Fiscal Policy and Labor Markets in Low Income Economies*

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Abstract

We propose a general equilibrium framework with search frictions with (1) endogenous labor force participation decisions; (2) a distinction between agricultural and non-agricultural self-employment; and (3) a feedback effect from public capital to private-sector productivity to study the implications of changes in distortionary fiscal policy on sectoral employment, unemployment, participation, and aggregate outcomes in low income economies. Increasing taxes on salaried-firm profits and capital gains raises salaried employment, output, consumption, and unemployment, and reduces self-employment in non-trivial ways. Conversely, increasing consumption taxes raises self-employment and reduces salaried employment, output, and consumption. Abstracting from the presence of non-agricultural self-employment and endogenous participation decisions—two margins of central importance low-income economies—imply minuscule employment and aggregate responses to plausible changes in fiscal policy. The prevalence of self-employment—a reflection of the level of development—plays an important role for the quantitative consequences of policy.

JEL Classifications: J40, O10, E6, H2
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1 Introduction

Low-income economies are well known to have higher rates of labor force participation, agricultural and non-agricultural self-employment, and informal employment relative to other income groups (see Section 2; De Vreyer and Roubaud, 2013; Gutman, Sy, and Chattopadhyay, 2015; Golub and Hayat, 2015).[1] These features are particularly prevalent in Sub-Saharan African (SSA) economies. Indeed, informal employment in this region represents, on average, more than 80 percent of total employment, with self-employment accounting for the bulk of both informality and total employment (OECD, 2009). At the same time, SSA economies face substantial public infrastructure needs and, tied to the high rates of informality and self-employment, severe challenges in raising domestic revenue to finance public investment without relying on natural-resource revenue and foreign grants (see Tables 1 and 2 in Section 2; IMF, 2014, 2015a, 2015b). Creating the necessary domestic fiscal space is all the more pressing since this much-needed public investment can have non-negligible positive effects on private-sector productivity. However, little is known about the labor market and aggregate consequences of moving towards a more dependable domestic fiscal structure in economies where self-employment, informality, and agricultural employment is highly prevalent. More broadly, understanding the channels through which fiscal policy changes influence sectoral and aggregate employment is critical to enact effective policies, especially in economies where labor is the main source of income for the majority of households.

In this paper, we present a general equilibrium model with frictional unemployment and productive public investment that embodies key features of the employment and tax structure in low-income economies, with a focus on SSA economies. Calibrating the model to Tanzania, we explore the impact of changes in domestic distortionary taxation on: (1) the allocation of sectoral employment across key categories in SSA; (2) unemployment and

[1] In the rest of the paper, we use the terminology low-income economies to refer to the group of countries comprised of low- and lower-middle-income economies. Low-income economies, as defined by the World Bank, are countries with a per capita gross national income below USD$1,050 as of 2014. Lower middle-income economies are countries with a per capita gross national income between USD$1,050 and below USD$4,130 (data.worldbank.org/news/new-country-classifications-2015). Most low-income and lower-middle-income economies have the highest rates of informal employment out of all income groups, and this holds regardless of how informality is defined (lack of access to pension benefits, health benefits, labor protections, etc...).

labor force participation; and (3) key macroeconomic aggregates. The model allows us to shed light on the mechanisms through which changes in exogenous fiscal policy affect labor market and aggregate outcomes in a low-income-economy context.[2]

Our framework is comprised of two sectors—agriculture and non-agriculture—and four employment categories—agricultural and non-agricultural self-employment, and non-agricultural formal and informal salaried employment. The non-agricultural sector is comprised of salaried and self-employed firms. We assume that only salaried firms—firms that account for a very small share of employment but, in relative terms, contribute substantially more to output—are subject to capital gains and profit taxation. In addition, non-agricultural consumption is subject to consumption taxes. These distortionary sources of revenue account for the bulk of government revenue in several low– and lower-middle-income economies in SSA (see Section 2). Following related literature and given the importance of public investment in SSA economies, there is a positive feedback effect from tax collection to public investment and private-sector productivity.[3] Finally, in contrast to most developing-country labor search models, we introduce endogenous sectoral labor force participation. Allowing households to reallocate their members across the different employment categories prevalent in low-income economies provides a key margin of flexibility that generates non-trivial employment and aggregate effects in the presence of productivity-enhancing public investment (this margin is critical for characterizing the impact of exogenous policy changes).

Our policy experiments consist of increasing taxes on salaried capital gains and profits *or* taxes on non-agricultural consumption (the increase in either tax tax is the same in percentage-point terms). Our main findings are as follows. In the presence of productivity-enhancing public investment and high non-agricultural self-employment shares—a well-known feature of low-income economies—an exogenous increase in the tax rate on salaried profits and capital gains *increases* salaried employment, total output and consumption; it reduces non-agricultural self-employment in a non-negligible while leaving agricultural self-employment virtually unchanged; and it generates a modest increase in unemployment.

[2]A natural second step would be to consider optimal (Ramsey) fiscal policy in such a context. However, understanding the basic mechanisms through which policy operates—regardless of whether these policies are optimal or not—is a necessary first step before undertaking a formal analysis of optimal policy, which we leave for future work.

[3]See IMF (2015b) for more on the link between public investment and productivity.

Intuitively, the increase in tax revenue is channeled to productive public investment, which boosts salaried labor productivity. The rise in the latter increases salaried labor demand, which pushes households to reallocate their search efforts away from non-agricultural self-employment and into (non-agricultural) salaried employment. Of note, the positive reallocation effects towards salaried employment take place if (1) households can explicitly reallocate individuals searching for non-agricultural self-employment towards searching for salaried employment (that is, if there is an endogenous participation margin for all employment categories), and (2) there is initially a large share of individuals in *non-agricultural* self-employment, which represent a readily-available pool of potential labor that salaried firms can tap into. As such, differentiating between agricultural from non-agricultural self-employment is crucial as agricultural self-employment responds only marginally to policy (changes in relative output prices are quantitatively minimal given plausible fiscal policy changes).

Conversely, a commensurate increase in the tax rate on non-agricultural consumption affects households' decisions between agricultural and non-agricultural consumption, but also the costs of labor force participation across all employment categories. As a result, and consistent with standard Walrasian models, an increase in consumption taxes increases the marginal cost of labor force participation and directly affects labor supply (or participation) decisions. In particular, all else equal, the rise in the cost of participation exerts upward pressure on labor costs and reduces salaried labor demand, which pushes households to reallocate their members towards self-employment to counteract the fall in salaried employment demand. This occurs *despite the rise in participation costs across the board* (that is, households are more inclined to move their members to employment states that become more accessible and less costly *in relative terms*). In equilibrium, higher consumption taxes result in lower salaried employment and output, and therefore in lower tax revenue from salaried firm profits and capital; lower unemployment, consumption, and output; and in higher self-employment and aggregate participation. Changes in public (productivity-enhancing) capital are minimal despite the increase in consumption taxes since, quantitatively, the increase in consumption-tax revenue is fully offset by lower capital-tax revenue due to lower salaried capital gains and profits as a result of the reallocation of individuals into self-employment.

Importantly, while the changes in aggregate labor force participation and unemployment in response to either policy are small, the *sectoral* compositional changes in participation and employment are non-negligible. Thus, our analysis suggests that focusing on aggregate labor market measures alone may yield an incomplete picture regarding the employment effects of fiscal reform.

To further stress the relevance of our framework and results for low-income economies, we present two additional findings. First, we show that from a quantitative perspective, the positive effects from capital taxes are decreasing in the economy's level of development (as reflected in the prevalence of self-employment in the economy). Put differently, conditional on having tax-funded productive public investment, the gains from raising revenue via distortionary capital taxation are increasingly limited as low-income economies become more developed. Second, a comparison of our baseline model to simpler alternatives illustrates how the key ingredients of our framework—specifically, (1) the distinction between agricultural and non-agricultural self-employment and (2) the inclusion of endogenous labor force participation for all employment categories, both of which are generally absent in existing models—play an important role for the impact of fiscal policy changes. Specifically, the response of sectoral employment, unemployment, consumption, and output to higher distortionary taxes are (1) either minuscule when we abstract from endogenous participation, or (2) considerably negative when we abstract from having non-agricultural self-employment in the economy.

Our findings point to two important implications for the analysis of policy in low-income economies. First, despite accounting for a large share of total employment, *agricultural* self-employment appears to play a limited role as a relevant adjustment margin to plausible changes in fiscal policy. This stands in contrast with non-agricultural self-employment, which plays a central role. Second, while total unemployment and aggregate participation seem to be relatively unresponsive to policy, there are non-negligible sectoral employment reallocation effects. Of note, the fact that labor supply decisions appear to be relatively more influential than labor demand in a low-income-economy context is consistent with self-employment—which is driven by households' labor supply decisions—being by far the most prevalent source of employment in these economies. Despite this fact, most of the theoretical

literature on frictional labor markets in low-income economies has generally abstracted from endogenous labor force participation and an explicit distinction between agricultural and non-agricultural self-employment. As such, our results stress the relevance of explicitly taking into account households' endogenous sectoral labor supply decisions jointly with the full set of available employment options that households have access to in the quantitative analysis of fiscal policy in low-income economies. Relative to existing literature, which we discuss in more detail further below, our work is the first to characterize the effects of changes in exogenous fiscal policy on sectoral employment and aggregate outcomes in a low-income-economy context with equilibrium unemployment *and* labor force participation. Our model introduces a distinction between informal employment (reflected in self-employment and informal salaried employment) and unemployment; it explicitly incorporates endogenous participation for all employment categories, which proves to be critical for generating non-negligible employment responses to plausible policy changes; and it introduces productivity-enhancing public investment to analyze the effects of fiscal policy on sectoral employment, unemployment, and macro outcomes in economies. More broadly, the distinction between self-employment and unemployment is important for economies where self-employment rates are on average more than 70 percent of total employment, as is the case in SSA, and also in determining the potential differential effects of fiscal policy on unemployment vis-à-vis informal (self-)employment.[4]

The rest of the paper is structured as follows. Section 2 presents a series of stylized facts on the labor market and fiscal structure of low-income-economies in SSA that motivate our theoretical framework. Section 3 presents the model. Section 4 outlines the baseline calibration of the model. Section 5 presents the main quantitative results. Section 6 concludes.

[4]While self-employment rates tend to be high in middle-income developing countries as well, these rates are much lower relative to both SSA and other low-income economies (OECD, 2009).

2 Related Literature and Stylized Facts

2.1 Related Literature

Our work is related to the search and matching literature on informality in developing economies (Ulyssea, 2010; Kerr, 2012; Charlot, Malherbet, and Terra, 2015), the literature that incorporates self-employment in general equilibrium Walrasian and search models (Gollin, 2008; Finkelstein Shapiro, 2014; Epstein and Finkelstein Shapiro, 2016), studies that consider self-employment and labor force participation in a context with equilibrium unemployment (Finkelstein Shapiro and Mandelman, 2016), and to the strand of work that incorporates rural or agricultural production and rural-urban flows (Harris and Todaro, 1970; Fields, 1975; Cook and Nosaka, 2005; Satchi and Temple, 2008, Zenou, 2011; Adam, Bevan, and Gollin, 2013; Gollin, Parente, and Rogerson, 2004; Restuccia, Tao Yang, and Zhu, 2008; Gollin and Rogerson, 2013).[5]

Using a search model with formal and informal salaried employment, Charlot, Malherbet, and Terra (2015) study deregulation in the goods market and changes in labor taxes in the context of Brazil. While they abstract from self-employment, they extend their baseline environment to allow for directed search. The latter adds a margin of flexibility that is related to the inclusion of endogenous participation in our framework. Our results suggest that the combination of endogenous participation and self-employment—and not endogenous participation alone—is important to characterize the quantitative effects of changes in fiscal policy in economies where self-employment is the prevalent source of employment.

