to updated, coherent, and harmonized input data that align with the modelling goals of this study.

While a greater part of the microsimulation literature examines the effect of fiscal reforms on household welfare (see Bargain 2012; Bargain and Callan 2010; Christiansen et al. 2018; Berry 2019; Jara and Varelas 2019), these studies focus on policy changes in 'normal times' and in effect are silent on the effects of crises while concentrating on high-income countries such as in the EU and US. In the area of examining shocks using microsimulation methods and automatic stabilization, most studies rely on macro-analysis (Girouard and André 2005), while the few existing micro studies (Dolls et al. 2012; Auerbach and Feenberg 2000; Kniesner and Ziliak 2002; Paulus and Tasseva 2020) focus on the EU and US. With the exception of Devarajan et al. (2013), no existing work has been done on developing countries. Finally, literature on safety nets in the form of tax-benefit policies highlight their importance among micro-units without making reference to inherent shocks that may affect their efficiency (see Devereux 2002; Adu-Ababio and Osei 2018; Jäntti et al. 2020).

This paper therefore contributes to literature in the following ways. As the first of its kind, the study provides automatic stabilization coefficients for developing countries by examining peculiar shocks to income, demand, and informality. As a unique case for developing economies, I also focus on informality shocks as most developing countries reflect the dominance of this sector in their economies. It is important to assess the contribution of automatic stabilizers to existing fiscal systems as well as to compare their magnitudes across developing economies. As transitioning economies are more susceptible to growth relapses due to crisis, it is imperative to examine the nature of existing policies as to how they hold up when there is a shock to household incomes and employment (Devarajan et al. 2013). Second, my study provides stress test results of various tax-benefit policies in a developing economy. By examining shock simulations with and without these policies in place, insight into the status of existing systems is gained. A typical example can be how an existing old age or child care transfer programme can be designed to incorporate a crisis scenario as a result of households being worse off even when the benefit is in place. This is achieved by examining these existing policies in terms of eligibility criteria and benefit quotas to draw conclusions on their cushioning capabilities. Third, poverty and inequal-

ity estimates in crisis responses are evaluated using poverty stabilization coefficients. A result is not shown in the existing literature where authors calculate automatic stabilization coefficients (see Dolls et al. 2012, 2020; Girouard and André 2005; Auerbach and Feenberg 2000; Paulus and Tasseva 2020). Moreover, with this study based on household data, it is the first to examine existing and counterfactual policy actions that have the potential to protect the poor against the next crisis in a developing country context. To achieve this, a new concept of welfare stabilization is formalized to gauge the extent of vulnerability mitigation amid shocks. Fourth, the relationship between automatic stabilization and fiscal stimulus in developing economies is revealed. Comparisons that will be made among sampled countries can help us draw conclusions on the ability to protect the welfare of households during a crisis without government action. A country that is adequately cushioned without much effort will be classified as one with strong automatic stabilization and vice versa. This consequently leads to an examination of how the social protection systems can be enhanced to better protect citizens against shocks. Moreover, the extent to which risks can be mitigated as discovered by this study will also help provide updated recommendations as to how these contingencies can be improved through discretionary action. Last, although with a different perspective by employing microsimulation methods, my study contributes to the large literature that informs on the effects of economic shocks in transitioning economies (Yüksel 2017; Egger et al. 2019).

With emphasis on current and potential fiscal policy that tries to mitigate output fluctuations with or without discretionary government action, my study is able to analyse policy impacts and give recommendations on addressing systemic shocks that may occur due to crisis scenarios. These extensions to existing scholarly work not only inform the driving factors to automatic stabilizers in developing but also the nature of fiscal policy in countries surveyed. The results of this study analysis can be summarized for automatic stabilization as follows. In the case of a gross income shock, about 1.2 per cent of this shock would be mitigated by automatic stabilizers in Ghana. For South Africa and Ecuador, I find a stabilization coefficient of 22 per cent and 10 per cent, respectively.[1] This points to a stronger fiscal system in South Africa compared to Ghana and Ecuador to safeguard household disposable income. Similarly for an informality shock where labour force explodes disproportionately in the informal sector, about 3.6 per cent, 8.3 per cent, and 12 per cent of this shock is absorbed by automatic stabilizers in Ghana, South Africa, and Ecuador, respectively. These results point to the impact of the informal sector in these countries. With a smaller share of the labour force in the informal sector, South Africa records a smaller stabilization coefficient for an informality shock than a gross income shock while Ghana and Ecuador record relatively higher coefficients due to the high informality in these countries.

In terms of how these income shocks trickle to demand shocks based on consumption and liquidity constraints, there is not much change in the magnitudes of stabilization coefficients compared to coefficients-related gross income shocks. Depending on the approach, results reflect how existing fiscal structures affect households. For direct consumption shocks where available data exist, approximately 5 per cent of this shock would be absorbed by automatic stabilizers in Ghana and Ecuador. For liquidity-constrained households, South Africa continues to record high stabilization coefficients of 25 per cent compared to the below 5 per cent average recorded for Ghana and Ecuador.[2]

The novel automatic stabilizer, welfare stabilization does not deviate from results seen so far. With emphasis on poverty mitigation and policy impacts, about 0.8 per cent, 47.8 per cent, and 46.4 per cent are absorbed by automatic stabilizer for Ghana, South Africa, and Ecuador, respectively, when there is

[1] Dolls et al. (2012) calculate similar income stabilization coefficients for the EU and US as 38 per cent and 39 per cent, respectively.

[2] Dolls et al. (2012) calculate similar demand stabilization coefficients for the EU and US as 8.3 per cent and 5.7 per cent, respectively.

a gross income shock. South Africa continues to mitigate poverty at a rate of 14.3 per cent when there are informality shocks while Ghana and Ecuador do not do much in this regard.

Further results are shown on the policy interrelations with shocks to obtain estimates for policy impact estimates based on four scenarios. This study reveals that hypothetical policies have the potential to improve household exposure against risks from 12 per cent to 33 per cent for an income shock and from 16 per cent to 29 per cent for demand shock. This is achieved in two ways: (1) by introducing policy swaps that involve replicating the existing Child Dependency Grant benefit policy from South Africa in Ghana as motivated from higher stabilization results observed in this country; and (2) by expanding the LEAP transfer social policy in Ghana as motivated by the need to examine the flexibility of existing benefit policies capable of being expanded rapidly when there is a crisis and as well scaled down when the crisis recedes (see Appendix for details on simulating hypothetical discretionary action policies).

The paper is structured as follows. A short overview of previous research with respect to shocks and automatic stabilization as well as its measurement and comparisons of tax-benefit systems with emphasis on social protection in transitioning economies based on brief country backgrounds is discussed in Section 2. The automatic stabilization and microsimulation models, GHAMOD, SAMOD, and ECUAMOD, used in this study are mainly discussed in Section 3. Moreover, this section also describes how the models are theoretically and empirically applied in this study and the simulation approaches with the various shock conditions used in this study. Section 4 deals with results on automatic stabilizers and stabilization effects and their comparison across countries. Presentation of results from counterfactual actions and government discretionary policy with emphasis on stress testing fiscal and social protection policies when there are shocks is done in Section 5. This section concludes with suggested solutions on how the effects of shocks can be mitigated with targeted social policies. In doing this, my study tries to establish the relationship that exists between automatic stabilization and fiscal stimulus programmes. Section 6 discusses the results obtained from stabilization coefficients and discretionary actions with robustness checks regarding the approaches used. Section 7 draws some conclusions and provides the pathway to future research.

2 Country backgrounds and previous research

2.1 Country backgrounds

This study concentrates on three countries, Ghana, South Africa, and Ecuador. As explained above, these countries were selected based on data and model availability. This section espouses the differences and similarities within these countries to give more reason for this choice. According to the IMF (2019), these countries are developing countries with a diverse and rich natural resource base. However, these countries are very different. Ghana is a small fast-growing economy yet very similar to many African countries. To a large extent, this study can liken Uganda, Tanzania, Mozambique, and Ethiopia to Ghana. On one hand, South Africa is large and often considered a reference or comparison point in Africa. It is one country whose economy most developing countries and emerging economies look to emulate in terms of its affordability and availability of capital, financial market sophistication, business tax rates, and infrastructure. On the other hand, Ecuador has the eighth-largest economy in Latin America with a significant export base for raw materials (CIA 2020c). The country serves as an example of one whose status is currently higher-middle income with more autonomy from its previous lower-middle income and donor-dependent status compared to Ghana, which continues to be donor dependent (Horn and Grugel 2018).

In specific terms, Ghana is a lower-middle income West African country with rapid growth reflected in successful poverty reductions. Currently, the services sector contributes most to gross domestic product (GDP) (57.2 per cent), followed by industry (24.5 per cent), and then 18.3 per cent by agriculture. On the contrary, in terms of labour force by occupation, the agricultural sector dominates (44.7 per cent), followed by the services sector (40.9 per cent), and then 14.4 per cent is contributed by labour from industry (CIA 2020a). This points to the large informal nature of Ghana's economy. Taxation in Ghana is mainly administered on a value-added and consumption basis. Tax regimes were first implemented in 1998 with subsequent adjustments in 2007. Value-added tax (VAT) first started at 10 per cent but increased to 12.5 per cent in 2000. Corporate and top income tax rates stand at 25 per cent. Additional taxes in the country are excise duties, national health insurance levy, and capital gains tax. It can be said that Ghana is currently building up its benefit policies. This point is made to reinforce the fact that, in terms of benefit policy structure and framework, not much has been done to promote the social protection of the vulnerable. Notable safety nets that targeted the poor started gaining ground in 2006 with the Livelihood Empowerment Against Poverty (LEAP) programme, which was instituted to tackle chronic poverty amongst the poorest of the poor. Other social policies like the Capitation Grant in 2007 and the Free Senior High School in 2017 have followed suit. It is the belief that Ghana will gradually, with the help of guided research, build a more stable social protection framework just as most transitioning economies are embarking on (Abdulai et al. 2019; Niño-Zarazúa et al. 2012).

South Africa is an upper-middle income southern African country with a rather large public sector. The industry and services sectors combined contribute about 97.2 per cent (29.7 per cent and 67.5 per cent, respectively) to GDP. The agricultural sector contributes only 2.8 per cent to GDP. This statistic is reflective in how various occupations are distributed in the labour force. Combined labour force participation from industry and services is 95.4 per cent (23.5 per cent and 71.9 per cent, respectively) while agricultural labour force is 4.6 per cent (CIA 2020b). Taxation in South Africa is not complex in nature. Clearly defined top personal income and corporate tax rates stand at 45 per cent and 28 per cent, respectively. Other taxes include VAT and capital gains tax. The country has a well built social benefit structure where the number of beneficiaries outnumber income tax payers. Resource reallocation to black households increased in the late 1990s compared to the 80s. The country currently spends over 80 per cent of social spending on the latter with less than 10 per cent to white households (Omotoso and Koch 2018). Financed from tax revenue with no bearing on contributions and benefits, there are a number of non-contributory, means-tested safety nets granted by the state to the vulnerable. Notable among these are the Care Dependency Grant, Grant in Aid, Foster Child Grant, Old Age Grant, Child Support Grant, and Disability Grant. All of these have gone a long way to improve livelihoods and welfare in the country.

