Malawi M1 road rehabilitation project: An Ex-ante Employment Impact Assessment Report

[Draft for discussion]

STRENGTHEN2: Employment impact assessment to maximize job creation in Africa

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Funded by the European Union

Executive summary

A central task of the ILO STRENGTHEN2 project is to conduct employment impact assessments of EU-funded investments in sub-Saharan Africa, with the goal of promoting the creation of more and better jobs. Through the External Investment Plan (EIP), the European Union (EU) is supporting Malawi's M1 Road Rehabilitation project. The project aims at improving access to trade and essential services, fostering regional integration, strengthening growth, and reducing the time and cost of transport along the Common Market for Eastern & Southern Africa (COMESA) North-South Corridor. More generally, the project intends to contribute to transforming Malawi in to middle income country by 2063. The project consists of the rehabilitation, widening and marginal alignment of about 300 km of the M1 road in the following sections, Kacheche-Chiweta (66 km); Jenda-Mzimba (47 km); Kasungu-Jenda (86 km) and Kamuzu International Airport (KIA) - Kasungu (102 km). The project was originally intended to commence in 2019 with a total budget of €191 million and an EU contribution of €134 million through the European Investment Bank (EIB).

An ex-ante employment impact assessment of the M1 Road project is conducted in this study and given the available information we obtain three kinds of employment impacts: direct, temporary, and permanent. Direct employment effects were obtained from projections based on information provided by the construction companies across the rehabilitated sections of the M1 road. The ILO's Structural Model for Sustainable Development (SMSD) is used to calculate the temporary and permanent job impacts. This model is constructed based on the 2014 Malawi IFPRI SAM which contains information on production, income generation and distribution and use of products. Information from the Social Accounting Matrix (SAM) and other country-level statistics is used to calibrate the model. A key component of the model is the sector-level adjustment mechanism which reflects features of a low-income developing economy.

The ex-ante assessment indicates that 3,932 direct jobs can be created by the implementation of the M1 road project. Most of them are male young workers with varying skill levels across the different lots. A sizeable impact on temporary employment is found, resulting in the creation of 11,977 temporary jobs. Most of these jobs are generated in the retail trade sector, followed by the Human health and social work sector. The temporary jobs tend to favour young and skilled workers, while no bias is found for female workers. The temporary macroeconomic effect of the project includes real GDP and employment growth accompanied with inflation and an improvement in the government, private and trade balances (as shares of GDP). All rural farm households experience a real income growth of about 2 per cent.

The completion of the project (once the road has been rehabilitated) brings the economy to a higher level of economic activities accompanied with higher output and employment. That is, the economy experiences a "capacity expansion" in the transportation sector which causes the spill-over effects spread across the rest of the economy. The capacity effect reduces the output constraint in the transport sector which pushes the economy towards a higher equilibrium activity level with additional output and employment. The employment generated by the capacity effect is "permanent" in the sense that, it is generated by the long-lasting outcomes of the project and not by the labour demanded during the implementation of the project. Using the well-established concept of Incremental Capital Output Ratio (ICOR), the permanent employment effect of the M1 project amounts to 2,950 jobs. Most of them are generated in the transport sector followed by the retail trade sector.

The permanent jobs tend to favour female, young and skilled workers, however the extent of this positive bias is bigger for skilled workers. The macroeconomic effect after the completion of the project includes real GDP growth and employment growth accompanied by an improvement in the real government and private balances and slight worsening of the current account balance. Although households across all income groups and categories experience real income growth, non-farm rural households of the first and second quintiles are the ones with the highest real income growth of about 0.7 per cent.

In sum, the M1 road rehabilitation project is estimated to provide a substantial positive employment impact. Although most of the jobs generated by the implementation of the project fall in the category of "temporary", those workers could gain the necessary experience and skills from this project that can make them employable in projects with similar labour needs. Thus, there might contribute to skill building that can benefit the Malawian economy after the M1 road project is completed. The permanent employment effects might be encouraging since they are likely to be long-term and relatively formal. In addition, these jobs are also likely to address female youth employment problems that are common in sub-Saharan African countries since they tend to favour female and young workers. The negative gender bias in the direct jobs generated by the project is a source of concern, while not entirely surprising since these jobs belong to the construction sector typically male-intensive. The gender bias observed in the direct employment could be addressed with gender-sensitive hiring practices and workplace policies that encourage female workers to opt for jobs in this sector.