Closest to our economic environment are Cook and Nosaka (2005), Satchi and Tem-

[5]Finkelstein Shapiro and Mandelman (2016) study the interaction of frictional self-employment and labor force participation and its impact on cyclical unemployment dynamics in an emerging-economy context with remittance fluctuations. Rud and Trapeznikova (2016) focus on wage dispersion and salaried employment in Sub-Saharan Africa in partial equilibrium search environment and argue that movements between salaried work and self-employment—modeled as home production—play an important role. Given the magnitude of self-employment and the high rates of participation in SSA, our preferred approach is to separate home production (effectively, captured by the population outside the labor force in our model) from self-employment. Gollin (2008) does not incorporate search and matching frictions, but his work highlights the importance and relevance of self-employment in low- and middle-income economies. Also, Kumar and Schuetze (2007) incorporate self-employment and employers in a partial equilibrium search model, but their application is not to developing countries. Finally, see Agénor and Aizenman (1999) for earlier work on informality and fiscal policy in a Walrasian developing country context, and Melina, Yang, and Zanna (2015) for a policy application of general equilibrium models in a low-income-economy context.

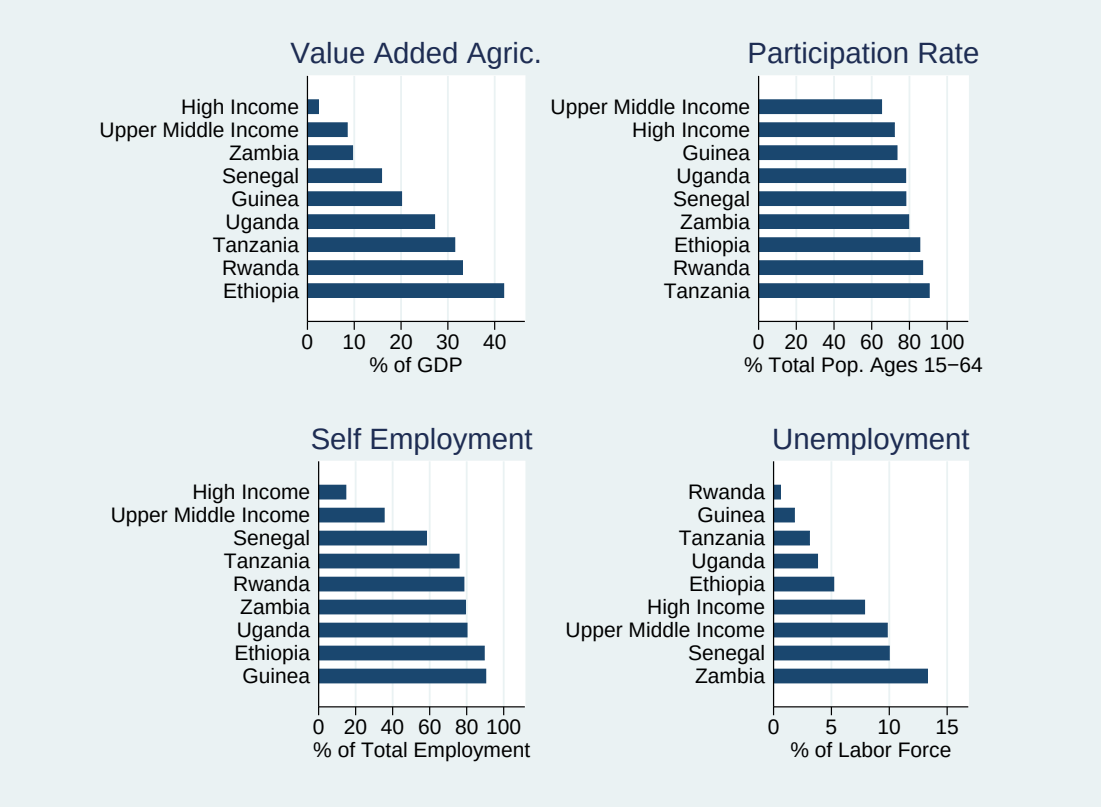
ple (2008), Kerr (2012), and Adam, Bevan, and Gollin (2013), where the first three use search-based frameworks. Cook and Nosaka (2005) present a three-sector model with search frictions in the (formal) tradable sector, and frictionless agricultural and nontradable (informal) sectors.There is no distinction between unemployment and informal employment and labor force participation is exogenous. Satchi and Temple (2005) focus on a middle-income developing economy and allow for rural-urban migration, where the rural sector is Walrasian and informality is reflected in self-employment. They allow self-employed individuals to actively search for formal employment; their framework also implies no distinction between unemployment and self-employment. While the presence of endogenous search by the self-employed introduces a margin of adjustment similar to endogenous labor force participation in our environment, their model differs fundamentally from ours since endogenous *sectoral* participation in our framework establishes an important linkage *across all employment categories* (and therefore sectors); that is, allowing for endogenous search by the self-employed without also allowing for endogenous salaried search can yield dramatically different results, as we show in our work. Moreover, their analysis and implications from corporate tax changes is different from ours since we explicitly assume that tax revenue affects (productive) public investment. This component is absent in both Cook and Nosaka (2005) and in Stachi and Temple (2008), and is relevant to include in economies with large public infrastructure needs.

Kerr (2012) proposes a model of Tanzanian urban labor markets to explore the link between wage work and self-employment and earnings variations across the two employment categories, but abstracts from considering non-urban employment, public investment, or fiscal policy. Finally, Adam, Bevan, and Gollin (2013) use a Walrasian general equilibrium environment with public investment and rural-urban transitions to explore the role of different policies, including taxes, on poverty in the context of Tanzania. Our work complements theirs by, among other things, introducing endogenous participation decisions and focusing on fiscal policy changes, public investment, sectoral employment reallocation, and unemployment and labor force participation in an environment with equilibrium unemployment.

2.2 Stylized Facts

This subsection presents evidence on the structure of labor markets, the state of public infrastructure, and the structure of government revenue in low income economies in SSA.

Figure 1: Labor Market Characteristics in SSA LICs vs. Country Groups



Source: World Bank World Development Indicators. Note: Latest observation for each country. We included the countries that have information for all the indicators.

Labor Markets Figure 1 shows that, relative to middle- and high-income economies, the contribution of agriculture to GDP, the contribution of self-employment to total employment, and the labor force participation rate are all considerably higher in low- and lower-middle-income economies in SSA. Also, despite the absence of safety nets, unemployment rates are non-negligible for several countries in the region.[6] Importantly, while self-employment accounts for a very large share of employment in these economies, self-employment outside of

[6]For evidence on job creation and destruction in Sub-Saharan Africa, see Shiferaw and Bedi (2009).

agriculture accounts for close to 50 percent of non-agricultural employment. In contrast, non-agricultural self-employment represents around 12 and 30 percent, respectively, in developed and other developing countries.

Infrastructure Deficits and Revenue Shortfalls The contribution of public infrastructure to growth and productivity has been recently highlighted by Calderón and Servén (2014), among others. As illustrated in Table 1, compared to other low-income economies outside of Africa, low-income economies in SSA face severe public infrastructure challenges. In turn, Figure 2 shows that, despite having relatively high public investment-GDP ratios, SSA low-income economies rely more heavily on grants, have lower tax revenue from corporations, and have lower revenue and expenditures shares relative to both emerging economies and advanced economies.[7] Projections for 2021 suggests that the gap in tax revenue and expenditures between SSA and emerging and advanced economies will remain substantial despite efforts to boost revenue and efficiency, with a reduction in the share of revenue from grants.

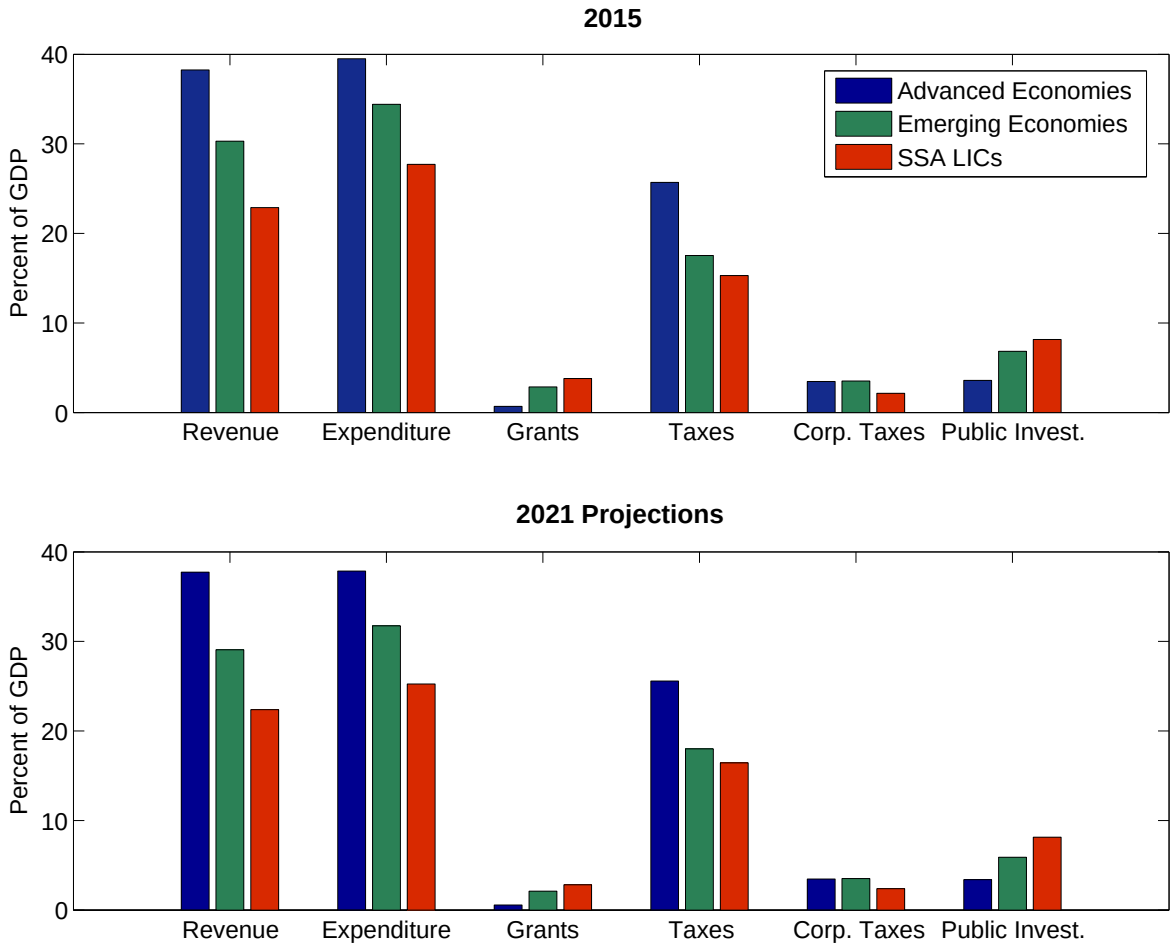
Table 1—Infrastructure Challenges in Sub-Saharan Africa

Infrastructure Category	SSA LICs	Other LICs
Paved-Road Density (kms/100 squared kms of arable land)	31	134
Total Road Density (kms/100 squared kms of arable land)	137	211
Main-Line Telephone Density (per thousand pop.)	10	78
Mobile Phone Density (per thousand pop.)	55	76
Electricity Generation Capacity (MW per million pop.)	37	326
Electricity Coverage (% of pop. with access)	16	41

Source: Reproduced from Gutman, Sy, and Chattopadhyay (2015) (original source: Table 2.2 in Yepes, Pierce, and Foster, 2009). Notes: LIC refers to low-income countries. The category "Other LICs" includes other low-income countries outside of Sub-Saharan Africa as categorized by the World Bank. The countries included in the Sub-Saharan Africa LIC category are: Burkina Faso, Burundi, Côte D'Ivoire, Liberia, Mali, Mozambique, Sierra Leone, Tanzania, Kenya, Malawi, and Uganda.