Similarly, Ecuador is also an upper-middle income South American country quite comparable to South Africa. With a large public sector, agriculture contributes 6.7 per cent to GDP with the rest going to industry and services (CIA 2020c). Labour force participation by sector does not deviate from these magnitudes. However, these large sectors are highly informal, which some studies link to the country's poverty rates (Canelas 2014). Based on the Ecuadorian National Living Standards Survey (ECV) 2014, conducted by the Ecuadorian National Institute of Statistics (INEC), if social security coverage is used to link poverty and informality, then 84 per cent of employees who do not have this coverage (60 per cent self-employed) are among the poorest coupled with the fact that households headed by informal workers have higher poverty rates than those headed by formal workers (Canelas 2019). However, evidence gathered from Jara and Montesdeoca (2020) point to the fact that national development is at the heart of policy and backed by sacrosanct policies and aspirations. *Sumac kawsay* in Quechua or *Buen Vivir* in Spanish ('living well' in English) is one such policy agenda (Horn and Grugel 2018). The country has a number of contributory social protection schemes including Old Age, Survivors, Invalidity, Unemployment, and Occupational Risks. In terms of social protection, Ecuador has the Human Development Transfer (*Bono de Desarrollo Humano*, HDT), which seeks to safeguard households at risk of poverty and promote social mobility. Moreover, physically challenged persons enjoy the Joaquín Gallegos Lara

Transfer (*Bono Joaquín Gallegos Lara*), which encompasses persons with severe illness who are unable to thrive in precarious economic conditions. This study notes that, as compared to South Africa, Ecuador has a few social protection policies that directly target household poverty. It is evident from the number of non-contributory benefit policies. This has a tendency of stifling the progress and well-being of existing poor households who may be overlooked or ineligible within the context of the few social protection policies.

2.2 Previous research

The study of shocks or crisis can be conceptualized in a framework discussing a series of perturbations that have the potential of affecting both macro-indicators and micro-units. In this light and in line with this study, scholars empirically adopt these micro- and macro-pathways to carry out the analysis and measurement of automatic fiscal stabilization. There were some prior models that tried, to some extent, to help in the assessment of automatic stabilization. However, they were unable to explain the stylized fact that the proxy for automatic stabilizers (the magnitude of fiscal spending) is inversely correlated with economic shocks.[3] With this in hindsight, simple macro models employed by researchers point to automatic stabilization amid shocks through ratios of revenue and expenditure to gross production indices. Such macro studies are extended to cater for periodic responses of government budget such as social security contributions, benefits, and indirect and income taxes. The disadvantages here are issues of identification, which crop up in relation to the regressors employed as researchers cannot tell clearly if they account for gross output responses solely based on automatic stabilizers or other inherent factors. There are various approaches to this complex empirical strategy. Girouard and André (2005) bring this to life by regressing calculated differences in some fiscal variables on economic growth based on a macro-econometric model that is succinct and easy to follow. The disadvantage is the inability of the modelling technique to clearly delineate specific discretionary and non-discretionary (automatic stabilization) fiscal actions, which is a key research question in this study.

It is worth mentioning the work by Devarajan et al. (2013), which uses a similar methodological microsimulation approach as this study to stress test some macroeconomic indicators in developing countries. Commissioned by the World Bank, the study uses LINKAGE global CGE modelling and the Global Income Distribution Dynamics (GIDD) microsimulation framework to examine (ex-post) stabilization based on macro indicators. The advantage of this study is the consideration of a wide spectrum of shock scenarios to examine stabilization dynamics. It is, however, based on macro data, combined with a CGE model, and dynamic in nature, which cannot examine heterogeneous impacts as well as poverty dynamics, which is a key research objective for this study.

Scholarly work measuring automatic stabilizers based on micro data exists but has not seen much expansion over the last dacade. Earlier work based on microsimulation modelling in this area started in the US by Auerbach and Feenberg (2000). Their study using TAXIM with US input data, the microsimulation model by NBER estimates the country's level of household cushioning based on disposable income using data between 1962 and 1995. Authors observe coefficients between 25 per cent and 35 per cent.[4] Moreover, Kniesner and Ziliak (2002) examine the extent to which the same country's tax reforms some two decades ago have impacted household demand stabilization. Authors show by using ERTA81 and TRA86 that there is 50 per cent demand stabilization.

Similar studies have been done using European data. Notable earlier work by Mabbett and Schelkle (2007) is based on 1998 data for 15 western European countries. Basing their analysis on EUROMOD, the authors find an increased stabilization coefficient between 32 per cent to 58 per cent. Dolls et al.

[3] The standard RBC model, based on some suitable assumptions, shows a direct relation (Andrés et al. 2008).

[4] Auerbach (2009) specifies a coefficient of 25 per cent in updated work.

(2012), which is similar to this study, examine the effectiveness of fiscal systems in 19 European countries and the US based on income and demand stabilization indices. The study combines EUROMOD with European input data and TAXSIM with US input data to conclude that automatic stabilizers absorb 38 per cent of a proportional income shock in the EU compared to 32 per cent in the US. More recently, Paulus and Tasseva (2020) study the role of automatic stabilizers in EU countries for a period of eight years. Based on a decomposition approach, they observe that, in addition to discretionary action, automatic stabilizers, especially those related to benefits, have significant impact on welfare.

An additional key component of related literature focuses on comparisons of fiscal systems or policies in countries and how they measure up to improving targeted welfare. There are many ways through which this can be discussed; however, this study limits it to how microsimulation techniques have been used to study benefits (safety nets) and their respective impacts on livelihoods. Such benefits may be in the form of a tax holiday, credit, or transfer based on some means test. It is evident that a number of studies look at automatic stabilizers using micro data, but to date most have focused on high-income countries mainly in the EU and US.

This paper contributes to our understanding of how policy could absorb uncertainties and risks when a crisis hits. The existing literature under this theme usually concentrates on how benefits are acting as redistribution catalysts or cushioning to economic units as a whole. Bargain (2012) illustrates such an idea where the redistributive impacts of tax-benefit reforms implemented by the New Labour party help in alleviating poverty. The study reveals with comparison to previous policy years that those new reforms, if non-existent, would have raised market income inequality as well as increase child poverty and poverty amongst single parent households. Although similar analysis has not been carried out in developing economies by focusing on how safety nets adjust when there are shocks as I do in this paper, work by Del Ninno and Bradford (2015) show the importance of various safety nets and how they can be adjusted and targetted to improve poverty alleviation in developing economies. Adu-Ababio and Osei (2018) and Devereux (2002) support this notion by showing that in sub-Saharan Africa even tiny income transfers are usually used to fund gainful activities, social networks, education, or even investment in productive assets. This implies that social safety nets cannot be loosely classified as a means to only prevent transitory and livelihood shocks but, on the contrary, can be a major tool to tackle chronic poverty. With a general perspective, Jäntti et al. (2020) provide an expansive analysis on the determinants of redistribution around the world by accounting for methodological differences in measurement. Results show variations in redistribution depending on absolute or relative inequality. The authors however mention the difficulty in drawing similar conclusions on redistribution parameters in developing countries due to scarcity of data.

In conclusion, a syntheses of literature on microsimulation methods for the two areas of study, automatic stabilization from shocks and safety net cushions, reveal some prominent gaps. To the best of my knowledge on the former subject, no research has covered the effects of shocks on micro- or macro-fiscal stabilization coefficients in developing or transitioning economies. Studies that may hover around fiscal policy stabilization in developing countries usually state that they are minimal and negligible, and as such, there is no need to exert extra research efforts on them. However, no exact estimates are given. On fiscal cushioning, I observe that tax-benefit reforms in general are analysed under normal circumstances devoid of shock or polar cases. In other words, scholars mostly assume that policy would be implemented under ideal conditions of income and consumption patterns. Moreover, existing studies that cover shocks usually do not cover benefits while those that cover benefits are silent on shocks. For, sub-Saharan Africa, the existing knowledge on these themes may be scant.

3 Methodology and data

This section is divided into four main subsections. The first discusses the theoretical concepts behind automatic stabilization and how to derive its disaggregated components. The second subsection discusses how stabilization coefficients are derived empirically based on available data and parameterization. The third subsection discusses the rationale for selecting specific shock criteria for the study countries, while the final subsection discusses the microsimulation models used for the analysis.

3.1 Theoretical framework

Under this subsection, I first discuss the concepts of automatic stabilization and second explain how they are used in this study. As this study hinges on two broad themes, theories discussed in this subsection centre on methods that estimate the effects of automatic stabilizers on shocks, while the next subsection discusses methods used to estimate efficient social protection policies given counter-factual scenarios. The common ground for these theories is the role played by the fiscal system implemented by the policy maker.

Aiming to examine shocks to micro units, this study considers theoretical underpinnings that guide knowledge on the mitigation of shocks, specifically to household income and consumption or demand. Such theories rely on two basic principles. First, with a given shock to gross incomes, the existing fiscal (tax and transfer) system reveals the change in disposable income. A progressive tax system can explain this principal notion further[5] and from now is referred to as an income stabilization coefficient. In circumstances where a household loses 20 per cent of a EUR100 gross employment income due to a shock, the progressive tax schedule puts this household in a lower tax band compared to the *a priori* crisis scenario. Subsequently, tax revenues reduce but household disposable income is cushioned as a result of the stronger stabilizing effect.

Second, there is a relationship between current disposal income and current consumption of goods and services. Some idea of permanent income hypothesis can apply for this principle of demand automatic stabilization, hereafter referred to as demand stabilization. While a permanent income hypothesis would predict no demand change with a temporal income shock, empirical research from the EU and US shows that income does affect consumption (Dolls et al. 2012). In developing economies, it is likely that the income-consumption nexus is stronger because of weaker systems of social protection and the presence of credit rationing as well as low credit access (Evans 2018; Bond et al. 2015; Banerjee 2001).

In addition to existing frameworks on income and demand stabilization to assess automatic stabilization, this study introduces the notion of poverty stabilization as a complement to how households are protected from vulnerability due to the fiscal system in place. The varying degrees of poverty headcount in pre- or post-crisis situations cannot only be centred on disposable income or consumption but also on the extent of vulnerability. The relationship between poverty headcount and the level of automatic stabilization is assessed by observing changes in the ratio based on existing shock conditions.

This study sides with the interpretation of Auerbach and Feenberg (2000) for automatic stabilizers as being the built-in malleability of a fiscal system when authors estimated automatic stabilization effects based on a normalized tax change rather than applying a decomposition approach as used by some authors (see Paulus and Tasseva 2020; Bargain and Callan 2010). This commonly used measure employed in the study is formally restricted to how individual tax liabilities have the potential to adjust disposable income through variations in gross incomes because of various factors. As shown by Dolls et al. (2012) and (2020), this study equally extends the existing normalized tax change concept to incorporate bene-

[5] A transfer system can also explain this.

fits or transfers and social security contributions. I specifically take into account for my study poverty headcount ratio as a complement to Dolls et al. (2012), which I discuss below.