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Acronyms and abbreviations

AfDB	African Development Bank
BPM6	Balance of Payments and International Investment Position Manual, sixth edition (2008)
CGE	Computable General Equilibrium
COMESA	Common Market for Eastern and Southern Africa
COMTRADE	Commodity Trade Statistics Database
EFSD+	European Fund for Sustainable Development Plus
EIB	European Investment Bank
EIP	External Investment Plan
EU	European Union
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GFS2014	Government Finance Statistics manual 2014
GTAP	Global Trade Analysis project
ICOR	Incremental Capital Output Ratio
ICT	Information and Communication Technology
IFPRI	International Food Policy Institute
IHS3	Integrated Household Survey
ILO	International Labour Office/Organization
IMF	International Monetary Fund
ISIC	International Standard Industrial Classification of All Economic Activities
KIA	Kamuzu International Airport
LCMS	Living Condition Monitoring Surveys
LES	Linear Expenditure System
LFS	Labour Force Survey
MGDSIII	Malawi Growth Development Strategy
MW	Megawatt
MWK	Malawi Kwacha
NAM	National Accounting Matrix
NSC	North-South Corridor
PIDA	Programme for Infrastructure Development in Africa
RA	Roads Authority
SADC	Southern Africa Development Community
SAM	Social Accounting Matrix
SMSD	Structural Model for Sustainable Development
UNFPA	United Nations Population Fund
USD	United States of America Dollar

1. Introduction

STRENTHEN2 is a joint initiative of the European union and the ILO that focuses on leveraging employment impact assessments to promote the creation of more and better jobs in sub-Saharan African countries. The STRENGTHEN2 project is currently conducting a series of in-depth employment impact assessments for the European Fund for Sustainable Development Plus (EFSD+) as well as the External Investment Plan (EIP) projects in sub-Saharan African countries. The EIP has recently implemented several projects across various sectors in Malawi. One of these projects is the M1 road rehabilitation project, which aims at fostering regional integration by expanding intra-Africa trade, strengthening growth, and reducing the time and cost of transport along the corridor. More generally, the project intends to contribute to transforming Malawi in to middle income country by 2063. The project consists of the rehabilitation, widening and marginal alignment of about 300 km of the road in the following sections, Kacheche-Chiweta (66 km); Jenda-Mzimba (47 km); Kasungu-Jenda (86 km) and Kamuzu International Airport (KIA) - Kasungu (102 km). The project was originally intended to commence in 2019 with a total budget of €191 million and an EU contribution of €134 million through the EIB.

Since the implementation of the project started in 2022 and most of the project will be completed in 2024, an ex-ante assessment is conducted in this report. The available information allows to obtain three kinds of employment impacts: direct, temporary, and permanent. Direct employment effects were obtained from projections using information provided by the construction companies across the rehabilitated sections of the M1 road. To obtain the temporary and permanent effects we use the Structural Model for Sustainable Development (SMSD) an economy-wide modelling framework developed at the ILO. A country specific model for Malawi was constructed using its Social Accounting Matrix (SAM), which reflects the socioeconomic structure of the economy. The M1 road rehabilitation project investment is translated into a shock to the model to simulate the temporary and permanent job impacts caused by the project based on information from project documents.

The report has the following structure: Section 2 provides an overview of the socioeconomic and general development situation in Malawi. Section 3 highlights the key information about the M1 road rehabilitation project. Section 4 introduces the assessment model as well as the underlying data. Section 5 presents and discusses the employment impact assessment results. Section 6 contains the conclusion of the report.