[7]Note that a relatively high public investment share may simply reflect the relatively low levels of public infrastructure in these economies relative to other income groups.

Figure 2: Revenue, Expenditure, and Taxes Across Income Groups: 2015 and 2021 Projections



Source: IMF World Economic Outlook (WEO) April 2016. Notes: LICs refers to low-income countries. The countries included in the Sub-Saharan Africa LIC category are: Burkina Faso, Burundi, Côte D'Ivoire, Liberia, Mali, Mozambique, Sierra Leone, Tanzania, Kenya, Malawi, and Uganda.

Fiscal Structure and Tax Potential in Low-Income Sub-Saharan African Economies

Taxes on goods and services, taxes on income, profits, and capital gains, and grants account for a substantial share of total revenue (see Table 2). Taxes on international trade and

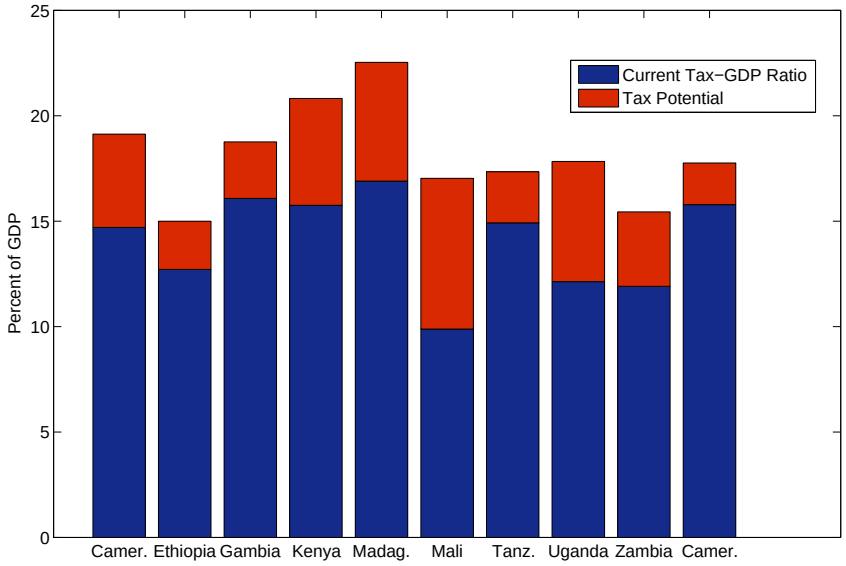
transactions are also relevant, but their importance varies considerably across countries. Importantly, several low-income and lower-middle-income economies in SSA face non-negligible gaps between their potential tax-to-GDP ratio and their current levels (Figure 3). This suggests that (1) there is further need to improve countries' domestic fiscal structure, and (2) there is room to strengthen the domestic fiscal structure via fiscal reform in these economies.

Table 2—Fiscal Structure in Low-Income SSA Economies

Source of Revenue	Percent of GDP	Percent of Total Revenue
Taxes on Goods, Services	6.252	28.81
Taxes on Income, Profits, and Capital Gains	5.974	27.44
Grants	4.280	18.47
Taxes on International Trade and Transactions	3.325	15.05
Other Revenue	1.639	7.401
Other Taxes	0.481	2.056
Payroll Taxes	0.111	0.442
Property Taxes	0.049	0.205
Social Contributions	0.004	0.126

Source: IMF Government Finance Statistics (GFS) 2013. Notes: Other revenue includes property income, sales on goods and services, fines, penalties, forfeits, voluntary transfers other than grants, and unidentified revenue. The countries included are: Burkina Faso, Burundi, Côte D'Ivoire, Liberia, Mali, Mozambique, Sierra Leone, Tanzania, Kenya, Malawi, and Uganda.

Figure 3: Current Tax-to-GDP Ratios and Tax Potential in Low and Lower-Middle-Income Sub-Saharan African Economies (2014)



Source: Reproduced from Figure 1.20, IMF (2015a) (IMF Regional Economic Outlook, Sub-Saharan Africa, October 2015). Notes: Kenya, Ghana, Cameroon, and Zambia are categorized as lower-middle-income countries, with the remaining countries being low-income economies.

Modeling Implications All told, the above facts suggest that: (1) agricultural and non-agricultural economic activity are both important in low income economies; (2) self-employment accounts for a substantial share of agricultural, non-agricultural, and total employment; and (3) taxes on goods and services, capital gains, and profits, and grants represent the bulk of government revenue from distortionary sources.[8] At the same time, most self-employment activities are effectively excluded from direct taxation given their small scale. Our model incorporates these features in an environment where we can study the effects of fiscal policy on sectoral employment, unemployment, labor force participation, and

[8]We abstract from taxes on international trade since this would imply having a richer model of a small-open-economy that exports and imports goods. Furthermore, tackling revenue from international transactions in Sub-Saharan Africa in a relevant and consistent way would also require taking into account the prevalence of informal cross-border trade in the region (see, for example, Golub, 2015). Given our focus on employment and not international trade per se, we leave these relevant issues for future work.

aggregate outcomes.

3 The Model

The economy is comprised of three agents—households, owners of salaried firms, and a government—and two production sectors—agricultural and non-agricultural. In turn, there are two categories of firms within the non-agricultural production sector—salaried firms (ultimately owned by salaried-firm owners) and self-employed firms (owned by households). Total non-agricultural output is given by the sum of output from salaried firms and output from non-agricultural self-employed firms. The agricultural sector is owned by households and comprised solely of self-employed firms. The government collects non-agricultural consumption taxes and salaried-capital-gains and profit taxes to finance (productive) public capital accumulation and lump-sum transfers to households.

Salaried-firm owners consume non-agricultural goods and accumulate capital for salaried firms. These firms are the only ones subject to profit and capital-gains taxes, and they use capital rented from salaried firm owners and formal and informal salaried labor supplied by households to produce. We make two additional assumptions. First, formal salaried labor is more productive than informal salaried labor.[9] Second, public capital, which is taken as given by salaried firms, improves salaried-firm productivity.[10] Hiring salaried labor is subject to standard search and matching frictions between households and firms, which gives rise to equilibrium unemployment. The non-agricultural self-employment sector is comprised of one-person firms created and owned by households. The creation and operation of these firms is time-consuming and entails a utility cost for households. Each firm uses a single unit of labor (that is, these are owner-only or one-person firms). Self-employed firms in the agricultural sector are similarly created and use an identical production technology to their

[9]For our purposes and given the tax revenue structure in the model, our definition of informal salaried employment and informality more generally is innocuous. We discuss this in more detail in another footnote below. Alternative definitions based on the inclusion of payroll and labor income taxes, where the latter are minuscule as a share of government revenue in SSA, do not change our results.

[10]In this sense, our setup is related to Agénor and Aizenman (1999), where salaried firms produce goods using skilled (formal) and unskilled (informal) labor. We explore the consequences of assuming that public capital improves productivity for all firms (both salaried and non-salaried) as part of our robustness checks (see Table A5 in the Appendix for more details).

non-agricultural counterparts.[11]

Following the search literature, a representative household has a large number of members who enjoy perfect consumption insurance within the household. The household consumes both agricultural and non-agricultural consumption goods and makes explicit sectoral labor force participation (labor supply) decisions for their members. Employed household members can be in one of four employment categories—formal or informal salaried employment, and agricultural or non-agricultural self-employment. If not employed, they can be searching in a given employment category. Searchers are categorized as unemployed. Members who are neither employed nor searching are categorized as outside of the labor force. The total household population is normalized to 1.

We abstract from modeling an explicit rural-urban margin as this would introduce additional complexity without necessarily providing additional insights.[12] While the majority of agricultural employment is often located in rural areas, not all rural employment is in agriculture (see, for example, Henderson, Roberts, and Storeygard, 2013). Since our focus is on sectoral employment at the economy-wide level, we consider the rural-urban distinction to be less relevant, even though there may be non-negligible internal migration costs. However, the inclusion of these costs are unlikely to affect our main conclusions since households' labor force participation decisions in our environment entail (utility) costs. The latter can partially embody the costs of migration to search for employment.[13]

3.1 Salaried Matching Processes

Let $v_{f,t}$ and $v_{i,t}$ be the (non-agricultural) formal and informal vacancy postings, respectively, chosen by salaried firms. Let $s_{f,t}$ and $s_{i,t}$ be the measures of (non-agricultural) formal and informal salaried searchers, respectively, within the household. Sectoral labor market tightness for formal and informal salaried employment is given by $\theta_{f,t} \equiv v_{f,t}/s_{f,t}$ and $\theta_{i,t} \equiv v_{i,t}/s_{i,t}$. New salaried employment is created via a matching process between vacan-

[11] Assuming that the self-employment sector (in either agriculture or outside of agriculture) uses internally-accumulated capital to produce does not change our results.

[12] For seminal work on rural-urban migration, see Harris and Todaro (1970). For recent search models that explicitly consider rural-urban migration, see Satchi and Temple (2008).

[13] We discuss the implications of abstracting from a rural-urban distinction as part of our caveats at the end of the paper.

cies and salaried searchers. Following the search literature, the matching functions $m_{f,t} = m_f(v_{f,},s_{f,t})$ and $m_{i,t} = m_i(v_{i,t}, s_{i,t})$ are constant-returns-to-scale, increasing and concave in each of their arguments. The job-finding probabilities for formal and informal salaried employment, respectively, are given by $p(\theta_{f,t}) = m_{f,t}/s_{f,t}$, $p(\theta_{i,t}) = m_{i,t}/s_{i,t}$. Analogously, the job-filling probabilities are given by $q(\theta_{f,t}) = m_{f,t}/v_{f,t}$, and $q(\theta_{i,t}) = m_{i,t}/v_{i,t}$. It follows that all job-finding probabilities are increasing in their respective market tightness.

3.2 Households, Agricultural Production, and Non-Agricultural Self-Employment

There is a representative household comprised of a large number of members who enjoy perfect consumption insurance within the household. Household members can be in four different employment states: employed in formal salaried employment $n_{f,t}$, employed in informal salaried employment $n_{i,t}$, self-employed in the non-agricultural sector $n_{e,t}$, and self-employed in the agricultural sector $n_{a,t}$. They can also be in four search (or unemployment) states: searching for formal or informal salaried employment, $s_{f,t}$ and $s_{i,t}$, respectively, or searching for non-agricultural or agricultural self-employment, $s_{e,t}$ and $s_{a,t}$, respectively. The economy-wide unemployment *level* is then given by: $\mathbf{s}_t = s_{f,t} + s_{i,t} + s_{e,t} + s_{a,t}$. In turn, total labor force participation is given by $lfp_t = s_{f,t} + s_{i,t} + s_{e,t} + s_{a,t} + n_{f,t} + n_{i,t} + n_{e,t} + n_{a,t} = \sum_j (s_j + n_j)$ where $j \in \{f, i, e, a\}$. As such, the total unemployment *rate* is $\mathbf{u}_t = \mathbf{s}_t/lfp_t$.