I define the following notational concepts, drawing heavily on Dolls et al. (2012), to explain how this study analyses automatic stabilizers for the three stabilization coefficients described. The representative individual i earns some gross income Y_i^M, which is an aggregate of all earnings from market activities.

$$Y_i^M = E_i + N_i + C_i + P_i + O_i \tag{1}$$

From Equation 1, the representative individual sets E_i as wage and self-employment income (including agricultural income), N_i as non-farm income, C_i as capital income , P_i as property income, and O_i as other income. When the agent's gross incomes are filtered through the fiscal system G_i in place, disposable income Y^D is the remaining income concept. Disposable income encompasses discretionary fiscal policy, comprising direct and indirect taxes $T_{i,}$, employee social security contributions,[6] S_i and social protection, and B_i (transfers) which applies to a specific agent. Formally, if $G_i = T_i + S_i - B_i$, then the latter stipulates that

$$Y_i^D = Y_i^M - G_i = Y_i^M - (T_i + S_i - B_i) \tag{2}$$

As seen, benefits are regarded as a draw on government intervention or negative taxes since governments transfer resources to households rather than the latter losing proportions of gross incomes to the policy maker.

This study defines the coefficient of income stabilization, τ^I, based on a usable generic and effective correlation between disposable and gross earnings, formally represented as Equation 3:

$$\tau^I = \tau^I \left(Y^M, T, S, B\right) \tag{3}$$

This functional relationship can be deduced at the macro level by defining aggregate changes for market and disposable incomes as ΔY^M and ΔY^D, respectively. Macro frameworks are formally represented as:

$$\Delta Y^D = \left(1 - \tau^I\right) \Delta Y^M \tag{4}$$

However, this approach creates problems of identification and endogeneity in macro study results, as disentangling effects to single out the exact role of automatic stabilization is impossible at the macro level (Bargain 2012; Bargain and Callan 2010).

This study is based on a micro model that aggregates computational household changes (Δ) for disposable income $\left(\sum_i \Delta Y_i^D\right)$ and market income $\left(\sum_i \Delta Y_i^M\right)$. Microsimulation facilitates this process as information on an agent's disposable and market income is obtained from tax-benefit calculators based on micro input data. These arithmetic techniques based on microsimulation have a greater potential to simulate external changes and by implication steers clear of identification problems (Bourguignon and

[6] Dolls et al. (2012) incorporate employer social security contributions in their framework.

Spadaro 2006). Formally, an income stabilization coefficient using micro data is derived in Equation 5 as:

$$\sum_i \Delta Y_i^D = \left(1-\tau^I\right)\sum_i \Delta Y_i^M$$

$$\tau^I = 1 - \frac{\sum_i \Delta Y_i^D}{\sum_i \Delta Y_i^M} = \frac{\sum_i \left(\Delta Y_i^M - \Delta Y_i^D\right)}{\sum_i \Delta Y_i^M} = \frac{\sum_i \Delta G_i}{\sum_i \Delta Y_i^M} \tag{5}$$

with τ^I explaining the actual change in disposable income Y_i^D to market income Y_i^M. A direct interpretation of this coefficient means that a stronger cushioning translates into a higher value in τ^I. In fact, this represents the income cushioning effect as well as the insurance provided by the fiscal policy in place with $\left(1-\tau^I\right)$, gauging an agent's susceptibility to income shocks.

Subsequently, this approach decomposes the income coefficient based on how the tax-benefit system in place adjusts given the situation. Following Equation 5, this study breaks down the corresponding coefficient into contributions from social security contributions, taxes, and transfers:

$$\tau^I = \sum \tau^I_{\mathscr{A}} = \tau^I_S + \tau^I_T + \tau^I_B = \frac{\sum_i \Delta S_i}{\sum_i \Delta Y_i^M} + \frac{\sum_i \Delta T_i}{\sum_i \Delta Y_i^M} - \frac{\sum_i \Delta B_i}{\sum_i \Delta Y_i^M}$$

$$\tau^I = \frac{\sum_i \left(\Delta S_i + \Delta T_i - \Delta B_i\right)}{\sum_i \Delta Y_i^M} \tag{6}$$

The study next defines demand stabilization τ^C as the stabilization effect on final household consumption. As discussed thoroughly in Dolls et al. (2012), under a permanent income hypothesis with transitory shocks, households can, through savings and loans, fully smooth consumption between periods avoiding shocks to consumption. However, the case is different for low- and middle-income economies with poor saving culture and access to credit (Dupas et al. 2019; Banerjee 2001). The usefulness of this coefficient is to measure the extent to which liquidity-constrained households are cushioned by the fiscal system. The principle of a proportional association of household disposable income variations to that of consumption, as this study estimates using the demand coefficient based on Dolls et al. (2012), τ^C is formally expressed as:

$$\tau^C = 1 - \frac{\sum_i \Delta L_i^{CH}}{\sum_i \Delta Y_i^M} \tag{7}$$

where L_i^{CH} characterizes the demand response of liquidity-constrained households of a representative agent. This coefficient has similar meaning in terms of stabilization effects, as explained for τ^I.

The study finally defines welfare stabilization τ^P as the stabilization of absolute household poverty headcount and inequality. In developing economies, poverty is endemic. As such, developing economics research in such regions make it a point to examine ways to incorporate policies that improve these key welfare metrics due to their overarching influence on other aggregate indicators. The inclusion of this coefficient informs on the cushioning effects on vulnerability due to existing tax-benefit policies in

the presence of shocks. This is achieved from a simple arithmetic post-fiscal poverty and inequality calculation, based on disposable income or equivalized consumption.[7] The post-fiscal income concept is described as income after taxes net of benefits based on how tax liabilities and government transfers are allocated to households (Lustig 2018). For post-fiscal purposes, this study incorporates the impact of indirect taxes into stabilization coefficient calculations. The study formally defines the post-fiscal income or consumption-based poverty or inequality index of a representative agent as $P_i\left(Y^j\right)$ with $j =$ disposable income or market income. Subsequently, variations in the index caused by crisis $\Delta P_i\left(Y^j\right)$ measure the extent of this stabilization coefficient as:

$$\tau^P = 1 - \frac{\sum_i \Delta P_i\left(Y^D\right)}{\sum_i \Delta P_i\left(Y^M\right)} \tag{8}$$

In essence, this coefficient reveals the level of mitigation of household poverty and inequality exposure from existing tax-benefit policies. Interpreting this coefficient has to be put into perspective. The existing fiscal system in place needs to be efficient to an extent that negative impacts on shocks need not increase vulnerability. From a social insurance perspective, a higher value of τ^P means a strong stabilization effect and vice versa. This is implied from the magnitudes of poverty in the presence or absence of a shock. In an ideal circumstance, welfare stabilization should be close to one for comprehensive insurance. This implies that shocks can be assumed to have very little or no effect on micro units. However, conclusions should also be drawn based on related income and demand coefficients.

3.2 Empirical framework

Based on micro data available for each study country, this study is able to translate the macro model for the stabilization coefficient in Equation 4 into the micro model seen in Equation 5. This circumvents the identification problem by distinguishing the exact automatic stabilization effects in the presence of other inherent factors. Additionally, the micro model has the ability to inform on the specific constituents such as social security contributions, taxes, and transfers, which are important components of automatic stabilization. I discuss below how micro data are used to estimate the interest parameters in my study.

Income stabilization coefficient

The income stabilization coefficient is calculated in two ways for all countries:

1. A proportional decline in household gross income by 5 per cent (income shock), which applies to all countries. This aggregate shock in microsimulation studies to analyse automatic stabilizers is modelled in the usual way in the spirit of some macro studies such as Sala-i-Martin and Sachs (1991) and Devarajan et al. (2013).

2. An addition to the literature via reweighing to reflect the dominance of the informal sector in all countries. Thus, an unemployment shock is reflective in a scenario such that a decrease in formal workers goes fully into an increase in informal workers to an extent that gross incomes fall by 5 per cent to reflect this informal sector dominance in each country. As discussed in the country background, for many households in low-income settings, going into informality is a more realistic response to a shock than complete unemployment. This gives credence to my addition of an informality shock.

[7] Consumption expenditure less government intervention is used for poverty calculations in most African developing countries.

Demand stabilization coefficient

There may be some interest in the effort to observe how liquidity constraints manifest in African developing economies, as several approaches have been used to estimate the prevalence of liquidity constraints in developed countries. As stated by Jappelli and Pistaferri (2010), there is no perfect approach as each method has its pros and cons. As a result, this study estimates demand stabilization based on three diverging approaches:[8]

1. The first approach employs data on consumption expenditure and assumes that shocks to disposable income translates in equal proportion to demand or consumption shocks. With the help of consumption expenditure data, which are usually common in survey data for most countries in the sub-region, this study assumes that a shock affecting disposable income ripples directly into household demand based on Equation 7. With reference to calculating demand stabilization, the availability of expenditure data is essential. This approach is not possible for South Africa as household data on consumption expenditure are non-existent.

2. The second approach employs data on home ownership information and assumes liquidity constraint if the household does not own its place of domicile. All households who answer in the affirmative to not owning their place of residence are implied to be liquidity constrained. There are available data on this indicator for Ghana, South Africa, and Ecuador.

3. The third approach employs data on credit applications that have either been rejected or not fully approved or filled but not submitted because of other external factors. The approach assumes that in the presence of shocks, loss of disposable income can potentially limit the ability to settle outstanding debt, hence credit liquidity constraint. The final approach used also draws from micro-survey data and has been tested by Jappelli et al. (1998). This study employs this approach as there are available data on Ghana, South Africa, and Ecuador on credit applications All households who could not obtain loans they applied for or may have outstanding credit obligations are implied to be liquidity constrained.

The approaches chosen can only be a close approximation to household dynamics in shock scenarios as household behaviour, especially in a developing country context, may be impossible to model perfectly.

Welfare stabilization coefficient

Welfare stabilization is the difference in the poverty headcount ratio or Gini coefficient as a result of the various scenarios considered based on shock simulations[9]for all countries in the study. Based on the micro approach employed, this coefficient also doubles as the measured impact of the tax-benefit system existing in the country. With welfare stabilization, this study accounts to control for heterogeneity among the different agents in terms of various liquidity-constraint conditions of housing and credit, as discussed above. In such similar circumstances, the study informs on which groups of households are most cushioned in terms of poverty. All these approaches give different results that elicit diverse interpretations based on the case studies considered in terms of the gainers and losers of fiscal policy.

[8] Auerbach and Feenberg (2000) follow Zeldes (1989) to split samples according to a specific wealth-to-income ratio. A household is liquidity constrained if the household's net financial wealth (derived from capitalized asset incomes) is less than the disposable income of at least two months. Poor income and wealth data make this approach impossible to use for this study with difficulties in obtaining capitalized asset incomes.

[9] Results on inequality stabilization are omitted as there is not much variation in Gini coefficients seen when shocks are applied in the study analysis (see Appendix for changes in Gini).