2. Malawi country situation analysis

Malawi is a landlocked Southern African country that spans over 118,484 square kilometres of land area. With a subtropical climate, the country shares borders with Mozambique, Zambia and Tanzania and its total population are estimated at 20.44 million in 2022 (UNFPA, 2022). The rate of population growth is estimated at an average of 2.7 per cent per annum from 3.79 people in 1960 to 18.91 million in 2018 (World Bank, 2022). If this trend persists, the Malawian population is expected to double by 2038.

Malawi has implemented significant economic and structural reforms to foster economic growth, yet it remains one of the slow growing nations in the last decade. Real GDP (Gross Domestic Product) growth has averaged 1.5 per cent per annum between 2000 and 2019 (refer to Figure A1 in the Appendix). The country's economic structure is heavily reliant on the agriculture sector, which employs 80 per cent of the working population and generates 90 per cent of foreign exchange earnings. This reliance makes the economy vulnerable to external shocks, particularly those caused by climate-related factors. In 2020, the agriculture sector contributed 22.71 per cent to Malawi's Gross Domestic Product, while the industry and services sectors contributed approximately 18.49 per cent and 52.62 per cent, respectively. Due to the combined impact of external and local shocks from the Covid-19 pandemic, Malawi experienced a contraction in GDP growth, falling from 5.4 per cent in 2019 to 0.9 per cent in 2020 (World Bank, n.d.). While there was a modest recovery in 2021, with GDP growth of 2.2 per cent, it still fell below pre-pandemic levels. However, this recovery was short-lived, as the GDP growth rate declined to 0.9 per cent in 2022, equivalent to a 1.8 per cent decline in per-capita GDP (World Bank, n.d.).

Malawi's debt-to-GDP ratio has been increasing in recent years, rising from 21 per cent in 2010 to 37 per cent in 2019, making the country highly vulnerable to debt distress (World Bank, n.d.). As of 2020, Malawi's external debt stood at approximately $3.2 billion USD, equivalent to about 41 per cent of the country's GDP. The government has been relying on domestic financing and non-concessional borrowing from regional development banks, resulting in a significant increase in public debt from 32 per cent in 2013 to 55 per cent of GDP in 2020. However, the government has committed to budgetary restructuring, as seen in its 2023 budget. It aims to reduce the overall fiscal deficit in 2022/23 to 7.7 per cent of GDP from 8.7 per cent of GDP in 2021/22 (World Bank, n.d.). The government plans to reduce the Affordable Inputs Program, which has contributed to deficits in recent years, and increase public investment through foreign-financed projects.

Despite the Sustainable Development Goals' target to eradicate extreme poverty globally by 2030, Malawi continues to have a poverty rate of over 70 per cent. The proportion of Malawians living below the international poverty line declined from 71.7 per cent in 2010 to 70.3 per cent in 2016 but has since risen to 74 per cent due to weather-related shocks affecting agricultural productivity and incomes (World Bank, 2022). Poverty is most prevalent in rural areas, particularly in the South and Northern parts of the country. Limited access to education, production assets, shocks affecting agricultural productivity, lack of diversification, and access to markets are among the drivers of poverty. Malawi's trade is unstable due to export restrictions and a lack of infrastructure, and as a landlocked country, high transportation costs for imports and exports increase the cost of production, making Malawian goods and services uncompetitive on the international market.

Malawi’s infrastructure backbones follow the north-south axis running parallel to Lake Malawi. Regional transport connectivity is quite limited as evidenced in the Roads Authority (RA) five-year Strategic and Business Plan (refer to Table A1 in Appendix). The main method of transportation is by road with 90 per cent of goods and 70 per cent of passengers using this method of transportation for local and international destinations, respectively. The country's road network is 15,451 km long and only 28 per cent is paved. In 2017, the road network was composed of 41 per cent paved roads, 42 per cent unpaved roads, and 17 per cent in good, fair, and poor condition, respectively. The remaining 72 per cent of the road network is composed of earth/gravel surface roads.