The household's problem is to choose consumption of agricultural and non-agricultural goods $c_{a,t}$ and $c_{n,t}$, the desired measure of household members employed in the (self-employed) agricultural sector $n_{a,t+1}$, the desired measures of individuals working in salaried employment, $n_{f,t+1}$ and $n_{i,t+1}$, and the desired measure of non-agricultural self-employment, $n_{e,t+1}$. In addition, they choose the measures of sectoral searchers $s_{a,t}, s_{f,t}, s_{i,t}, s_{e,t}$ to maximize

$$\sum_{t=0}^{\infty} \beta^t \left[u(c_{a,t}, c_{n,t}) - h\left(\sum_j (s_j + n_j) \right) \right],$$

for $j \in \{f, i, e, a\}$, subject to the budget constraint

$$\begin{aligned}(1+\tau^c)c_{n,t} + p_{a,t}c_{a,t} &= w_{f,t}n_{f,t} + w_{i,t}n_{i,t} + p_{a,t}z_{a,t}n_{a,t} \\ &\quad + z_{e,t}n_{e,t} + T_t,\end{aligned}$$

and the perceived evolution of, respectively, formal salaried employment, informal salaried employment, non-agricultural self-employment, and agricultural self-employment

$$n_{f,t+1} = (1-\rho^f)\left[n_{f,t} + s_{f,t}p(\theta_{f,t})\right], \tag{1}$$

$$n_{i,t+1} = (1-\rho^i)\left[n_{i,t} + s_{i,t}p(\theta_{i,t})\right], \tag{2}$$

$$n_{e,t+1} = (1-\rho^e)\left[n_{e,t} + \phi_e s_{e,t}\right], \tag{3}$$

$$n_{a,t+1} = (1-\rho^e)\left[n_{a,t} + \phi_a s_{a,t}\right], \tag{4}$$

where the function u satisfies $u' > 0, u'' < 0$ for each of its arguments. The function h captures the disutility from total labor market participation and satisfies $h' > 0, h'' > 0$ (Arseneau and Chugh, 2012). The left-hand-side of the household's budget constraint is comprised of non-agricultural and agricultural consumption, where τ^c is the (time-invariant) proportional tax rate on non-agricultural consumption goods.[14] The right-hand-side includes income from having household members in formal and informal salaried employment, $w_{f,t}n_{f,t}$ and $w_{i,t}n_{i,t}$, respectively, where $w_{f,t}$ and $w_{i,t}$ are the real formal and informal wages. Households also receive income $p_{a,t}z_{a,t}n_{a,t}$ from agricultural self-employment production, where $p_{a,t}$ is the price of agricultural output relative to the price of non-agricultural output (normalized to 1), and $z_{a,t}$ is exogenous agricultural productivity. In addition, households receive income $y_{e,t} = z_{e,t}n_{e,t}$ from total non-agricultural self-employment production, where $z_{e,t}$ is exogenous non-agricultural self-employment productivity. Finally, T_t denotes lump-sum transfers from the government. Turning to the evolution of salaried employment, ρ^j and $p(\theta_{j,t})$ denote the exogenous separation probability and the endogenous household-side matching probability associated with working in salaried employment $j = f, i$. In turn, ρ^e is the exoge-

[14] Given our focus on different steady-state equilibria, we abstract from introducing time-varying taxes for simplicity.

nous separation probability for self-employed individuals. Transitions from unemployment to self-employment are affected by the search efficiency of agricultural and non-agricultural self-employment searchers, which we assume to be fixed and given by $0 < \phi_a$ and $0 < \phi_e$, respectively.

The household's first-order conditions yield an optimal choice over agricultural and non-agricultural consumption goods:

$$\frac{p_{a,t}}{(1+\tau^c)} = \frac{u_{c_a}(c_{a,t}, c_{n,t})}{u_{c_n}(c_{a,t}, c_{n,t})}, \tag{5}$$

and four conditions that characterize the sectoral participation decisions in the non-agricultural and agricultural sectors:

$$\frac{\frac{h'_t(1+\tau^c)}{u_{c_n,t}}}{p(\theta_{j,t})} = (1-\rho^j)\Xi^h_{t+1|t}\left\{ w_{j,t+1} - \frac{h'_{t+1}(1+\tau^c)}{u_{c_n,t+1}} + \frac{\frac{h'_{t+1}(1+\tau^c)}{u_{c_n,t+1}}}{p(\theta_{j,t+1})} \right\}, \tag{6}$$

$$\frac{\frac{h'_t(1+\tau^c)}{u_{c_n,t}}}{\phi_e} = (1-\rho^e)\Xi^h_{t+1|t}\left\{ z_{e,t+1} - \frac{h'_{t+1}(1+\tau^c)}{u_{c_n,t+1}} + \frac{\frac{h'_{t+1}(1+\tau^c)}{u_{c_n,t+1}}}{\phi_e} \right\}, \tag{7}$$

$$\frac{\frac{h'_t(1+\tau^c)}{u_{c_n,t}}}{\phi_a} = (1-\rho^e)\Xi^h_{t+1|t}\left\{ p_{a,t+1}z_{a,t+1} - \frac{h'_{t+1}(1+\tau^c)}{u_{c_n,t+1}} + \frac{\frac{h'_{t+1}(1+\tau^c)}{u_{c_n,t+1}}}{\phi_a} \right\}, \tag{8}$$

for $j = f, i$, where $\Xi^h_{t+1|t} \equiv \beta\left[u_{c_n,t+1}/u_{c_n,t}\right]$. Intuitively, households equate the expected marginal cost of searching for employment (given by the marginal disutility of participating in the labor market, given by the left-hand-side of each of the four conditions) to the expected marginal benefit of searching. In the case of salaried employment, the marginal benefit is given by the Nash wage net of the disutility from working, plus the continuation value of the salaried employment relationship. Similarly, the marginal benefit of entering (agricultural or non-agricultural) self-employment is given by the marginal product of having an additional household member in self-employment net of the disutility cost from working, plus the continuation value of keeping a household member in self-employment next period. Importantly, these conditions imply that households can reallocate searchers across different employment categories in response to changes in fiscal policy. In particular, all else equal,

changes in consumption taxes have a direct impact on the incentive to search for employment in any given employment category. Also, note that in contrast to self-employment participation decisions and as is standard in search models, salaried labor force participation decisions are also affected by firms' labor demand decisions via wages and market tightness.

3.3 Salaried Firm Owners

Salaried firm owners own and rent capital to salaried firms. For simplicity, we assume that salaried firm owners only consume non-agricultural goods. They choose consumption $c_{k,t}$ and capital accumulation $k_{s,t+1}$ to maximize $\sum_{t=0}^{\infty} \beta^t u(c_{k,t})$ subject to

$$(1+\tau^c)c_{k,t} + i_{s,t} = (1-\tau^k)\left[\Pi_{s,t} + r_{s,t}k_{s,t}\right], \tag{9}$$

and the evolution of salaried capital

$$k_{s,t+1} = (1-\delta)k_{s,t} + i_{s,t}, \tag{10}$$

where τ^k is the (time-invariant) tax rate on capital gains and profits—henceforth referred to simply as the capital tax rate—$i_{s,t}$ is private investment, $r_{s,t}$ is the rental rate on capital, and δ is the exogenous capital depreciation rate.[15] $\Pi_{s,t}$ are salaried-firm profits and are taken as given by salaried-firm owners. The salaried firm owners' first-order conditions yield a standard capital Euler equation augmented to include capital income taxation:

$$1 = \Xi^k_{t+1|t}\left[(1-\tau^k)r_{s,t+1} + (1-\delta)\right], \tag{11}$$

where we define $\Xi^k_{t+1|t} = \beta\left[u_{c_k,t+1}/u_{c_k,t}\right]$ as the salaried firm owners' stochastic discount factor.

[15] We could assume a small open economy by allowing salaried firm owners to hold foreign debt. *In the absence of public capital*, an increase in capital or investment taxes would push salaried firm owners to reduce private capital accumulation (with adverse consequences for salaried labor demand and output) and to hold more foreign debt.

3.4 Salaried Production

Salaried firms operate in the non-agricultural sector. They choose formal and informal vacancies $v_{f,t}$ and $v_{i,t}$, desired formal and informal salaried employment $n_{f,t+1}$ and $n_{i,t+1}$, and private capital demand $k_{s,t}$ to maximize $\sum_{t=0}^{\infty} \Xi_{t|0}^{k}(1-\tau^{k})\Pi_{s,t}$ subject to

$$\Pi_{s,t} = z_{s,t}F(n_{f,t}, n_{i,t}, k_{s,t}, k_{g,t}) - w_{f,t}n_{f,t} - w_{i,t}n_{i,t} - \psi(v_{f,t} + v_{i,t}) - r_{s,t}k_{s,t},$$

and the firm's perceived evolution of formal and informal salaried employment

$$n_{f,t+1} = (1-\rho^{f})\left[n_{f,t} + v_{f,t}q(\theta_{f,t})\right],$$

$$n_{i,t+1} = (1-\rho^{i})\left[n_{i,t} + v_{i,t}q(\theta_{i,t})\right],$$

where $z_{s,t}$ is exogenous salaried productivity. The production function $F(n_{f,t}, n_{i,t}, k_{s,t}, k_{g,t})$ is constant-returns-to-scale in salaried employment and private capital, and k_g denotes public capital. The latter is taken as given by salaried firms. We assume that formal and informal salaried labor is imperfectly substitutable, and that the former is more productive than the latter. Given that vacancy posting costs are the same for formal and informal employment, the only difference between workers is traced back to exogenous productivity.[16] The inclusion of public capital in private sector production embodies the notion that public investment improves salaried-firm productivity (see, for example, Baxter and King, 1993, and Adam, Bevan, and Gollin, 2013, among others).[17] The firm's formal (informal)-employment wage bill is $w_{f,t}n_{f,t}$ ($w_{i,t}n_{i,t}$), where $w_{f,t}$ ($w_{i,t}$) is the formal (informal) Nash real wage and ψ is the exogenous flow cost of posting a vacancy.[18]

[16] Imperfect labor substitution implies that both types of vacancies are positive in equilibrium. We can introduce a payroll tax to further distinguish between formal and informal salaried workers. Our results do not change with this modification because of the small share of (formal) salaried employment. We combine formal and informal salaried employment in a single firm as opposed to having two separate formal and informal salaried firms for two reasons. First, even though salaried employment is important from an economic development perspective, it accounts for a small share of total employment in SSA, implying that having two types of salaried firms would add another layer to an already complex economic environment. Second, a non-negligible share of salaried firms hires formal and informal salaried workers (OECD, 2009).

[17] We analyze how our main results change if self-employment production also benefits from public capital as part of our robustness checks.

[18] Allowing for differences in vacancy posting costs does not change our main conclusions.

The salaried firm's first-order conditions deliver standard job creation conditions and a capital demand condition:

$$\frac{\psi}{q(\theta_{f,t})} = (1-\rho^f)\Xi^k_{t+1|t}\left\{\left(z_{s,t+1}F_{n_f,t+1} - w_{f,t+1} + \frac{\psi}{q(\theta_{f,t+1})}\right)\right\}, \tag{12}$$

$$\frac{\psi}{q(\theta_{i,t})} = (1-\rho^i)\Xi^k_{t+1|t}\left\{\left(z_{s,t+1}F_{n_i,t+1} - w_{i,t+1} + \frac{\psi}{q(\theta_{i,t+1})}\right)\right\}, \tag{13}$$

and

$$r_{s,t} = z_{s,t}F_{k_s,t}, \tag{14}$$

where F_{n_f}, F_{n_i}, and F_{k_s} denote the marginal product of formal and informal employment and the marginal product of private capital, respectively. The job creation conditions equate the expected marginal cost of posting a vacancy to the expected marginal benefit of doing so, where the latter includes the continuation value of employment relationships, for each type of salaried employment. Note that given the structure of firm ownership, in steady state capital taxes will not *directly* affect firms' decisions to hire workers, but these taxes will *indirectly* affect job creation through their impact on public capital (and therefore the marginal product of capital) and private capital accumulation (refer to the salaried-firm owners' Euler equation).