As the second theme in this section of the study is to embed counterfactual scenarios in existing policy when there is a crisis, there is the need to disaggregate the redistributive effects of tax-transfer reforms from changes in the milieu through which reforms function. To accomplish this, the study compares stabilization coefficients across countries. For countries that perform poorly based on the stabilization and policy impact coefficients, there is the justification for discretionary action. This study calculates new poverty stabilization coefficients based on assumed counterfactual policies.

3.3 Microsimulation using GHAMOD, SAMOD, and ECUAMOD

The microsimulation models play a key role in the analysis. They are used to simulate shock and status quo scenarios by calculating changes in household disposable income $\left(\sum_i \Delta Y_i^D\right)$ and in market income $\left(\sum_i \Delta Y_i^M\right)$ as well as liquidity-constraint indicators $\left(\sum_i \Delta L_i^{CH}\right)$. Moreover, they are used to calculate changes in headcount poverty measures $\left(\sum_i \Delta P_i\left(Y^D\right)\right)$ and $\left(\sum_i \Delta P_i\left(Y^M\right)\right)$.

Using GHAMOD, SAMOD, and ECUAMOD—the Ghana, South African, and Ecuador microsimulation models for calculating fiscal obligations under Ghanaian, South African, and Ecuadorian laws, respectively—simulations are carried out. These are static microsimulation models that, although with some adjustments to conform to the EUROMOD platform, come under the global SOUTHMOD project. They have been designed for comparative analysis of eight developing countries.[10] The models can simulate most taxes and government benefits if only cross-sectional household data were acquired when the specific fiscal structure was in place. Moreover, models have the ability to analyse and compare the effects of various actual and hypothetical benefit policy scenarios on poverty, inequality, and government revenues by assuming full benefit take-up as well as tax adherence. Information on policy rules and instrumental thresholds are sourced directly from the available micro data, making the latter a necessity for model execution. Subsequently, these tax-benefit rules are fed into the models. The next stage is the imputation of assessment units for each corresponding fiscal instrument. This is where eligibility is established, beneficiaries are marked, and liabilities are checked against each member within the unit. Disposable income or equivalized consumption is the final result of simulating the required taxes and benefits.

For the current model versions discussed in this study, simulations are based on existing policies from 2013 to 2019 that can be carried out. Table 1 summarizes the microsimulations used based on input data used and source, welfare metric used, existing safety nets modelled, income reference period, and sample size. It is seen that the South African model simulates more safety nets (Care Dependency Grant, Grant in Aid, Foster Child Grant, Old Age Grant, Child Support Grant, and Disability Grant) than the other two models for Ghana and Ecuador.

[10] All these models are freely accessible for non-commercial use. For country reports with detailed information on the input data, modelling, and validation of each tax-benefit system on GHAMOD, SAMOD, and ECUAMOD, see Adu-Ababio et al. (2017), Wright et al. (2016), and Jara and Montesdeoca (2020) or visit https://www.wider.unu.edu/project/southmod-simulating-tax-and-benefit-policies-development. For further information on EUROMOD, see https://www.euromod.ac.uk/about/what-is-euromod. The tax-benefit systems included in the model have been validated against aggregated administrative statistics as well as national tax-benefit models (where available).

Table 1: Microsimulation models for Ghana, South Africa, and Ecuador

Characteristic	(1) GHAMOD v.2.4	(2) SAMOD v.7.0	(3) ECUAMOD v.1.5
Input data	GLSS-7*	LCS-7**	EIGHUR
Input data source	Ghana Statistical Service	Statistics SA	Instituo Nacional de Estadisticas y Censos
Welfare metric	Consumption based	Income based	Consumption based
Policy years	2013–19	2014–19	2011–19
Safety nets	LEAP, School Capitation Grant, Free SHS Grant	Care Dependency, Grant in Aid, Child Support Grant, Foster Child Grant, Old Age Grant, Disability Grant	Human Development Transfer, Joaquín Gallegos Lara Transfer, Housing Grant
Sample	58,864 individuals	88,906 individuals	153,341 individuals
Households	14,009	23,380	39,617

Note: * Ghana Living Standards Survey Round 7. ** Living Conditions Survey Round 7.
Source: author's compilation.

Within GHAMOD, SAMOD, and ECUAMOD, this study concentrates on modelled fiscal policies that existed in 2017. The policy year is not arbitrary but based on the fact that countries have recent household survey waves that contain various indicators on household income and consumption expenditures that permit tax-benefit manipulations. Although more recent policies can be analysed, most recent accompanying data are non-existent coupled with the fact that uprating indices that may be used to inflate data might be unreliable. Moreover, countries in the study have, since 2017, improved and introduced more tax-benefit policies to cushion household livelihoods as dictated by respective development agenda. Hence, assuming directly from the data what would happen if there was a crisis in 2017 gives a fairly accurate picture. Input data used for Ghana (GLSS 7) is based on the specific period and does not require the use of inflation adjustment indices on incomes and expenditures. However, as input data for South Africa (LCS 6) and Ecuador (ENIGHUR) have reference periods of 2015 and 2011, respectively, the study from its microsimulation approach uses various uprating indices as a guide to inflate income and expenditure figures to ease the base comparison in the three countries.

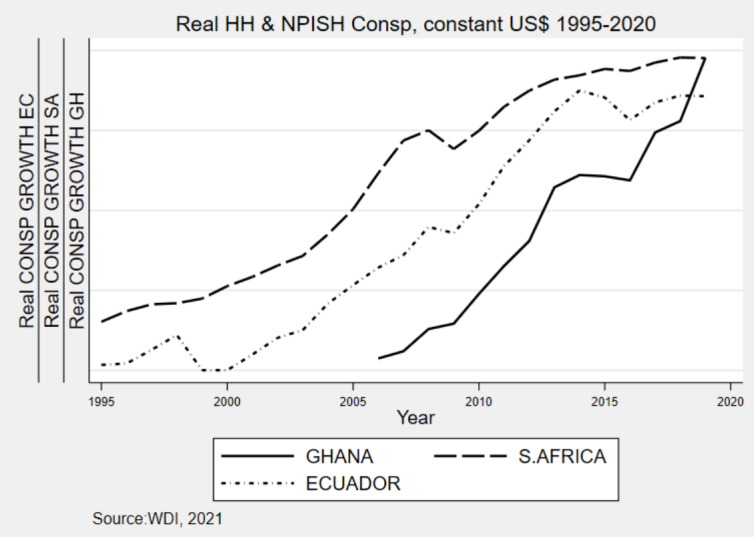
3.4 Selection and simulation of shocks and social protection

The aim of this subsection is first to justify the selection of a minimal shock with emphasis on consumption, which is a key metric in welfare measurement for developing countries rather than on income as done for developed economies. Second is to discuss the way policy impacts based on shock and social protection counterfactual simulations are carried out.

It is interesting to note that in some developing countries, household consumption is considered a better measure for welfare. In such cases, income measures are noisy and unreliable for research. There is the need, in light of recent crisis and the scope of this study, to examine how downturns are affected by consumption, which is particularly relied on in developing country contexts. The choice of an appropriate downturn should not be arbitrary but backed by research and data. Although research in this

area is nascent, especially in the developing country context, the data used in this study permit this assertion. Based on a time series representation of disaggregated household consumption, this study is able to make inferences on a proportional GDP relationship. Concrete conclusions on how the study can proceed with the appropriate level of shock to both household income and demand can be drawn from this. Figure 1 shows this relationship by representing the real household and non-profit institutions serving households (NPISH) consumption expenditure. As seen, household consumption is pro-cyclical as it tends to magnify the fluctuations in the series. Trends are affected by economic conditions, especially for South Africa and Ecuador, which see declines during crisis phases. For instance, between 2008 and 2009, real consumption expenditure fell by 5.5 per cent and 2.2 per cent, respectively. There is even a 22 per cent decline for Ecuador between 1999 and 2000. Similar conclusions can be said about Ghana, although not in the same magnitudes, as the country saw a 1.5 per cent decline between 2015 and 2016. This evidence points to the fact that consumption trends in these countries respond to changes in economic climate. This leads to the assumed 5 per cent demand shock.

Figure 1: Real household consumption



Source: author's illustration based on data from WDI 2021.

By examining how far national income is affected by consumption, this study creates the interest not only resulting in declines in incomes but also increases in informality. With a proportional fall in gross incomes by 5 per cent for all micro units (income shock), the study discusses scenarios where this idiosyncratic shock causes a decrease in income as well as a shift to the informal sector (informality shock). In both instances, there is some loss in labour earnings such that disposable income decreases in the same proportion as the income shock. This enables an easy comparison of scenarios. The increase in informality is modelled through reweighing samples.[11] In specific situations, weights of the informal labour is increased compared with similar samples of formal labour, which is decreased. In real terms, some proportion of formal labour is rendered informal. This is done holding the socio-demographic characteristics constant.

Simulating social protection is done in a straightforward manner. This study, assuming or relaxing shock assumptions, superimposes automatic adjustments via the fiscal structure in place. Automatic adjustment is mainly in the form of a variation in social protection or taxes bearing in mind crisis conditions. For instance, if the effect of automatic stabilization on household cushioning is minimal or non-existent for a specific country, discretionary action in the form of a tax holiday or a lump sum transfer can be simulated

[11] For the reweighting procedure, the author follows the approach of Osei et al. (2019), who have also simulated impacts of expanding social protection in a developing country case measured via the impacts on formal sector work. Their analysis focuses on changes in absolute and relative poverty rates after changes in the income distribution and the employment rate.

to improve the benefit component of stabilization effects. As an aim, this study concentrates on how social protection can be improved by introducing counterfactual policies and suggests the assessment of notions related to how taxes in developing economies can improve livelihoods for further studies.

Four scenarios are considered when there is a demand or income shock with assumed government effort exertion:

1. When tax-benefit policies are in place in the presence of a shock.
2. When tax-benefit policies are in place without the presence of a shock.
3. When tax-benefit policies are not in place in the presence of a shock.
4. When tax-benefit policies are not in place without the presence of a shock.

Moreover, the study goes a step further to introduce additional social policies for those countries whose existing social protection framework is not doing much to cushion households against risk exposure. Conclusions on the magnitude of household cushioning will be deduced from stabilization coefficients as well as policy impacts. These policy impacts can be regarded as the existing social protection structure given the fiscal policies at play. When there is a shock, we can consider the absence or otherwise of a tax-benefit system as discretionary fiscal policy action, which may be regarded as a stimulus package to lessen the burden of the shock to households. The magnitude of transfer being given to households in this case will be the size of the stimulus package for households. This can guide policy on how to improve livelihoods. To achieve this, two approaches are employed: first, a policy swap from a country with adequate welfare-improving social protection and, second, an expansion of an already existing social policy with welfare-improving potential.

In concluding this subsection on shock selection and simulation, it is important to note that all models are based on 2017 policy rules. They simulate market and disposable incomes first for baseline when there is no shock and second for reform where we superimpose the shock on households. Moreover, in the case of Ghana and Ecuador, the study calculates in a similar fashion simulated consumption for households regarding the two scenarios. Stabilization coefficients are calculated based on changes in simulated results for each scenario. Afterwards, current policies are put under stress to examine their cushioning effects. For countries that do not pass the stress test, policy swaps and expansions are suggested to remedy the lack of cushioning.