Moreover, Malawi is increasingly subject to energy stresses. More than 90 per cent of the country’s total demand for energy is met with firewood and charcoal. The main source of electricity is hydropower which generates about 95 per cent of the power in this country. Borgstein et. al. (2018) note that Malawi has an exceptionally low national electrification rate estimated at 12.0 per cent- the lowest in the Southern Africa Development Community (SADC) region. It trails Madagascar and Mozambique which are at 23 per cent and 24 per cent respectively. Rural and urban electrification rates are estimated at 3.9 per cent and 48.7 per cent. Installed generation capacity as of October 2017 was 367.3 MW (350.8 MW being hydro and 16.57 MW thermal diesel generators) against a peak demand of over 470 MW. Malawi’s inadequate infrastructure has hampered its economic prospects and competitiveness. While these infrastructure constraints cut across all types of infrastructure, they are more overt in Information and Communication Technology (ICT), energy and water supply.

Malawi is grappling with the significant challenge of unemployment. According to the 2020 Integrated Household Survey, the country's overall unemployment rate is 0.9 per cent, with a higher rate of 1.1 per cent for unemployed women (ILO, n.d.). The employment-to-population ratio for ages 15-24 was reported at 55.57 per cent in 2021, while the unemployment rate stood at 1.2 per cent (World Bank, n.d.). Although the agriculture sector still dominates employment, its share of total employment has declined from approximately 87 per cent in the 1970s to around 65 per cent in the 2000s. This shift in employment has resulted from "push factors" out of agriculture, such as population growth and soil degradation, rather than "pull" factors (Team, 2018). Despite the services sector being the main contributor to the country's GDP, it employs only 8 per cent of the workforce. On the other hand, the agriculture sector continues to employ over 70 per cent of the total workforce, with 42.7 per cent being women (ILO, n.d.). The industry sector employs 14 per cent, with women accounting for 10.2 per cent (refer to Figure A2 in the Appendix).

Sectoral employment analysis estimates that from 1990 to 2020, the agriculture sector employed a higher percentage of women (on average 85 per cent) compared to men (on average 7 per cent). The service sector has shown an increasing trend in employment, with more men being employed than women (from 16 per cent of employed men in 1991 to 21per cent in 2019). However, the proportion of women in the service sector has also increased significantly, doubling from 8 per cent in 1991 to 15 per cent of working women in 2019. This suggests that the rate of female employment in the service sector is higher than that of males.

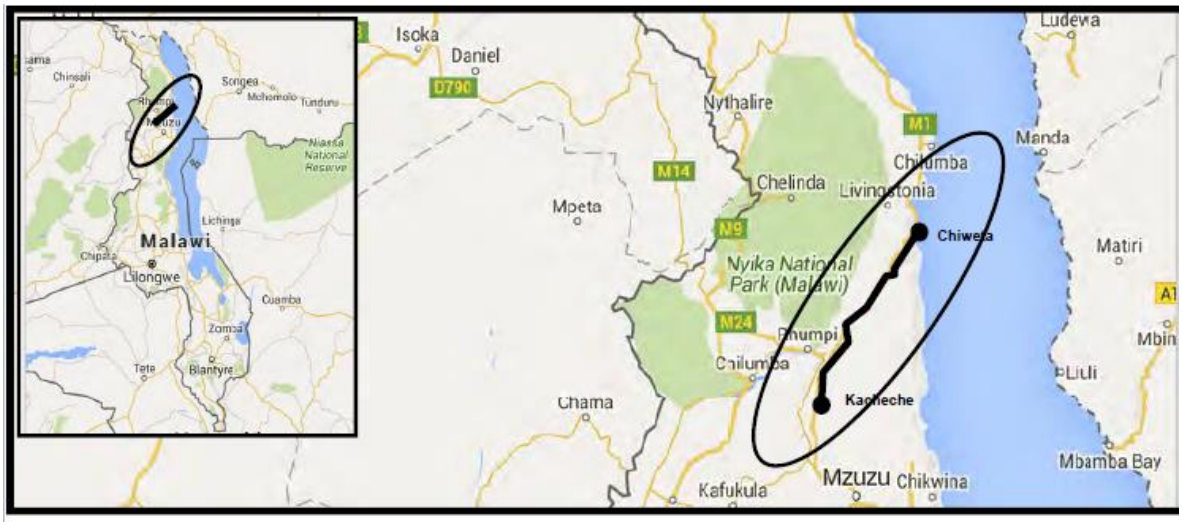
Overall, Malawi’s economy continues to heavily rely on subsistence, and rainfed agriculture, which limits its growth potential and is susceptible to climatic shocks. Trade policies and an unpredictable business environment continue to impede investment and commercialization, as well as erratic electricity supply. The national development framework such as Malawi 2063 and Malawi Growth Development Strategy (MGDSIII) has highlighted infrastructure development as a key component in the development (Government of Malawi, 2017). However, the perceived quality of infrastructure remains low, as are the measures for access and service delivery in the education, electricity, and roads sectors (IMF, 2018). Infrastructure development involves substantial amounts of up-front capital expenditure, which poor governments like Malawi struggle to meet given the small tax base and limited room to raise taxes, and declining official development assistance. In Malawi, this is evidenced by the low level of public investment (which averaged 4.18 per cent of the gross domestic product [GDP] between 1998 and 2017). As a result, the public capital stock per capita (a proxy for infrastructure stock) grew at a compound annual growth rate of only 0.88 per cent during the same period. Increasing public investment is associated with fiscal risk which could negatively impact the country’s debt management and stabilization policy. Therefore, Malawi’s public investment remains low and of mixed quality resulting in an infrastructure investment gap in the energy and water and sanitation sectors of approximately USD 332 million per year (Hettinger et. al., 2020).