3.5 Nash Bargaining

Following the search literature, we assume that real wages for formal and informal salaried workers are determined via bilateral Nash bargaining between workers and salaried firms. The value functions used to obtain the Nash wages, as well as the explicit Nash wages expressions, are relegated to the Appendix for expositional brevity. Denote the value to the household of having a household member employed in formal employment by $\mathbf{W}_{f,t}$; the value of having a member employed in informal salaried employment $\mathbf{W}_{i,t}$; the value to a salaried firm of having a formal salaried worker by $\mathbf{J}_{f,t}$; and the value to a salaried firm of having an informal salaried worker by $\mathbf{J}_{i,t}$. Finally, denote by $\chi_f \in (0,1)$ and $\chi_i \in (0,1)$ the bargaining powers of formal and informal salaried workers, respectively. The implicit expressions for the Nash wages are then given by: $(1-\chi_j)\,\mathbf{W}_{j,t} = \chi_j \mathbf{J}_{j,t}$ for $j = f, i$.

3.6 Non-Agricultural Total Production, Government, and Market Clearing

Non-agricultural output is given by the sum of salaried and non-agricultural self-employment output, $y_{n,t} = y_{s,t} + y_{e,t}$. The government uses revenue to finance public capital accumulation $k_{g,t+1}$ and transfers to households T_t. The government budget constraint is given by[19]

$$T_t + k_{g,t+1} - (1-\delta)k_{g,t} = \tau^c \left(c_{n,t} + c_{k,t}\right) + \tau^k \left[\Pi_{s,t} + r_{s,t}k_{s,t}\right], \tag{15}$$

In turn, the sectoral resource constraints are given by

$$y_{n,t} = c_{n,t} + c_{k,t} + i_{s,t} + i_{g,t} + \psi(v_{f,t} + v_{i,t}), \tag{16}$$

and

$$y_{a,t} = c_{a,t}, \tag{17}$$

where $i_{g,t} = k_{g,t+1} - (1-\delta)k_{g,t}$ is public investment. Total output is given by $y_t = y_{n,t} + p_{a,t}y_{a,t}$.

4 Functional Forms and Parameterization

Household utility over consumption is given by

$$u(c_{a,t}, c_{n,t}) = \frac{\left[\left[\gamma_c c_{n,t}^{\phi_c} + (1-\gamma_c)c_{a,t}^{\phi_c}\right]^{\frac{1}{\phi_c}}\right]^{1-\sigma}}{1-\sigma},$$

with $\sigma > 1$, $0 < \gamma_c < 1$, $\phi_c < 1$. In turn, the disutility from participation is

$$h\left(\sum_j (s_j + n_j)\right) = \mu \frac{\left[\sum_j (s_j + n_j)\right]^{1+1/\phi}}{1+1/\phi}.$$

[19] Allowing for exogenous government spending and exogenous sources of revenue (grants and revenue from additional sources outside of the scope of the model, such as royalties from natural resources) does not change our main conclusions.

for $j \in \{f, i, e, a\}$ and $\mu, \phi > 0$ (see, for example, Arseneau and Chugh, 2012).[20] The utility function for salaried firm owners is $u(c_{k,t}) = c_{k,t}^{1-\sigma}/(1-\sigma)$. The production function of salaried firms is given by: $F(n_{f,t}, n_{i,t}, k_{s,t}, k_{g,t}) = \left(\left[\gamma_n n_{f,t}^{\phi_n} + (1-\gamma_n) n_{i,t}^{\phi_n}\right]^{\frac{1}{\phi_n}}\right)^{\alpha} (k_{s,t})^{1-\alpha} (k_{g,t})^{\alpha_g}$, where $0 < \alpha < 1$, $0 \leq \alpha_g < 1, 0 < \gamma_n < 1$, and $\phi_n < 1$. The matching functions for salaried firms are Cobb-Douglas: $m_{j,t} = M_j (s_{j,t})^{\xi} (v_{j,t})^{1-\xi}$ for $j = f, i$.

We calibrate the model to Tanzania. A period is a year. Following the macro literature, we set $\beta = 0.95$, the capital depreciation rate to $\delta = 0.08$, the relative risk aversion parameter to $\sigma = 2$, and the private capital share to $\alpha = 0.32$. As a starting point, we impose $\alpha_g = 0.10$, which is consistent with the macro literature that incorporates public capital in private-sector production, and investigate how our results change with alternative values. We normalize the productivity of salaried firms z_s to 1. We initially set parameters ϕ_c and ϕ_n in the CES aggregators for consumption and salaried employment to 0.5 and 0.7, respectively, implying a reasonable degree of substitution between salaried employment categories. Our main conclusions are unaffected by other reasonable choices for these parameters.[21] Given the unavailability of data on vacancies for low income economies, we cannot estimate the matching function for salaried employment. As such, we follow the search literature and set the matching elasticity and the bargaining power of salaried workers to 0.5.[22] We initially set the parameter for the elasticity of participation $\phi = 1$, implying quadratic utility costs from participation, and test the sensitivity of our results to this value. We set ρ^f, ρ^i,and ρ^e to be consistent with the transition probabilities computed using Tanzania's labor force survey for 2012-2013. Since we cannot separate formal from informal salaried separations or obtain the separation probability for agricultural self-employment from the Tanzanian labor force survey, we set $\rho^f = \rho^i = 0.025$ and $\rho^e = \rho^a = 0.043$. Finally, we set the baseline tax rates using information from the Tanzania Revenue Authority. This yields: $\tau^c = 0.18$ and $\tau^k = 0.30$. We normalize the search efficiency parameters ϕ_a and ϕ_e to 1 but experiment

[20] This specification for the distutility of participation delivers an empirically-factual negative relationship between steady-state output levels and self-employment shares.

[21] Differences in ϕ_c only affect the sensitivity of sectoral employment to changes in τ^c, but not to changes in τ^k. Of note, assuming a much smaller degree of substitution for the consumption aggregator does not change our main conclusions. Results available upon request.

[22] A lower bargaining power for workers relative to the matching elasticity implies that the elasticity of salaried employment to tax rates is lower relative to our benchmark results, but our main qualitative conclusions remain unchanged.

with alternative values as part of our robustness checks (presented and discussed in Table A3 in the Appendix).

Calibrated Parameters The remaining parameters $M_f, M_i, \gamma_c, \gamma_n, \psi, \mu, z_a, z_e$, and T are calibrated to match particular targets using Tanzanian data. The calibration targets are: the share of self-employment in non-agricultural employment (0.7365, Tanzanian Labor Force Survey); a probability of finding formal (informal) salaried employment of 0.40 (0.50) (Tanzanian Labor Force Survey, 2012-2013); the share of food consumption in total consumption (0.48); the ratio of formal to informal salaried employment (0.95, Tanzanian Labor Force Survey); a total labor force participation rate of 0.85 (World Bank World Development Indicators); the share of agriculture in total output (0.333, World Bank Development Indicators); the share of public investment in GDP (0.07, World Development Indicators); and the relative share of formal salaried employment in total salaried employment (0.49, Tanzanian Labor Force Survey). The resulting parameter values are: $M_f = 0.0979, M_i = 0.1224, \gamma_c = 0.4952, \gamma_n = 0.5108, \psi = 0.0155, \mu = 15.3677, z_a = 0.1244, z_e = 0.2836$, and $T = 0.0156$. Our calibration therefore implies non-negligible productivity differentials between agricultural self-employment, non-agricultural self-employment, and salaried production ($z_a < z_e < z_s$). In particular, the resulting low productivity in agriculture z_a is consistent with existing evidence for the region (McMillan and Rodrik, 2011; Gollin, Lagakos, and Waugh, 2014). Also, in line with the search and matching literature, the resulting costs of hiring salaried workers represent a small share of total output (less than 0.5 percent of total output in our calibration). Finally, our calibration implies a sectoral contribution to output outside of agriculture that is in line with the data.[23]

[23]Using 2012 data from the World Development Indicators for Tanzania, the share of value added from industry (as a percent of GDP) was roughly 23 percent, the share of value added from services was roughly 44 percent, and the share of value added from agriculture was 33 percent. Our baseline calibration yields similar shares assuming that industry is mainly comprised of salaried firms and services of self-employed firms.

5 Quantitative Analysis

To determine the effect of changes in fiscal policy on sectoral employment, unemployment, participation, and macro aggregates, we increase each tax rate (τ^c or τ^k) by two percentage points by holding the tax rate that does not change at its baseline value. The magnitude of the change in fiscal policy we consider is within plausible values in the context of fiscal reforms (IMF, 2015b). Also, all distortionary tax changes take place while holding exogenous transfers T at their baseline value since we want to take into account the interaction between changes in fiscal policy and public capital and not between fiscal policy and transfers to households. Our main findings remain unchanged if we allow transfers to endogenously adjust to changes in revenue. Throughout our experiments, we assume that the official tax rates τ^c and τ^k are also the effective tax rates and that there are no losses in government absorptive capacity. Our main conclusions would not change if we assume a plausible degree of inefficiency in public capital (though the quantitative positive effect of an increase in capital taxes would be smaller; see the Appendix for more details).

5.0.1 Main Results

Table 3 shows the elasticities of different labor market and aggregate variables with respect to individual changes in τ^c or τ^k of the same magnitude (the elasticity of variable x with respect to τ^j is denoted by ε_{x,τ_j} for $j = c, k$)). Therefore, the numerical results we present in Table 3 as well as in subsequent tables should be interpreted as percent changes in the variable of interest in response to a 1% increase in each tax rate.[24]

[24] A similar comment applies to all results presented in the Appendix.

Table 3—Benchmark Model Under Alternative Distortionary Tax Regimes: Elasticities

	τ^c	τ^k
Original τ	0.180	0.300
New τ	0.200	0.320
$\varepsilon_{n_f,\tau}$	-2.243	1.988
$\varepsilon_{n_i,\tau}$	-2.243	1.988
$\varepsilon_{n_e,\tau}$	0.817	-0.752
$\varepsilon_{n_a,\tau}$	0.124	0.006
$\varepsilon_{\mathbf{u},\tau}$	-0.096	0.084
$\varepsilon_{lfp,\tau}$	0.049	-0.013
$\varepsilon_{lfp_{na},\tau}$	0.003	-0.024
$\varepsilon_{lfp_a,\tau}$	0.124	0.006
$\varepsilon_{y,\tau}$	-0.218	0.220
$\varepsilon_{c,\tau}$	-0.136	0.056
$\varepsilon_{k_g,\tau}$	0.000	1.458

Notes: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ. lfp_{na} (lfp_a) denotes labor force participation in the non-agricultural (agricultural) sector.

Consumption Taxes A 1% increase in consumption taxes (recall that the other tax rate is held at its baseline value) leads to a reduction in salaried employment of 2% and to an increase in non-agricultural (agricultural) self-employment of roughly 0.82% (0.12%). Output and consumption fall by 0.22% and 0.14%, respectively. Given the magnitude of the change in taxes and the sectoral reallocation that takes place, the change in total unemployment is very small. Intuitively, an increase in consumption taxes, all else equal, increases household members' marginal cost of participating in the labor market (refer to the optimal participation decisions of the household). This is most relevant for salaried employment. Indeed, the initial fall in salaried labor supply as a result of the increase in consumption taxes pushes salaried firms to reduce capital and labor demand, resulting in an equilibrium reduction in salaried employment and output and, ultimately, in total output. As a result, households shift the allocation of household members towards agricultural self-employment, where consumption taxes are not collected, and towards non-agricultural self-employment to counteract the reduction in salaried employment opportunities. This occurs despite the fact that, as a result of the increase in τ^c, the participation cost has increased across the board for all employment categories, but the incentive to search for salaried employment is more adversely affected *in relative terms* given the response of labor demand. As such, households ultimately redirect their members to self-employment.