4 Results on automatic stabilization

I first discuss all stabilization coefficients by contrasting values for Ghana, South Africa, and Ecuador as shown in Table 2 (disaggregation in Table 11 and Table 12). Various comparisons are made among the interest stabilization coefficients. Next is a discussion on the impacts of policy and poverty stabilization. Although this study relies on post-fiscal poverty headcount ratio, hereafter referred to as poverty headcount ratio, for income stabilization, the study shows the respective consumption-based poverty headcount ratios associated for these countries. Based on data quality assertions, consumption-based poverty is associated with demand stabilization and shown for Ghana and Ecuador while South Africa continues to show income-based poverty for this coefficient.

I now discuss the results on automatic stabilization, as presented in Table 2, while making reference to associated headcount poverty rates in Tables 3–6. Poverty stabilization is also referred to as the policy impact and shown in all tables in this subsection.

Income stabilization: When there is a proportional drop in gross incomes by 5 per cent caused by some crisis situation, 1.2 per cent of this shock would be absorbed by automatic stabilizers in Ghana. This shock is accompanied with a rise in poverty; without shocks, baseline income-based poverty is 55.86 per cent while the crisis situation increases poverty headcount to 57.03 per cent. For South Africa, the study discovers a higher coefficient value of 22 per cent when there is a similar shock. There is a similar increase in income-based poverty from 33.67 per cent to 34.25 per cent. In Ecuador, income stabilization is 10.3 per cent with a rise in poverty from 14.6 per cent to 15.38 per cent. This difference tells a lot about the nature of the fiscal system in these countries.

Table 2: Income, demand, and poverty stabilization coefficients

	Ghana	**South Africa**	**Ecuador**
Income stabilization			
Gross income shock	0.012	0.220	0.103
Informality shock	0.036	0.083	0.117
Demand stabilization			
Consumption expenditure shock	0.049	-	0.050
Housing liquidity constraint	0.038	0.249	0.011
Credit-liquidity constraints	0.00	0.251	0.045
Poverty stabilization			
Gross income shock	0.008	0.478	0.464
Informality shock	0.00	0.143	0.00

Source: author's computation based on GHAMOD, SAMOD, and ECUAMOD 2022.

As far as gross income shocks are concerned, the effects of income automatic stabilization differ as qualified from the results. From Table 11, a breakdown of the constituents within the income coefficient (tax, employee social insurance, and benefits) reveals that stabilization due to benefits is non-existent in Ghana and Ecuador.

Second, on income stabilization with emphasis on informality dominance, it is observed that for Ghana and Ecuador when there is a shock such that the informal sector increases proportionally more than the formal sector, stabilization coefficients are 3.6 per cent and 12 per cent with poverty headcount also increasing to 56.02 per cent and 14.7 per cent, respectively. In a similar fashion for South Africa when there is an informality shock, there is an income stabilization coefficient of 8.3 per cent with income-based poverty increasing to 33.73 per cent.[12] The lower coefficient for South Africa reveals the minimal effect of informality in that economy. The higher coefficient for Ghana and Ecuador can be attributed to the dominance of informality within these economies. Input data used show that the weighted informality share is greater for Ghana (90 per cent) and Ecuador (83 per cent) compared to South Africa (24.5 per cent). Reweighing, as used by Osei et al. (2019), has an effect on the income stabilization coefficient from an informality shock in countries where informality shares are larger.

Table 3: Income stress test redistributive results for Ghana

Scenarios	Switch	Baseline	Income shock	$\Delta P_i(Y^j)$
Fiscal	On	55.86	57.03	1.17
	Off	55.34	56.52	1.18
Policy impact (τ^p)			0.01	

Source: author's computation based on GHAMOD 2022.

Demand stabilization: On how this coefficient cushions households against risk exposure, the study presents three different coefficients for Ghana and Ecuador and two for the South African case. In the

[12] See full results on informality shock in Appendix A1.

case where all households are rendered liquidity constrained as a result of the income shock translating directly into a proportional decline in household consumption expenditure as applied to only Ghana and Ecuador, the demand stabilization is 5 per cent for both countries. For Ghana, this is higher compared to stabilization due to both gross income and informality shocks. For Ecuador, the interest coefficient is lower compared to both income coefficients. Household-consumption-based poverty increases from 23.59 per cent and 28.49 per cent when there is no such shock to 25.57 per cent and 31.57 per cent in the presence of the shock for Ghana and Ecuador, respectively. A similar analysis cannot be carried out for South Africa as data on consumption expenditure is non-existent. In Ghana and Ecuador, when households are liquidity constrained due to their inability to own their place of dwelling, leading to a proportional decline in consumption expenditure, demand stabilization is 4 per cent and 1 per cent while consumption-based poverty increases to 25.22 per cent and 28.81 per cent, respectively. Using a similar approach for South Africa, demand stabilization is 25 per cent with income-based poverty increasing to 33.73 per cent in the shock scenario. This coefficient is higher compared to income stabilization, supporting the notion that automatic stabilization in South Africa is demand responsive compared to income shock responsiveness. In Ghana, when liquidity constraints are classified as the inability to obtain credit or loans leading to a proportional decline in consumption expenditure, demand stabilization is nil with poverty rate increasing marginally to 23.61 per cent. Similarly for Ecuador, the coefficient is a marginal 4.5 per cent with poverty increasing to 30.34 per cent. This strengthens the argument for the high level of informality in both economies. Moreover, structural imbalances that exist in heavily informalized economies as well as the difficulty in obtaining credit in such economies contribute to this (Bond et al. 2015). This is reflective in the number of households that obtain credit from formal sources whether or not there is a crisis. This is sharply contrasted in the South African case. With similar liquidity-constraint circumstances with households unable to meet debt obligations in the presence of shocks, there is a higher demand coefficient of 25 per cent with household poverty rising to 33.73 per cent (see Appendix for all results on liquidity constraints).

Table 4: Income stress test redistributive results for South Africa

Scenarios	Switch	Baseline	Income shock	$\Delta P_i(Y^j)$
Fiscal	On	33.67	34.25	0.58
	Off	46.40	47.51	1.11
Policy impact (τ^p)			0.48	

Source: author's computation based on SAMOD 2022.

Table 5: Income stress test redistributive results for Ecuador

Scenarios	Switch	Baseline	Income shock	$\Delta P_i(Y^j)$
Fiscal	On	14.26	15.38	1.12
	Off	12.84	14.93	2.09
Policy impact (τ^p)			0.46	

Source: author's computation based on ECUAMOD 2022.

Table 6: Demand stress test redistributive results for Ghana

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	23.59	25.57	1.98
	Off	23.79	25.93	2.14
Policy impact (τ^p)			0.08	

Source: author's computation based on GHAMOD 2022.

Poverty stabilization: I discuss these coefficients in relation to income and demand stabilization. The study observes very interesting estimates for these countries and sends similar signals concerning how far the fiscal system in each country is safeguarding livelihoods. In this manner, the extent to which tax-benefit policies impact household poverty is ascertained from this coefficient. These coefficients are very high for South Africa and Ecuador but lower for Ghana. Ecuador's coefficients denote larger impacts on disposable income compared to market incomes in shock scenarios. For demand shocks, poverty stabilization in South Africa is considerably higher than Ecuador and Ghana. Thus, in the presence of such shocks, the fiscal system in Ghana does worse at shielding households. Income coefficients reinforce this assertion by recording higher values for South Africa and Ecuador compared to Ghana. The magnitudes of income shock effects on poverty stabilization send proportionate signals in the countries. In terms of magnitudes, the coefficient is high for gross income shocks in South Africa and Ecuador but relatively low in Ghana (48 per cent, 46 per cent, and 0.8 per cent, respectively). This describes the nature of the welfare system in these countries. During the year in question, there were two major social intervention programmes in Ghana. One directly targeted the poor, the LEAP programme, which is means tested on the bottom 25 per cent of households falling below the extreme poverty line. The other was a general universal social policy, the Free Senior High School programme, which had just begun. On the other hand, this contrasts sharply with the South African case, which in principle has a stronger welfare system because of the number of targeted benefits run in the country with six different social policies in existence.

For informality shocks, results are lower (14 per cent and 0 per cent, respectively). Tax-benefit systems in South Africa, however, continue to cushion the informal sector while similar systems in Ghana and Ecuador do not. The study notes that the associated income stabilization coefficient is uneven for Ghana and South Africa but stable for Ecuador. The dominance of the informal sector is reflective in these results. This means that the fiscal system in Ghana does worse at cushioning both gross income with coefficients of 1.2 per cent and 3.6 per cent and in shielding against vulnerability from gross income shocks with a coefficient of 0.8 per cent. Poverty stabilization in South Africa is marginally responsive when there is an informality shock but highly responsive to gross income shocks. This is because of the large formal sector in the country.

As poverty stabilization shows impact in terms of how existing policies affect households, I discuss the coefficient's effects on consumption-based poverty and heterogeneous agents. With reference to a marginal demand shock of 5 per cent, high poverty stabilization coefficients relating to consumption are observed for Ecuador (51.6 per cent) compared to Ghana (7.5 per cent), signalling a better consumption cushion in Ecuador for poverty, as shown in Tables 7 and 6, respectively. Concentrating on heterogeneous households in terms of liquidity constraints, a higher policy effect is observed in South Africa and Ecuador when there are demand shocks related to housing ownership constraints (68 per cent and 92 per cent, respectively) and credit constraints (81 per cent and 67 per cent, respectively), as shown in Appendix A1. Heterogeneous households in Ghana continue to record lower policy impacts in all these instances, 8 per cent and 0 per cent for housing ownership and credit constraints, respectively. The higher policy effect from housing liquidity constraints in Ecuador is not surprising because of the country's housing benefit (Bono de la vivienda). This translates into a better cushioning effect, reflective in the income and demand coefficients associated with this indicator. The low effect (0 per cent) observed

for credit-constrained households in Ghana should be interpreted as an unresponsive effect based on the nature of the country's economy. This is confirmed by the virtually non-existent demand stabilization coefficient. South Africa and Ecuador generally record higher demand-driven policy effects, which points to the nature of fiscal policy as well as the degree of formalization in these countries.

Table 7: Demand stress test redistributive results for Ecuador

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	28.49	31.57	3.08
	Off	21.91	28.27	6.36
Policy impact (τ^p)			0.52	

Source: author's computation based on GHAMOD 2022.

5 Results on counterfactual and discretionary actions

In this section, I concentrate on how automatic stabilization can improve cushioning effects with alternate tax-benefit arrangements. The first step to this is experimenting on counterfactual scenarios of how households would fare if there were neither taxes nor benefits. In addition, the presence of an income or demand shock may apply.[13] In these scenarios, the cushioning effect examined concentrates on the amount of social protection with or without a shock. The belief is that countries with weak fiscal systems, including safety nets, will have a limited ability to protect against risk exposure and vice versa. In line with directing policy, the next step is simulating discretionary action for countries with weaker social policies. This is done by introducing additional benefit policy responses for such countries who inadvertently have fewer cushioning effects from safety nets. Safety nets or social protection is not limited to benefits alone but includes taxes and social security contributions that also have the potential to adjust given the state of households. The study finally calculates the impact that existing and counterfactual social protection has on households. This is formalized as an extension of the poverty stabilization coefficient.

5.1 Counterfactual actions

For baseline and reform scenarios, four simulations are carried out to examine the effect of each country's existing policies: (1) when tax-benefit policies are in place in the presence of a shock; (2) when tax-benefit policies are in place without the presence of a shock; (3) when tax-benefit policies are not in place in the presence of a shock; and (4) when tax-benefit policies are not in place without the presence of a shock. Baseline simulations involve the second and fourth cases (without shocks) while reform simulations involve the first and third cases (with shocks). Results are shown in Tables 3–6 while an extended version of the results with public revenue and expenditures as well as inequality measures are shown in Table 10 and Appendix B1–B7. Data availability affect how redistributive results are shown. For Ghana and Ecuador, input data permit representation of both effects on consumption- and income-based poverty when shocks are simulated. However, as poverty rates in South Africa are primarily income-based, the study only shows results of such magnitudes.

In the first scenario, the study reveals an increase in consumption/income-based post-fiscal absolute poverty for all countries, even when tax-benefit policies are in place. When this is compared to the second scenario, with social protection in place without a marginal income shock, there is an increase in income-based poverty for Ghana by 1.17 per cent, for South Africa by 0.58 per cent, and for Ecuador by 1.12 per cent (see Tables 3–5).

[13] In the Appendix, fiscal and redistribution results are shown for scenarios where only benefits do not exist.

In the third scenario, although the study shows increases in consumption/income-based post-fiscal absolute poverty for all countries when tax-benefit policies are not in place, their magnitudes are not as high when tax-benefit systems are in place. For instance, South Africa records 15.38 per cent as absolute poverty when fiscal is in place but 14.93 per cent when it is not in place. This informs on the regressivity of fiscal, especially taxes in the country. When the third and fourth scenarios, where social protection is not in place without a marginal income shock, are compared, there is a considerably higher increase in income-based poverty for Ghana by 1.18 per cent, for South Africa by 1.11 per cent, and for Ecuador by 2.09 per cent (see Tables 3–5).

As a robustness check for the policy impact results for Ghana and Ecuador, the same scenarios based on demand shocks emanating from proportional reductions in consumption expenditure are carried out and shown in Table 6 for Ghana and in Table 7 for Ecuador. The study observes sizeable effects on vulnerability as a result of implied shocks. Comparing the first and second scenarios in Ghana and Ecuador, consumption-based post-fiscal poverty increases by 1.98 per cent and 3.08, respectively. Incremental differences for the same countries based on the third and fourth scenarios are 2.14 and 6.36, respectively. These are higher in magnitude, as seen in the income shock cases (Tables 6 and 7). Concentrating on individual countries, there is no doubt that shocks play a role to a large extent on the amount of vulnerability in sampled countries. Moreover, the role of social policies cannot be overemphasized.

Table 8: Discretionary action to improve income shock cushioning

Scenarios	Switch	Baseline	Income shock	$\Delta P_i(Y^j)$
Fiscal	On	52.35	53.34	0.99
	Off	55.34	56.52	1.18
Safety net impact (τ^p)			0.16	

Source: author's computation based on GHAMOD 2022.

In Ghana, effects of shocks are evidently low irrespective of the social policies at play while the reverse holds for South Africa and to some extent Ecuador. Although vulnerability is not fully eliminated in the latter countries, it is evident that on average a 44 per cent and 49 per cent safety net income cushion, respectively, is significantly superior in such circumstances.

5.2 Discretionary actions

As Ghana fails both stress tests in terms of automatic stabilization and redistribution from existing benefit policies, the study simulates targeted discretionary policies for social protection.

The study adopts the following hypothetical social policies:

1. A Care Dependency Grant benefit policy, as exists in South Africa, as a counterfactual benefit for Ghana.

2. A redefined LEAP transfer system, which is extended and made more generous by expanding the existing old-age pension benefit into a more universal one, as done by Osei et al. (2019).

Amid both income and demand shocks, results for these additional discretionary actions are described in Table 8 and Table 9, respectively.

Table 9: Discretionary action to improve demand shock cushioning

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	20.14	21.88	1.74
	Off	23.79	25.93	2.14
Safety net impact (τ^p)			0.19	

Source: author's computation based on GHAMOD 2022.

The study compares discretionary actions based on the benefit structure in the status quo without shocks to the reform scenario when there are shocks. As explained, these scenarios are backed by the introduction of some additional benefits with the potential of mitigating household risk exposure. Concentration on older persons and children stems from the fact that they are the most vulnerable in the distribution. As observed, status quo scenarios now see an improvement in poverty compared to cases based on existing benefit policies. Discretionary action reduces the baseline poverty consumption (income) headcount from 23.59 per cent (55.86 per cent) to 20.14 per cent (52.35 per cent) without shocks and from 25.57 per cent (57.03 per cent) to 21.88 per cent (53.34) with shocks. Amid an income shock, there is an increase in poverty stabilization (impact of discretionary action) to 16 per cent compared to 0.8 per cent without the action. In terms of a demand shock, there is an improvement in household cushioning to 19 per cent from the initial 7.5 per cent. With discretionary action, households become better off with both demand and income insurance.

Table 10 shows the government budget figures for four conditions on the fiscal system at play: first, the cost in the status quo when there are no shocks with assumed existing normalcy; second and third, when there is a superimposition of a demand and income shock that reduces consumption expenditure and income, respectively; and fourth, how much cost is incurred when there is some state effort exertion in the form of tax-benefit manipulation amid the shocks. It can be concluded that the size of fiscal stimulus is negatively correlated to the stabilization coefficient.

Table 10: Demand shock simulation results of discretionary action on government budget

Fiscal index	Status quo	Demand shock with status quo fiscal	Income shock with status quo fiscal	Demand shock with discretionary action
Revenue	**9,219.22**	**9,208.95**	**9,062.53**	**9,275.13**
Direct taxes	4,824.47	4,824.47	4,792.20	4,824.73
Indirect taxes	1,872.83	1,862.56	1,874.50	1,928.73
SSC	2,521.92	2,521.92	2,395.83	2,521.92
Expenditure	**2,145.40**	**2,149.51**	**2,145.40**	**9,479.24**
Child benefits	1,129.94	1,129.94	1,129.94	2,528.95
Social assist.	29.25	33.36	29.25	3,698.22
Pensions	986.21	986.21	986.21	3,252.07

Note: budgetary considerations are in millions of Ghana cedis.
Source: author's computation based on GHAMOD 2022.

As observed, the country is spending GHS2,145 million on social protection at baseline without shocks, although this increases by GHS4 million when there is a demand shock. A greater part of this expenditure is from the Free SHS and the Home Grown School Feeding programme within child benefits. As shown in social assistance, it is interesting to note that much less is spent on the LEAP programme, which tackles household vulnerability. It is not surprising that, in the shock situation, this is where the cushion is noticed by an increase in LEAP expenditure by about GHS4.1 million. The demand shock affects indirect taxes because of the reduction in consumption purchases while an income shock will affect direct taxes. This equally reflects in the increased poverty rate amid the crisis situation. Discretionary action with emphasis on improved social protection rectifies this situation. With an increased budget expenditure of GHS3,665 million (GHS1,399 million on the Child Dependency Grant and GHS2,266

million on Universal Pension), the country is able to shield households from risk exposure. Although a steep price to pay, there is an increase in indirect taxes because of the rise in disposable income, making such expansions favourable if managed efficiently. The telling impact of such a stimulus package on household poverty makes this option a viable one to consider.

6 Discussion of results

In this section, the study discusses some questions raised based on the results from the inquiries made. First, there is a brief comparison of the coefficients obtained to those seen in the EU and US, i.e. the so-called developed economies. As one main contribution of this paper is to estimate stabilization coefficients in developing countries, there is the need to establish a yardstick to compare these estimates to previous work to gain a general perspective of where developing countries stand in terms of safeguarding welfare. In addition, some macro indices in the case countries are compared. Second, discretionary action is discussed with reference to the cost of existing and suggested social programmes in the presence or absence of shocks. Motivation for this stems from possible funding objections that may be raised in a developing country context.

6.1 Stabilization coefficients

Income stabilization based on micro data in the EU and US is generally higher using similar methodological approaches. A recent study by Dolls et al. (2012) puts the average absorption of income shocks in the EU at 38 per cent and 39 per cent in the US. In such economies, taxes and social security contributions carry much weight when τ^I is disaggregated into its various components. As observed, benefits do not matter as much as contributing to income insurance. In our case studies for Ghana and Ecuador, these coefficients are small. South Africa differs as the income coefficient is 16 percentage points smaller relative to the US but 17 from the EU, while those of Ghana and Ecuador are considerably lower than what developed economies record in terms of cushioning. As shown in Table 11 when there are gross income shocks, disaggregated components show that for Ghana tax and social insurance contributions carry all the weight with no attribution to social transfers. For South Africa, tax and benefits carry more weight for the income stabilization coefficient. The magnitudes of the coefficients in the EU and US are similar to the latter results when unemployment shocks are considered. Table 12 reveals from disaggregated components that stabilization from benefits and taxes in the EU and US contribute more to income stabilization in this regard.

Table 11: Comparison and decomposition of income stabilization coefficient from gross income shock

	τ_S^I	τ_T^I	τ_B^I	τ_A^I
GH	0.006	0.006	0.00	0.012
SA	0.002	0.201	0.018	0.220
EC	0.061	0.043	0.0	0.103
EU	0.100	0.260	0.017	0.378
US	0.102	0.215	0.007	0.388

Source: author's computation based on GHAMOD, SAMOD, and ECUAMOD 2022; Dolls et al. 2012 based on EUROMOD and TAXIM.

Table 12: Comparison and decomposition of income stabilization coefficient from unemployment/informality shock

	τ_S^I	τ_T^I	τ_B^I	τ_A^I
GH	0.005	0.057	0.026	0.036
SA	0.003	0.126	0.046	0.083
EC	0.068	0.075	0.026	0.117
EU	0.124	0.156	0.188	0.469
US	0.051	0.174	0.071	0.337

Source: author's computation based on GHAMOD, SAMOD, and ECUAMOD 2022; Dolls et al. 2012 based on EUROMOD and TAXIM.

The study draws a clear conclusion on the progressivity of income taxes in each country as well as the benefit structures. Taxes in South Africa may not be progressive, but social protection in place makes up this gap. The country reduces more of household risk exposure compared to developed countries who also achieve this mainly from income tax progressivity. Ghana and South Africa are similar regarding coefficient component disaggregation when conclusions are made for income stabilization coefficients drawn from unemployment shocks, as shown in Table 12. It is quite interesting to note that income stabilization from gross income shocks diverges sharply when unemployment shocks are considered in these countries. Thus, Ghana's coefficient increases significantly with that of South Africa dropping likewise. The study realizes that for Ghana the rise in the informal sector means a fall in payroll taxes as only formal sector employees are liable for such taxes. Households are greatly cushioned from taxes and benefits as represented by the disaggregated coefficients. A reduced cushion for South Africa is due to non-simulation of actual unemployment benefits non-existent in the study model. Its existence would shore up income stabilization associated with benefits as seen with other shock scenarios. Ecuador exemplifies this when income cushions from social security (τ_S^I) and benefits (τ_B^I) all increase in an unemployment shock case.