The marginal fall in unemployment is mainly explained by a rise in total participation, where the latter is explained by the rise in self-employment and not salaried employment (in fact, salaried participation drops drastically). Importantly, while revenue is directed to public investment, the adverse impact of the tax change on salaried-firm profits and capital gains is large enough to offset any initial revenue gains from higher capital taxes that would otherwise bolster public investment. As such, public capital remains virtually unchanged. All told, reasonable changes in consumption taxes can have negative labor market and aggregate consequences.[25]

Capital Taxes In principle, an increase in taxes on profits and capital gains, all else equal, reduces salaried firm owners' expected return to capital (refer to the salaried firm owners' capital Euler equation). However, to the extent that the additional revenue is devoted to accumulating public capital, which in turn contributes to salaried-firm productivity, the increase in public capital bolsters salaried firms' labor productivity and incentive to demand private capital and labor. As a result, a 1% increase in capital taxes generates a non-negligible increase in salaried employment of roughly 2%. In response to the rise in salaried labor demand, households reallocate their members away from searching for non-agricultural self-employment and into searching for salaried employment, resulting in a fall in non-agricultural self-employment of 0.75%. The policy also generates an increase in total output of 0.22%. However, unemployment increases by 0.08%, mainly because self-employment plays such a prevalent role as a source of employment in the economy (so that a fall in self-employment all else equal increases unemployment) and labor force participation falls slightly (in turn, this puts upward pressure on the unemployment rate).[26]

Agricultural self-employment remains virtually unchanged. Of note, this takes place despite the absence of explicit sectoral resource-based reallocation costs often associated to

[25]Note that $\varepsilon_{n_f,\tau}$ and $\varepsilon_{n_i,\tau}$ are of exactly the same magnitude, not only in response to changes in τ^c and τ^k. This traces back to having endogenous sectoral participation, and in particular, sectoral participation margins in salaried employment and non-agricultural self-employment. Intuitively, in response to tax changes, households will respond by changing salaried employment in by the same magnitude, *as long as they can reallocate searchers away from non-agricultural employment and into salaried employment.* If endogenous participation or non-agricultural self-employment are absent, then these elasticities would differ as a result of productivity differences within salaried employment (see Tables 4 and 5).

[26]As shown in Table A4 in the Appendix, conducting the same policy experiment when the efficiency of search for self-employment is lower leads to a reduction in unemployment in response to higher τ^k.

movements out of agriculture and into other sectors. The fact that agricultural employment is not responsive to changes in taxes is consistent with evidence suggesting that changes in productivity are one of the main drivers of transitions out of agricultural employment (Diao, Harttgen, and McMillan, 2016).[27] As we show further below, the strong reallocation of sectoral searchers by households plays an important role in eventually boosting salaried employment and reducing non-agricultural self-employment. While higher capital taxes would clearly have a negative effect on capital accumulation (and therefore labor demand) absent any productive public investment, channeling the extra revenue into productivity-enhancing public investment means that public capital increases by 1.46%. Given the presence of public capital in salaried-sector production, this ultimately explains the positive and non-negligible effect of the policy on non-agricultural employment, salaried employment, and output relative to a similar consumption-tax-based policy.

5.0.2 The Importance of Endogenous Participation

Table 4 illustrates how our results change when we shut down households' decisions over the measure of salaried searchers (we continue to allow households to make decisions over self-employment). In such a model, salaried employment is primarily driven by labor-demand considerations while self-employment is still optimally chosen by households.[28] Of note, recall that self-employment continues to account for the bulk of total employment (salaried employment represents only 16 percent of total employment under the baseline tax rates). In the absence of endogenous salaried participation, increases in τ^c and τ^k have negligible effects on salaried employment and non-agricultural self-employment. Despite households' choice over self-employment, the latter becomes virtually unresponsive to policy when household members cannot be redirected to search for salaried employment. This exercise confirms that households' option to reallocate their members across all employment categories—including salaried employment—via explicit sectoral participation decisions *including salaried employ-*

[27] Indeed, changing the sectoral productivity parameters in the model confirms that such changes generate a non-trivial reallocation of employment in the economy, which includes large changes in agricultural self-employment.

[28] Briefly, when we remove endogenous participation, we assume that the labor force is normalized to one and that households choose the amount of household expenditures needed to send individuals from unemployment into (agricultural and non-agricultural) self-employment.

ment is important for characterizing the effect of changes in policy, with labor demand playing a secondary role.

Table 4—Benchmark Model vs. Economy Without Participation Margin Under Alternative Distortionary Tax Regimes: Elasticities

	Benchmark Model		No Participation	
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.243	1.988	−0.063	−0.008
$\varepsilon_{n_i,\tau}$	−2.243	1.988	−0.104	0.020
$\varepsilon_{n_e,\tau}$	0.817	−0.752	0.000	0.000
$\varepsilon_{n_a,\tau}$	0.124	0.006	0.057	−0.012
$\varepsilon_{\mathbf{u},\tau}$	−0.096	0.084	−0.208	0.093
$\varepsilon_{lfp,\tau}$	0.049	−0.013	–	–
$\varepsilon_{y,\tau}$	−0.218	0.220	0.064	−0.040
$\varepsilon_{c,\tau}$	−0.136	0.056	−0.019	−0.056
$\varepsilon_{k_g,\tau}$	0.000	1.458	1.403	0.503

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ.

Why is endogenous participation so critical for generating sizeable responses to fiscal policy changes? Our calibration implies a low unemployment level, consistent with Tanzanian data. Also, in the absence of endogenous participation, unemployment is given by $\mathbf{u} = 1 - n_f - n_i - n_e - n_a$. If n_e and n_a are not very responsive to policy, and households cannot change the measure of searchers across sectors—recall that the latter are part of the unemployed in the benchmark model—then all else equal $\mathbf{u}$ will be little changed. In addition, if salaried firms have a difficult time attracting searchers from other sectors because households cannot reallocate their workers in the absence of endogenous sectoral participation, market tightness (and the job-filling probability) will not change much either. These elements combined ultimately lead to a quantitatively small *equilibrium* response in unemployment, salaried employment, and more broadly other macro variables.

Finally, there is one more contrasting result with respect to our benchmark findings: note that absent endogenous participation, a change in consumption taxes will not be fully offset by a sharp and endogenous reduction in revenue from capital taxes (as was the case in the benchmark model). This is due to the fact that salaried firms are not adversely affected by changes in search behavior on the part of household members in response to changes in τ^c. This explains why $\varepsilon_{k_g,\tau}$ is positive when τ^c increases in the model without participation.

5.0.3 The Importance of Non-Agricultural Self-Employment

Table 5 shows the results for a version of the benchmark model where non-agricultural self-employment is absent. The response of labor market variables to changes in taxes is surprisingly different relative to the benchmark model. In fact, the direction of the response of salaried employment is the opposite, and the size of the response is considerably lower, relative to the benchmark model. This is particularly true for a change in τ^k.

To understand why $\varepsilon_{k_g,\tau}, \varepsilon_{n_f,\tau}$, and $\varepsilon_{n_i,\tau}$ all change signs in response to a higher τ^k relative to our benchmark findings, note that even if higher taxes all else equal bolster the stock of public capital, salaried firms are unable to attract potential workers who were previously searching for non-agricultural self-employment since the latter employment category no longer exists. Moreover, the tax has little impact on the relative price of agricultural output. As such, the rise in taxes induces a fall in salaried labor demand, capital, and output, which eventually leads to a reduction in capital gains, salaried profits, and total output. Without households' ability to move workers from self-employment into salaried employment within the non-agricultural sector, the increase in taxes causes the equilibrium amount of consumption and total output to fall.

Importantly, these results suggest that, while the inclusion of public capital does matter for the quantitative effects of changes in fiscal policy on sectoral employment, the presence of public capital *alongside non-agricultural self-employment* is critical as well. Indeed, bolstering public capital, which in turn increases salaried productivity, will not have the desired effects if salaried firms cannot easily respond to the rise in public capital by hiring more labor outside of agriculture. Since tax changes have negligible quantitative effects on the price of agricultural output, households have little incentive to redirect their members away from agricultural self-employment and towards salaried employment, and this further reduces salaried firms' possibility to hire workers. More broadly, our results show that when it comes to changes in fiscal policy, differentiating between the two types of self-employment—two types that are equally important in low-income-economy labor markets—is relevant for assessing the possible impact of changes in fiscal policy on sectoral employment.

Table 5—Benchmark Model vs. Economy Without Non-Agricultural Self-Employment Under Alternative Distortionary Tax Regimes: Elasticities

	Benchmark Model		No Non-Agric. SE	
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.243	1.988	0.117	−0.078
$\varepsilon_{n_i,\tau}$	−2.243	1.988	0.097	−0.068
$\varepsilon_{n_e,\tau}$	0.817	−0.752	–	–
$\varepsilon_{n_a,\tau}$	0.124	0.006	−0.116	0.114
$\varepsilon_{\mathbf{u},\tau}$	−0.096	0.084	−0.066	0.027
$\varepsilon_{lfp,\tau}$	0.049	−0.013	−0.002	0.017
$\varepsilon_{y,\tau}$	−0.218	0.220	0.295	−0.136
$\varepsilon_{c,\tau}$	−0.136	0.056	0.158	−0.145
$\varepsilon_{k_g,\tau}$	0.000	1.458	1.837	0.590

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ.

5.0.4 The Importance of Employment and Sectoral Output Allocation

Our baseline calibration reproduces a share of self-employment in non-agricultural employment of 0.74, in line with the data for Tanzania and other low-income economies. To illustrate how the impact of policy depends on the economy's level of development *as reflected in the allocation of employment across employment categories and the contribution of agriculture to output*, we now assume an economy that resembles emerging and developed economies in terms of (1) having a smaller share of self-employment, and (2) a smaller contribution of agriculture to GDP relative to our baseline (low-income) economy. Note that a lower share of agriculture in total output also implies a smaller share of agricultural self-employment.

For purely illustrative purposes, we halve the share of non-agricultural self-employment *in total non-agricultural employment* and the contribution of agriculture to output relative to our baseline calibration for Tanzania, and then conduct the same fiscal policy changes. Specifically, we recalibrate the economy using these two new targets. The new calibration implies that the share of non-agricultural self-employment *in the total labor force* falls from 0.438 to 0.269. In turn, the share of agricultural self-employment *in the total labor force* falls from 0.361 to 0.221. Importantly, an economy with lower self-employment also has a higher level of output and consumption, which is consistent with the negative cross-country relationship between the share of self-employment and the level of development.

Table 6—Benchmark Model vs. Economy with Smaller Share of Non-Agricultural Self-Employment and Agricultural Production: Elasticities

	Benchmark	Model	Model with	Smaller $n_e, p_a y_a/y$
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.243	1.988	−1.151	0.393
$\varepsilon_{n_i,\tau}$	−2.243	1.988	−1.151	0.393
$\varepsilon_{n_e,\tau}$	0.817	−0.752	2.111	−0.711
$\varepsilon_{n_a,\tau}$	0.124	0.006	0.151	0.004
$\varepsilon_{\mathbf{u},\tau}$	−0.096	0.084	−0.138	0.046
$\varepsilon_{lfp,\tau}$	0.049	−0.013	0.066	−0.007
$\varepsilon_{y,\tau}$	−0.218	0.220	−0.273	0.105
$\varepsilon_{c,\tau}$	−0.136	0.056	−0.187	−0.000
$\varepsilon_{k_g,\tau}$	0.000	1.458	0.000	1.458

Notes: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ.

As shown in Table 6, the smaller is the share of self-employment, the lower is the positive (negative) impact of changes in τ^k (τ^c) on salaried employment, consumption, and output. This suggests that the quantitative conclusions above are heavily dependent on the economy's level of development and its associated allocation of employment across sectors, with the benefits of fiscal policy changes being greater for economies at lower levels of development.[29] Intuitively, the difference in policy impact across the two scenarios traces back to the higher marginal product of public capital in a low-income economy relative to more developed economies. All told, the results in Table 6 suggest that, despite bolstering salaried-firm productivity via higher public investment, increasing government revenue via a higher τ^k is less effective in raising output, consumption, and salaried employment in economies where salaried work is a more prevalent source of employment (and the agricultural employment and output shares are smaller).