Table 13: Comparison of demand stabilization coefficients

	τ_2^C	τ_3^C
GH	0.038	0.0
SA	0.249	0.251
EC	0.011	0.045
EU	0.124	0.041
US	0.058	0.056

Note: τ_2^C- identification of liquidity constraint from housing ownership; τ_3^C- identification of liquidity constraint from credit availability.

Source: author's computation based on GHAMOD, SAMOD, and ECUAMOD 2022; Dolls et al. 2012 based on EUROMOD and TAXIM.

Demand stabilization from the study is also compared to that of the developed world. For similar base parameter considerations, the study compares survey evidence from liquidity constraints related to real estate property ownership and credit availability criteria. It is important to note the share of households that fall under these criteria, as this informs on the significance of demand stabilization. In Ghana and Ecuador, only a quarter of representative households are not constrained in terms of domicile ownership while less than 10 per cent of households are actually credit constrained. Hence, demand stabilization in these countries will be higher when the shock is relative to housing ownership but low when shock is relative to credit availability or debt obligation. In South Africa, one-third of representative households are liquidity constrained by housing ownership as well as credit availability. However, with the level of formalization, demand stabilization will be greater for both shock-related stabilization coefficients. Table 13 compares demand stabilization to developed economies, as calculated by Dolls et al. (2012).

Demand stabilization in developed economies based on similar liquidity constraints are relatively low and compares favourably to those in the study. For housing constraints, demand stabilization is highest in

South Africa owning to the share affected by such constraints. Ghana, although low, absorbs household vulnerability favourably close to what the US does. Ecuador is the lowest in this regard. South Africa continues to dominate demand stabilization with credit constraint as backed by the share of interest-sampled households. For this category, Ecuador compared closely to the EU block.

Average SSA poverty estimates based on broad spectrum shock impact scenarios by Devarajan et al. (2013) are used as a benchmark to compare poverty rates in this study. Although based on macro estimates, the authors discuss long-run poverty impacts from typical sub-Saharan economy shocks such as prolonged recessions, collapse of capital flows, crude oil shocks, droughts, and conflicts, which this study also assumes. Based on shock-induced microsimulations, poverty headcount rates in Ghana and South Africa average 30 per cent (24.89–27.79 per cent for Ghana and 34.25–33.73 per cent for South Africa). This compares favourably to long-run poverty rates for SSA based on various shock scenarios using the GIDD model when general equilibrium effects are considered.

6.2 Discretionary action

There exists some controversy in developing economies on social protection response to crisis situations (Beegle et al. 2018, 2016; Del Ninno and Mills 2015). These arguments arise when some policy makers believe that the extent of marginalization sinks deeper into the structural inefficiencies of these economies, such that the existing fiscal systems cannot be welfare improving no matter the cost incurred. Others believe that the fiscal system should not be considered in totality when a crisis hits but should be targeted in a manner that treats the affected as paramount no matter the cost incurred. The question that remains is to decipher how deep this cost goes irrespective of the viewpoints expressed. The study in this section provides a cipher by presenting how an underperforming country (Ghana), regarding its ability to provide income insurance to households in crisis mode, can use discretionary action to improve this situation. The discussion hinges on why poverty rates obtained in the previous section rise when there are shocks as well as why they fall when social policies based on swaps (Care Dependency Grant) and expansion (Universal Old Age Pension) are introduced. Although the model does not perfectly predict government budget as seen from external validation (Adu-Ababio et al. 2020), the study draws conclusions on permitted instances where these results hold in real budget scenarios.

On average, the model predicts that it is possible to roll out such intervention programmes when a crisis hits. The suggested social protection policies are means tested to target the specific household population most affected when the country is dealing with a shock. The amount of GHS3,665 million is a sizeable package comparable to about 11 per cent of Ghana's total revenue in 2017. This emphasizes the negative relationship established with the magnitude of automatic stabilization that Ghana records. However, roll-outs should be timely and efficient because if such new benefits require information on proxy means tests, the roll-out of a benefit package may delay, which is detrimental during shock periods.

There is the urgent need for more targeted safety nets to the already vulnerable groups in Ghana, as baseline scenarios point to the notion that these groups sink further into vulnerability when there are shocks. Discretionary actions that are general in nature without specific targeting cannot achieve the impacts seen in this study. By cushioning vulnerable groups, although at a cost, there is a clear improvement even amid shocks. This can be interpreted as a clear signalling approach to mitigating household risk exposure to other developing economies who are in the policy formulation stages of building up their social protection structures.

6.3 Robustness and sensitivity checks

The goal in this section is to check outcome indices and assess the underlying axioms and social evaluation functions using variance estimations. This is necessary as all input data used in this study are based on survey data that affect standard errors due to complex survey designs. As the study works

with sample data, there is the preoccupation of statistical significance and policy uptake in the above model predictions as these reinforce the confidence in the observed outcomes. Although uncommon in research dealing with microsimulation, income distribution and poverty scholars such as Pudney and Sutherland (1994) and Goedemé et al. (2013) have tried to argue for and report standard errors as well as significance tests in their work to account for sampling variability.

As shown above, the study presents ambiguous summary distributions using parametric indices of inequality welfare and poverty, which calls for proper consistency and robustness checks. To test the latter, the study shows consistent poverty and inequality estimates based on bootstrap standard errors.[14] This is done by accounting for within-household clustering. Bootstrapping is adopted here as a general empirically based approach that recalculates the welfare estimates over a number of replications. The method is contrasted with linearizations that are approximate and doubtful as the sample size increases (Biewen and Jenkins 2006).

Table 14 shows welfare estimates with statistical significance on the baseline model as all other simulations are based on this status quo parametrization. Subscripts denote whether an income- or consumption-based metric is employed. It is observed that, aside from the fact that all welfare indices are significant, absolute poverty headcount ratio FGT_0, as recorded in baseline modelling, compares favourably with the robustness test. Confidence intervals also lie within appropriate regions, although not shown. As the study assumes the margin of shock to apply, confidence bands are within the range for crisis scenarios. On the contrary, if shocks were predicted by actual time series data, confidence bands might be too high to render baseline indices insignificant. However, this is not the case in this study. From these results, the study concludes that results presented above are robust and can be relied on given defined guidelines.

In terms of policy uptake, there is always the problem of under- or over-simulation of not only reforms but also status quo parameters. One reassuring way is to undertake a macro validation exercise where model predictions are compared to external statistics. Although external statistics are difficult to come by in the study context, the few gathered by the study concludes that the models are quite close to national aggregates. For instance, SAMOD for the policy year 2016 reports total personal income taxes as ZAR327 million while the the national aggregate puts the figure at ZAR392 million. Moreover, in Ecuador social assistance benefits amount to US$724 million while ECUAMOD put this value at US$661 million. Last, national consumption-based poverty in Ghana is 23.4 per cent while GHAMOD put this index at 23.6 per cent. All this points to the notion that results obtained from these simulations can be relied upon by policy makers and researchers alike to make recommendations that seek to improve livelihoods.

[14] Methods using linear standard errors are also used and provide the same results and conclusions. Some of these include complex survey estimates of Generalized Entropy and Atkinson Inequality indices.

Table 14: Robustness check for baseline results

Welfare index	(1) Ghana GH	(2) South Africa SA	(3) Ecuador EC
FGT_{0Inc}	0.5566***	0.3367***	0.1427***
	(0.0070)	(0.0047)	(0.0025)
FGT_{0Con}	0.2355***	-	0.2846***
	(0.0050)	-	(0 .0036)
FGT_{1Inc}	0.4077***	0.1481***	0.0439***
	(0.0064)	(0.0025)	(0.0011)
FGT_{1Con}	0.3580***	-	0.0929***
	(0.0828)	-	(0.015)
FGT_{2Inc}	0.4939***	0.0913***	0.0214***
	(0.0801)	(0.0020)	(0.0010)
FGT_{2Con}	0.8800**	-	0.0443***
	(0.4331)	-	(0.009)
$Gini_{Inc}$	0.7770***	0.6363***	0.4621***
	(0 .0185)	(0.0035)	(0.0048)
$Gini_{Con}$	0.4087***	-	0.4328***
	(0.0043)	-	(0.0026)
GE_{0Inc}	1.5032***	0.8008***	0.3700***
	(0.0854)	(0.0103)	(0.0083)
GE_{0Con}	0.3000***	-	0.3229***
	(0.0051)	-	(0.0040)
Observations	14,009	23,380	39,617

Note: bootstrap standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Source: author's computation.

7 Conclusions

Microsimulation models for Ghana (GHAMOD), South Africa (SAMOD), and Ecuador (ECUAMOD) have been used in this study to achieve two main objectives. It ascertains the magnitudes of automatic stabilization mitigating household risk exposure in the event of macroeconomic shocks. It also assesses how the impact of shocks fare in the presence or absence of existing fiscal policies. In order to observe the impacts of these policies, the study demonstrates how discretionary action can be used to improve cushioning effects. Baseline simulations emphasize taxes, employee social insurance contributions, and social transfer benefits without shocks with the inverse holding for reform scenarios with similar parameterization. Automatic stabilization varies depending on the shock at play. Income stabilization encompassing gross income and informality or unemployment shocks average 1 per cent for Ghana, 15 per cent for South Africa, and 11 per cent for Ecuador. Demand stabilization, which is only achieved for liquidity-constrained households encompassing demand shocks related to consumption, real estate, and credit, average 4 per cent for Ghana, 25 per cent for South Africa, and 4 per cent for Ecuador. Poverty stabilization, which considers similar shocks, is on average lowest for Ghana (3 per cent) but high for Ecuador (51 per cent) and South Africa (53 per cent). This presents the general notion that automatic stabilization is considerably higher in South Africa and Ecuador than in Ghana owing to the fiscal system and welfare inclination in each country. Policy directions regarding discretionary action can be inferred from these results.

Further, tax-benefit stress tests continue to prove this assertion by showing the impacts that fiscal policy have on these developing economies. Households in South Africa and Ecuador have on average higher policy cushioning of 44 per cent and 49 per cent, respectively, when in crisis mode compared to an average mitigation of 4.5 per cent for Ghanaian households. This suggests that the rather generous tax-

benefit policies in South Africa and Ecuador to a greater margin explain the difference in the stabilization of household disposable income and demand, exacerbating observed variations in automatic stabilization compared to Ghana. Additional confirmation comes from a disaggregation of stabilization effects in the analysis. In the case of gross income shocks, benefits alone absorb 11 per cent of the shock in South Africa compared to no absorption in Ghana and Ecuador. In the case for informality shocks, fiscal policies cushion households by 8.3 per cent in South Africa but 3.6 per cent in Ghana and 12 per cent in Ecuador. The relatively low cushion in South Africa is attributed to formal sector dominance in that economy while the relatively high cushioning observed in Ghana and Ecuador is attributed to the dominance of the informal economy.

When counterfactual policies are introduced, cushioning effects in Ghana improve. With this done, consumption-based poverty headcount falls considerably. On average, improved safety net or total policy impacts also increase from 4.5 per cent to 17.5 per cent amid both income and demand shocks, which is closer to the average poverty stabilization in Ecuador and South Africa. A key result from discretionary fiscal action is that not only can it reduce vulnerability when demand shocks are considered, it also improves tax revenues as a result of increases in demand for household consumables due to the rise in disposable income. Moreover, the study establishes a negative correlation between fiscal expansion and automatic stabilizers. The size of such stimulus packages informs that with smaller automatic stabilization, there is the need to engage in more discretionary fiscal indices instead of relying on existing frameworks that may potentially worsen the situation. Policy dictates that Ghana would have to steer policy at a cost of GHS3,667 million (about 1.8 per cent of nominal GDP) to improve stabilization while South Africa might only need to work on benefit quotas if the already well performing cushion needs to be improved. Ecuador, in terms of current policy, needs to link the eligibility criteria to rely directly on income and expenditure thresholds to reduce the high impact observed in shock scenarios in the presence of shocks. In totality, results suggest that policy makers in these countries have different projections of how shocks can be dealt with. Policy makers in Ghana have not taken into account the potency of automatic stabilization in the design of effective fiscal structures that can address the recent economic crisis. The reverse can be said about policy makers in South Africa and Ecuador.

In as much as robustness tests show that the input data employed are devoid of any measurement errors due to the survey design, there are limitations to the analysis, and results discussed have to be interpreted with these in hindsight. First is the assumption on the link between income and demand stabilization. This can only happen when shocks to household disposable income translate directly to shocks in household consumption or demand. The study has suggested some ways through which this link holds from liquidity-constraint inspections. Although these may be the best available options, they in no way exhaust such translation mechanisms bearing in mind household behaviour. Second is the omission of corporate taxes as an automatic stabilization component. This study, although concentrating on micro units, emphasizes households. It is possible households may own these firms; however, the study abstracts the role of corporate taxes as these do not affect households directly. Third is the concentration on the trade-off between safeguarding against shocks based on redistribution and efficiency perspectives. Fourth, the use of the automatic stabilization model is not sacrosanct and also presents some challenges. In the bid to disentangle automatic stabilization effects from other behavioural effects, this approach ignores those elements of general equilibrium and behavioural changes due to income shocks. This study does not seek to ascertain aggregate changes arising from an income shock but tries to single out that specific effect that is associated with automatic stabilization. This drawback, although pertinent, is irrelevant if indicators are based on a static microsimulation model that estimates the automatic levelling of individual earnings without considering behavioural dynamics. Fifth, the study is not normative in nature as some optimal value of automatic stabilization coefficients is abstracted. Last, the study is silent on the impacts to labour supply and behavioural dynamics on influencing the size of automatic stabilization. This study is purely static and concentrates on 'morning after' effects, bearing in mind that such issues can be investigated in future research. Future research may also delve into how automatic stabilizers affect heterogeneous agents beyond the few instances that this study discussed.

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Appendix

A Additional results on stabilization coefficients

Table A1: Income stress test redistributive results for Ghana

Scenarios	Switch	Baseline	Informality shock	$\Delta P_i(Y^j)$
Fiscal	On	55.86	56.02	0.16
	Off	55.34	55.50	0.16
Policy impact (τ^p)			0.00	

Source: author's computation based on GHAMOD 2022.

Table A2: Housing liquidity stress test redistributive results for Ghana

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	23.59	25.22	1.63
	Off	23.79	25.22	1.77
Policy impact (τ^p)			0.080	

Source: author's computation based on GHAMOD 2022.

Table A3: Housing liquidity stress test redistributive results for South Africa

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	33.67	33.73	0.06
	Off	46.40	46.59	0.19
Policy impact (τ^p)			0.68	

Source: author's computation based on SAMOD 2022.

Table A4: Housing liquidity stress test redistributive results for Ecuador

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	28.49	28.81	0.32
	Off	21.91	26.00	4.09
Policy impact (τ^p)			0.92	

Source: author's computation based on ECUAMOD 2022.

Table A5: Credit liquidity stress test redistributive results for Ghana

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	23.59	23.61	0.02
	Off	23.79	23.81	0.02
Policy impact (τ^p)			0.00	

Source: author's computation based on GHAMOD 2022.

Table A6: Credit liquidity stress test redistributive results for South Africa

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	33.67	33.73	0.06
	Off	46.40	46.72	0.32
Policy impact (τ^p)			0.81	

Source: author's computation based on SAMOD 2022.

Table A7: Housing liquidity stress test redistributive results for Ecuador

Scenarios	Switch	Baseline	Demand shock	$\Delta P_i(Y^j)$
Fiscal	On	28.49	30.34	1.85
	Off	21.91	27.55	5.64
Policy impact (τ^p)			0.67	

Source: author's computation based on ECUAMOD 2022.

B Additional results on fiscals

Table B1: Income shock simulation results on government budget in Ghana

Fiscal index	Status quo	Income shock without status quo benefits	Income shock with discretionary action	Income shock without status quo fiscals
Revenue	**9,219.22**	**9,062.53**	**9,125.52**	**0.00**
Direct taxes	4,824.47	4,792.20	4,792.20	0.00
Indirect taxes	1,872.83	1,874.50	1,937.49	0.00
SSC	2,521.92	2,395.83	2,395.83	0.00
Expenditure	**2,145.40**	**986.21**	**9,479.69**	**0.00**
Child benefits	1,129.94	-	2,531.23	-
Social assist.	29.25	-	3,696.39	-
Pensions	986.21	986.21	3,252.07	-

Note: budgetary considerations are in millions of Ghana cedis.

Source: author's computation based on GHAMOD 2022.

Table B2: Income shock simulation results on government budget in South Africa

Fiscal index	Status quo	Income shock with status quo fiscals	Income shock without status quo benefits
Revenue	**344,398.41**	**322,437.50**	**344,398.41**
Direct taxes	233,573.70	211,901.08	233,573.70
Indirect taxes	101,144.99	101,144.99	101,144.99
SSC	9,679.72	9,391.43	9,679.72
Expenditure	**164,850.28**	**166,136.44**	-
Child benefits	72,581.51	73,384.69	-
Disability assist.	23,313.06	23,385.79	-
Pensions	68,955.71	69,365.97	-

Note: budgetary considerations are in millions of Rands.

Source: author's computation based on SAMOD 2022.

Table B3: Income shock simulation results on government budget in Ecuador

Fiscal index	Status quo	Income shock with status quo fiscals	Income shock without status quo benefits
Revenue	**8,520.57**	**7,896.04**	**7,896.04**
Direct taxes	1,228.25	1,089.91	1,089.91
Indirect taxes	2,132.34	2,060.40	2,060.40
SSC	5,159.98	4,745.72	4,745.72
Expenditure	**2,712.57**	**2,712.57**	**1,801.02**
Social assist.	739.66	739.66	-
Disability assist.	72.85	72.85	-
Orphan/widow ben	79.27	79.27	-
Unemployment ben	11.95	11.95	-
Pensions	1,808.84	1,808.84	1,801.02

Note: budgetary considerations are in millions of US dollars.

Source: author's computation based on ECUAMOD 2022.

Table B4: Consumption-based welfare implications of shock simulation in Ghana

Welfare index	Status quo	Demand shock with status quo fiscals	Demand shock without status quo fiscal	Demand shock with discretionary action
HH poverty	**23.59**	**25.57**	**25.93**	**21.88**
Male headed	25.79	28.03	28.09	24.71
Female headed	18.12	19.46	20.55	14.87
Children	26.39	38.60	29.08	24.71
Old persons	34.42	36.57	36.40	21.90
Gap	8.56	9.35	9.88	7.61
Gini	**0.4131**	**0.4127**	**0.4225**	**0.3980**
P80/P20	3.35	3.58	3.75	3.38
PF poverty line	1,719	1,719	1,719	1,719

Source: author's computation based on GHAMOD 2022.

Table B5: Income-based welfare implications of shock simulation in Ghana

Welfare index	Status quo	Income shock with status quo fiscals	Income shock without status quo fiscals	Income shock with discretionary action
HH poverty	**55.86**	**57.03**	**56.52**	**53.34**
Male headed	53.97	55.18	54.66	52.03
Female headed	60.58	61.65	61.15	56.61
Children	58.25	59.48	58.88	56.36
Old persons	66.04	67.30	68.94	53.22
Gap	39.31	40.15	40.69	34.98
Gini	**0.8005**	**0.8006**	**0.8030**	**0.7786**
P80/P20	35.50	34.88	58.87	19.14
PF poverty line	1,719	1,719	1,719	1,719

Source: author's computation based on GHAMOD 2022.

Table B6: Income-based welfare implications of shock simulation in South Africa

Welfare index	Status quo	Income shock with status quo benefits	Income shock without status quo benefits
HH poverty	**33.67**	**34.25**	**46.55**
Male headed	24.35	24.83	35.07
Female headed	46.46	47.16	62.30
Children	38.33	38.95	51.73
Old persons	35.51	35.90	62.71
Gap	14.61	14.90	35.02
Gini	**0.6396**	**0.6370**	**0.7202**
P80/P20	8.57	8.29	414.01
PF poverty line	7,843	7,843	7,843

Source: author's computation based on SAMOD 2022.

Table B7: Income-based welfare implications of shock simulation in Ecuador

Welfare index	Status quo	Income shock with status quo benefits	Income shock without status quo benefits
HH poverty	**14.26**	**15.38**	**18.52**
Male headed	13.90	15.10	18.04
Female headed	15.72	16.52	20.46
Children	15.27	16.59	19.92
Old persons	17.55	18.42	24.05
Gap	4.37	4.71	6.73
Gini	**0.4638**	**0.4641**	**0.4777**
P80/P20	3.57	3.58	3.82
PF poverty line	971	971	971

Source: author's computation based on ECUAMOD 2022.

C Discretionary action policy extensions

The expansion of pension policy is modelled such that the existing LEAP transfer system is extended and made more generous as follows:

- The benefit amounts are raised compared to the levels they were in the status quo. This implies that the previous benefit levels that range from GHS64 to GHS106 due to this expansion now range between GHS150 to GHS500 per month per household. Benefit amounts depend on the number of household members
- Eligibility is based on the idea that the household member is older than 65 years and is currently not receiving any pension benefits.

The Care Dependency Grant policy swap is modelled to cover caregivers/parents and children (orphaned or not). This follows directly the rules in South Africa by ensuring a benefit monthly amount of GHS500 per household depending on the following rules:

- Married or single individuals older than 16 years with dependants having gross incomes below the normal poverty line.
- A child is eligible up to the end of the year in which they turn 18. Additional conditions are that such persons should be younger than 18 years and not in foster care but physically challenged.
- Foster children are eligible if they are disabled and need full-time care. There is no income test for the foster parents of a care-dependent foster child. A child is eligible up to the end of the year in which they turn 18.