Efficiency of Public Investment Efficiency losses in public capital and investment are well-known to afflict low-income economies (IMF, 2015b). To explore the impact of such

[29]The reduction in self-employment we engineer is also accompanied by an endogenous increase in public capital and total output relative to the baseline calibration for Tanzania. This is consistent with the fact that more developed economies have higher public investment and output levels (even though public investment-output ratios may be lower). Moreover, if we were to include inefficient public capital in the model (which we discuss below), the results in Table 6 would suggest that increasing τ^k would have detrimental effects on salaried employment, output, and consumption in economies where non-agricultural self-employment and agriculture account for a smaller share of the labor force an the economy, respectively.

losses on our results, we assume that only a fraction of accumulated public capital becomes productive capital in the private sector. Specifically, the salaried-firm production function becomes $F(n_{f,t}, n_{i,t}, k_{s,t}, k^s_{g,t}) = \left(\left[\gamma_n n^{\phi_n}_{f,t} + (1-\gamma_n) n^{\phi_n}_{i,t}\right]^{\frac{1}{\phi_n}}\right)^{\alpha} (k_{s,t})^{1-\alpha} \left(k^s_{g,t}\right)^{\alpha_g}$, where *productive public capital* is given by $k^s_{g,t} = k_{g,t} - \varphi_k (k_{g,t})^{\eta_k}$, $\varphi_k > 0$ and $\eta_k \geq 1$. Importantly, $\varphi_k (k_{g,t})^{\eta_k}$ is a pure resource cost that reflects public investment inefficiencies.[30] We initially set $\eta_k = 1$ and calibrate φ_k such that this resource cost absorbs 40 percent of public investment, which is in line with evidence for low-income economies (IMF, 2015b).

Table 7 shows that, as should be expected, allowing for inefficient public investment reduces the positive quantitative effect of changes in τ^k on salaried employment, consumption, and output. Interestingly, despite having non-negligible efficiency losses in productive public capital, increasing τ^k continues to have positive effects via the effect of higher productive public capital on salaried firms. As such, our qualitative conclusions remain unchanged under plausible parameterizations.[31] The main takeaway from this experiment is that, despite having non-negligible losses in public investment efficiency, economies that have an allocation of employment and agricultural output consistent with low-income economies may still see positive effects on salaried employment, consumption, and output (with small quantitative effects on aggregate unemployment and participation) from increasing capital taxes in an environment with productivity-enhancing public investment. Finally, as shown in Table A6 in the Appendix, such benefits may no longer be present once the economy is more developed as reflected by smaller self-employment and agricultural output shares, *unless the loss in public investment efficiency decreases as the economy becomes more developed.*

[30] Alternative specifications of public capital and/or investment inefficiency yield similar conclusions. A similar comment applies to a specification where public capital affects productivity in all sectors, which we discuss below.

[31] We note that the higher η_k is, the smaller are the employment and output benefits from increasing τ^k, with values of η_k above 2 generating adverse effects from higher taxes.

Table 7—Benchmark Model vs. Model with Inefficiency in Public Investment

	Benchmark	Model	Public Inv.	Inefficiency
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.243	1.988	−2.125	0.969
$\varepsilon_{n_i,\tau}$	−2.243	1.988	−2.125	0.969
$\varepsilon_{n_e,\tau}$	0.817	−0.752	0.771	−0.209
$\varepsilon_{n_a,\tau}$	0.124	0.006	0.123	−0.027
$\varepsilon_{\mathbf{u},\tau}$	−0.096	0.084	−0.091	0.038
$\varepsilon_{lfp,\tau}$	0.049	−0.013	0.047	0.055
$\varepsilon_{y,\tau}$	−0.218	0.220	−0.206	0.161
$\varepsilon_{c,\tau}$	−0.136	0.056	−0.133	−0.009
$\varepsilon_{k_g,\tau}$	0.000	1.458	0.000	1.458

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ. $\varepsilon_{k_g,\tau}$ and $\varepsilon_{k_g^s,\tau}$ are quantitatively identical.

5.0.5 Robustness Experiments and Some Caveats

We present and discuss several robustness checks in the Appendix. These include, among others, using alternative functional forms for the disutility of participation (Table A1 in the Appendix), and adopting alternative plausible calibrations (Tables A2 and A3 in the Appendix), allowing for capital in self-employment (Table A4 in the Appendix), exploring the presence of public capital in all sectors (Table A5 in the Appendix), and a comparison of our baseline economy and a more developed economy (in terms of having smaller self-employment and agricultural output shares) under public capital inefficiency (Table A6 in the Appendix).

Some caveats are also in order. Evidence for low-income economies suggests that micro and small enterprises face significant capital and financial constraints relative to larger firms (Grimm et al., 2011). Our benchmark model abstracts from including such constraints in order to analyze the impact of fiscal policy changes on the labor markets in a transparent environment. Introducing capital constraints among self-employed firms, regardless of whether they operate in the agricultural or non-agricultural sectors, is unlikely to significantly affect our main results. Indeed, in the case of changes in τ^k, where (non-agricultural) self-employment falls, the response of self-employment is likely to be larger since households would be reallocating searchers away from more constrained (smaller) firms into relatively

less constrained (salaried or larger) firms.

Turning to the reallocation process across firm categories and sectors, while our model establishes a distinction between agricultural and non-agricultural production, the cost of reallocation of searchers away from agricultural employment and into non-agricultural (self-employed and salaried) employment is a utility cost purely associated to labor force participation, where the latter includes searchers and employed individuals for each employment category. The cost of search for salaried employment could be broadly interpreted as also embodying the cost of migration out of agriculture. Introducing an explicit resource cost of searching for non-agricultural employment, which could partly proxy for migration or transition (resource) costs, is unlikely to change our qualitative conclusions. However, since the cost of participation appears to play an important role, evidence on these costs may be critical to ultimately determine the true *quantitative* effect of policy changes. Relatedly, the benchmark model abstracts from resource losses as a result of inefficiencies in tax collection and in the execution of public investment projects. While reasonable degrees of inefficiency do not change the main message, the degree of convexity of these costs—which may be higher for higher levels of public investment—may ultimately lead to adverse salaried employment effects from higher capital taxes. Put differently, the rise in public investment and its associated effect on private-sector productivity must be large enough to offset the initial adverse effect of higher taxes on private-sector capital accumulation.

Finally, our framework assumes no differences in non-agricultural output between salaried and self-employed firms. While consumption taxes may be easier to collect for salaried-produced consumption goods and services, this may not be the case for self-employed-produced consumption goods and services. Assuming that consumption taxes only apply to salaried-produced consumption goods would still affect participation decisions by raising the marginal cost of participation, but the decrease in salaried employment (and increase in self-employment) would likely be larger since consumption taxes would be biased towards salaried-firm output. Despite these caveats, the fundamental mechanisms via which fiscal policy affects sectoral and aggregate employment, unemployment, labor force participation, and macro aggregates would remain intact.

6 Conclusion

Low-income economies in Sub-Saharan Africa (SSA) have higher shares of self-employment, employment and agriculture, and informal employment relative to other income groups. They have a limited tax base, revenue that is heavily dependent on external sources, and severe public infrastructure deficits that put a dent on private-sector productivity. Little is known about the labor market and aggregate consequences of moving towards domestic distortionary taxation to raise revenue geared towards public investment in these economies. We build a general equilibrium model with labor search frictions and endogenous participation consistent with the employment and tax structure in SSA economies. The model features formal and informal salaried employment, agricultural and non-agricultural self-employment, endogenous labor force participation, and a feedback effect from tax collection to public investment, where the latter positively affects private-sector productivity. Focusing on the main sources of taxation in SSA economies, we analyze the labor market and aggregate impact of individual changes in taxes on non-agricultural consumption and taxes on salaried profits and capital gains.

We find that a rise in distortionary salaried capital income and profit taxation can increase salaried employment, total output, and consumption; it reduces non-agricultural self-employment while leaving agricultural self-employment unchanged; and causes a slight increase (decrease) in unemployment (participation). Conversely, a similar rise in consumption taxes reduces salaried employment, output, total consumption, and increases self-employment. The joint inclusion of non-agricultural self-employment, public investment, and endogenous labor force participation for all relevant employment categories—three margins that are generally not jointly present in existing models of low-income-economy labor markets—play an important role for explaining the positive effects of revenue-neutral on capital and investment tax changes on salaried employment, consumption, and output, as well as the small adverse impact on unemployment.

Our results have three implications. First, in economies where self-employment is the most prevalent source of employment, explicitly accounting for endogenous changes in sectoral labor force participation *and* the full set of available employment options—in partic-

ular non-agricultural self-employment—is relevant for characterizing the impact of changes in fiscal policy on labor market and macroeconomic outcomes. Abstracting from these two features can lead to considerably different policy outcomes. Second, changes in capital taxes can have positive effects on salaried employment and output so long as government revenue is devoted to public investment, the latter benefits private-sector productivity, *and* salaried firms can bring individuals working in non-salaried employment into salaried employment. The latter is not trivial if most self-employed are located in another sector. Third, self-employment in agriculture plays a limited role as a quantitatively relevant adjustment mechanism in response to changes in fiscal policy despite its considerable contribution to total employment in SSA economies.

Our framework abstracted from particular characteristics of employment, firms and the fiscal structure in SSA economies, including taxes on international trade, the presence of agricultural salaried employment, and financial constraints, among others. However, the model can easily be extended to incorporate these features to address important questions related to financial development, firm structure, and broader structural reforms in a context where heterogeneity in employment arrangements is a critical feature of the labor market, as is the case in SSA economies.

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A Appendix

A.1 Value Functions and Price Determination

The net value to the household from having an additional member in formal salaried employment, $\mathbf{W}_{f,t}$, is given by:

$$\mathbf{W}_{f,t} = w_{f,t} - \frac{h_t^{'}(1+\tau^c)}{u_{c_n,t}} + \mathbb{E}_t \Xi^h_{t+1|t}(1-\rho^f)\mathbf{W}_{f,t+1},$$

Similarly, the net value to the household from having a member in informal salaried employment, $\mathbf{W}_{i,t}$, is:

$$\mathbf{W}_{i,t} = w_{i,t} - \frac{h_t^{'}(1+\tau^c)}{u_{c_n,t}} + \mathbb{E}_t \Xi^h_{t+1|t}(1-\rho^i)\mathbf{W}_{i,t+1},$$

Turning to the value functions of salaried firms, the value to a salaried firm of having an additional formal worker is:

$$\mathbf{J}_{f,t} = z_{s,t}F_{n_f,t} - w_{f,t} + \mathbb{E}_t \Xi^k_{t+1|t}(1-\rho^f)\mathbf{J}_{f,t+1},$$

Similarly, the value to a salaried firm of having an additional informal worker is given by:

$$\mathbf{J}_{i,t} = z_{s,t}F_{n_i,t} - w_{i,t} + \mathbb{E}_t \Xi^k_{t+1|t}(1-\rho^i)\mathbf{J}_{i,t+1},$$

where we assume free entry throughout. We assume standard bilateral Nash bargaining, where the workers' bargaining power is given by χ_j for salaried employment type $j = f, i$. The explicit Nash bargaining problems can be stated as:

$$\max_{w_{j,t}} \left\{ \left(\mathbf{W}_{j,t}\right)^{\chi_j} \left(\mathbf{J}_{j,t}\right)^{1-\chi_j} \right\}.$$

The implicit Nash wage is given by:

$$\mathbf{W}_{j,t} = \frac{\chi_j}{(1-\chi_j)}\mathbf{J}_{f,t},$$

The resulting explicit Nash wage expressions is given by:

$$w_{j,t} = \chi_j \left[z_{s,t} F_{n_j,t} + \frac{\psi}{q(\theta_{j,t})} \right] + (1 - \chi_j) \left[\frac{h_t'(1+\tau^c)}{u_{c_n,t}} \left(\frac{p(\theta_{j,t}) - 1}{p(\theta_{j,t})} \right) \right],$$

for $j = f, i$.

A.2 Robustness Checks

Alternative Specification of Labor Force Participation Costs The benchmark model assumes that total (agricultural and non-agricultural) participation represents a combined utility cost for households. To determine the model's sensitivity to this functional form, we modify the benchmark model to separate the cost of participation in agricultural production and non-agricultural production. Specifically, we assume that the household's utility function becomes

$$\sum_{t=0}^{\infty} \beta^t \left[u(c_{a,t}, c_{n,t}) - h\left(\sum_j (s_j + n_j) \right) - h(s_a + n_a) \right],$$

for $j \in \{f, i, e\}$. This specification continues to be consistent with the empirically-factual negative relationship between steady-state output levels and average self-employment shares. The general functional form for $h(\cdot)$ remains the same as the one used in the main text. As shown in Table A1, the policy results in response to changes in τ^c and τ^k remain qualitatively similar but become quantitatively stronger for the change in τ^c when participation costs enter separately by sector. All told, the fact that consumption (capital) taxes have a limited (significant and positive) quantitative effect on sectoral employment and macro outcomes remains unchanged.

Table A1—Benchmark Model vs. Model with Alternative Utility Participation Cost Specification: Elasticities

	Benchmark Model		Alt. Participation Cost I	
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.243	1.988	−2.322	1.970
$\varepsilon_{n_i,\tau}$	−2.243	1.988	−2.322	1.970
$\varepsilon_{n_e,\tau}$	0.817	−0.752	0.888	−0.735
$\varepsilon_{n_a,\tau}$	0.124	0.006	0.074	−0.006
$\varepsilon_{\mathbf{u},\tau}$	−0.096	0.084	−0.090	0.076
$\varepsilon_{lfp,\tau}$	0.049	−0.013	0.052	−0.012
$\varepsilon_{y,\tau}$	−0.218	0.220	−0.213	0.221
$\varepsilon_{c,\tau}$	−0.136	0.056	−0.128	0.058
$\varepsilon_{k_g,\tau}$	0.000	1.458	0.000	1.458

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ.

Differences in the Elasticity of Participation Parameter ϕ Our baseline calibration assumes that $\phi = 1$, implying that the utility cost of participation is convex. Table A2 shows that lower or higher values of this parameter have little effect on the quantitative changes in sectoral employment and do not change our main conclusions.

Table A2—Benchmark Model vs. Model with Different Values for ϕ: Elasticities

	Model	$\phi = 0.5$	Model	$\phi = 1.5$
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.210	1.980	−2.260	1.992
$\varepsilon_{n_i,\tau}$	−2.210	1.980	−2.260	1.992
$\varepsilon_{n_e,\tau}$	0.786	−0.745	0.832	−0.756
$\varepsilon_{n_a,\tau}$	0.112	0.009	0.130	0.005
$\varepsilon_{\mathbf{u},\tau}$	−0.094	0.084	−0.097	0.085
$\varepsilon_{lfp,\tau}$	0.036	−0.009	0.055	−0.014
$\varepsilon_{y,\tau}$	−0.225	0.222	−0.214	0.219
$\varepsilon_{c,\tau}$	−0.146	0.058	−0.131	0.054
$\varepsilon_{k_g,\tau}$	0.000	1.458	0.000	1.458

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ.

Efficiency of Search for Self-Employment Our baseline calibration normalized the exogenous efficiency of search for agricultural and non-agricultural self-employment to 1. These parameters can alternatively be interpreted as probabilities of entering self-employment (implying that they must be between 0 and 1). As shown in Table A3, assuming that the

efficiency of search for self-employment is lower than 1 does not change our main conclusions. Indeed, under this alternative calibration, τ^k continue to have non-negligible effects on the response of salaried employment and non-agricultural self-employment. Our assumption does have implications for the response of unemployment since changes in τ^k now generate a reduction in unemployment. This last result arises mainly from a higher (lower) elasticity of salaried employment (self-employment) with respect to τ^k relative to our benchmark calibration.

Table A3—Benchmark Model vs. Economy with Lower Efficiency of Search for Self-Employment: Elasticities

	Benchmark	Model	Model	$\phi_a, \phi_e = 0.5$
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.243	1.988	−2.395	2.151
$\varepsilon_{n_i,\tau}$	−2.243	1.988	−2.395	2.151
$\varepsilon_{n_e,\tau}$	0.817	−0.752	0.808	−0.754
$\varepsilon_{n_a,\tau}$	0.124	0.006	0.130	0.001
$\varepsilon_{\mathbf{u},\tau}$	−0.096	0.084	0.141	−0.126
$\varepsilon_{lfp,\tau}$	0.049	−0.013	0.037	−0.003
$\varepsilon_{y,\tau}$	−0.218	0.220	−0.215	0.221
$\varepsilon_{c,\tau}$	−0.136	0.056	−0.132	0.053
$\varepsilon_{k_g,\tau}$	0.000	1.458	0.000	1.458

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ.

Capital in Self-Employment As shown in Table A4, allowing the self-employment sectors to use capital implies that the response of salaried employment to an increase in τ^c is still negative, though more subdued relative to the benchmark model. Conversely, the response of salaried employment to an increase in τ^k is quantitatively stronger. All told, our main conclusions remain unchanged.

Table A4—Benchmark Model vs. Economy with Capital in Self-Employment: Elasticities

	Benchmark Model		Capital in SE	
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.243	1.988	−2.186	2.433
$\varepsilon_{n_i,\tau}$	−2.243	1.988	−2.186	2.433
$\varepsilon_{n_e,\tau}$	0.817	−0.752	0.743	−0.856
$\varepsilon_{n_a,\tau}$	0.124	0.006	0.128	−0.010
$\varepsilon_{\mathbf{u},\tau}$	−0.096	0.084	−0.095	0.105
$\varepsilon_{lfp,\tau}$	0.049	−0.013	0.023	0.010
$\varepsilon_{y,\tau}$	−0.218	0.220	−0.130	0.177
$\varepsilon_{c,\tau}$	−0.136	0.056	−0.116	0.057
$\varepsilon_{k_g,\tau}$	0.000	1.458	0.000	1.458

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ.

Public Capital in Agricultural and Non-Agricultural Self-Employment Production Modifying our benchmark framework to have all firm categories (salaried, non-agricultural self-employed, and agricultural self-employed) benefit from public capital reduces (increases) the negative (positive) effect of consumption (capital and investment) taxes on salaried employment, and increases the sensitivity of self-employment, output, and consumption to changes in τ^k. See Table A5 below. The impact of changes in τ^c remains virtually unchanged since our modification does not alter $\varepsilon_{k_g,\tau}$, where the latter plays a relevant role in explaining the sensitivity of salaried employment and self-employment to changes in fiscal policy (this can be seen by considering the case of τ^c, where no changes in public capital are accompanied by reductions in salaried employment and small but negative effects on output).

To understand why the results for τ^k are quantitatively stronger relative to the benchmark model, first note that there is no congestion effect from using public capital in one sector versus using it in multiple sectors. The rise in public capital boosts labor productivity among salaried firms, but now also among (agricultural and non-agricultural) self-employed firms. The latter allows consumption to rise by more after the change in policy relative to the benchmark model. Relative to an economy where public capital only benefits salaried firms and all else equal, the larger increase in consumption increases the cost of participation among the self-employed by more since the rise in consumption further reduces the marginal utility of consumption (a component of the cost of participation). Given the rise in labor

demand from salaried firms associated with the higher level of public capital, households therefore reallocate more searchers away from self-employment and into salaried employment relative to the benchmark model. This ultimately explains the larger response of salaried employment and self-employment to changes in τ^k when all firms benefit from public capital.

Table A5—Benchmark Model vs. Model with Public Capital in All Sectors Under Alternative Distortionary Tax Regimes: Elasticities

	Benchmark	Model	k_g	in All Sectors
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−2.243	1.988	−2.243	5.485
$\varepsilon_{n_i,\tau}$	−2.243	1.988	−2.243	5.452
$\varepsilon_{n_e,\tau}$	0.817	−0.752	0.817	−2.189
$\varepsilon_{n_a,\tau}$	0.124	0.006	0.124	−0.102
$\varepsilon_{\mathbf{u},\tau}$	−0.096	0.084	−0.096	0.194
$\varepsilon_{lfp,\tau}$	0.049	−0.013	0.049	−0.136
$\varepsilon_{y,\tau}$	−0.218	0.220	−0.218	0.856
$\varepsilon_{c,\tau}$	−0.136	0.056	−0.136	0.405
$\varepsilon_{k_g,\tau}$	0.000	1.458	0.000	3.817

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ.

Public Investment Inefficiency and Lower Self-Employment and Agricultural Output Shares Table A6 compares the results from Table 6 in the main text (second and third columns of Table A6), where we change the allocation of (non-agricultural) self-employment and sectoral output to mimic a more developed economy, to those obtained when (1) we allow for public investment inefficiency and (2) we also lower the share of self-employment in non-agricultural employment and the share of agricultural output in total output.[32] We continue to assume that the loss in public capital due to inefficiencies in public investment represents 40 percent of public investment. As shown below (see the fourth and fifth columns in Table A6), increasing τ^k when we have public investment inefficiency and a lower self-employment share has adverse (though quantitatively small) consequences on salaried employment and consumption. Assuming that more developed economies—economies with lower self-employment and a lower agricultural output share—have lower public investment efficiency losses would imply that increasing τ^k could still deliver positive

[32]Similar to the experiment in the main text, we halve both the share of self-employment in non-agricultural self-employment and the share of agricultural output in total output.

effects on salaried employment. The main takeaway from this experiment is that increasing capital taxes may be beneficial in economies that exhibit an allocation of employment and agricultural output consistent with low-income economies, even in the presence of public investment inefficiencies, while the same may not be true for more developed economies.

Table A6—Benchmark Model vs. Model with Inefficiency in Public Investment: with Lower Self-Employment, Agricultural Output Share

	Benchmark Lower SE, $p_a y_a/y$	Model	Public Inv. Lower SE, $p_a y_a/y$	Inefficiency
	τ^c	τ^k	τ^c	τ^k
Original τ	0.180	0.300	0.180	0.300
New τ	0.200	0.320	0.200	0.320
$\varepsilon_{n_f,\tau}$	−1.151	0.393	−1.101	−0.020
$\varepsilon_{n_i,\tau}$	−1.151	0.393	−1.101	−0.020
$\varepsilon_{n_e,\tau}$	2.111	−0.711	2.018	0.321
$\varepsilon_{n_a,\tau}$	0.151	0.004	0.150	−0.036
$\varepsilon_{\mathbf{u},\tau}$	−0.138	0.046	−0.133	−0.011
$\varepsilon_{lfp,\tau}$	0.066	−0.007	0.064	0.072
$\varepsilon_{y,\tau}$	−0.273	0.105	−0.261	0.047
$\varepsilon_{c,\tau}$	−0.187	−0.000	−0.184	−0.072
$\varepsilon_{k_g,\tau}$	0.000	1.458	0.000	1.458

Note: $\varepsilon_{x,\tau}$ denotes the elasticity of the steady state variable x with respect to policy τ. $\varepsilon_{k_g,\tau}$ and $\varepsilon_{k_g^s,\tau}$ are quantitatively identical.