3. The M1 road rehabilitation project

The M1 road rehabilitation project consists of a multi-scheme road operation for the rehabilitation of about 300 km of the single carriageway M1 road in Malawi with no changes to the existing alignment. The M1 road in Malawi is part of the Southern Africa Development Community (SADC)'s North-South Corridor (NSC), a major regional trade corridor, linking the two port cities of Dar-el-Salaam in Tanzania and Durban in South Africa. Approximately 1,145 km of the North-South Corridor passes through Malawi via the M1 road. The corridor is also prioritized by the Program for Infrastructure Development in Africa (PIDA), as well as by the Common Market for Eastern and Southern Africa (COMESA) to promote socio-economic development and poverty reduction in Africa through improved access to integrated regional and continental infrastructure networks and services.

The project consists of civil works along four distinct road sections identified from north to south as follows: Kecheche-Chiweta (66 km); Kamuzu International Airport (KIA) - Kasungu (102 km); Kasungu-Jenda (86 km); Jenda-Mzimba (47 km). The Kacheche junction to Chiweta section is part of the road that links Malawi to the port of Dar es Salaam and as such forms a vital link for the importation of strategic goods. The road provides a link between Malawi and Dar es Salaam while also providing an alternative link to the same port for Zambia. Zambia's Eastern Province especially makes use of this and other sections of the M1 road to take advantage of the shortest route to the port for import of agricultural inputs and export of agricultural produce. The need for the improvement arises from the increased levels of traffic using the facility, the high presence of pedestrian and bicycle traffic in urban areas and the structural condition of the existing pavement which is either nearing or has reached the end of its serviceable life.

Figure 1: M1 Road Project Map.



source: Civil & Planning Group. (2017)

According to project documents, the rehabilitation of the four different sections of the M1 road amounts to €120 million. The project is entirely funded by the EU through the EIB and the funding is distributed as follows: €44 million, €32.2 million, €11.5 million, and €31.8 million to Kacheche-Chiweta (66 km); Jenda-Mzimba (47 km); Kasungu-Jenda (86 km); Kamuzu International Airport (KIA) - Kasungu (102 km) respectively. The project is expected to be implemented over a period of 36 months.

In sum, the project is expected to : (i) foster regional integration by providing a vital link to the port of Dar-es-Salam and increase the intra-Africa trade as the road forms part of the Common Market of Eastern Africa (COMESA) North-South Corridor; (ii) it is estimated that within 15 to 20 years, the project will provide socio-economic benefits to the areas along the road; and (iii) reduce the time and cost of transport along this regional strategic corridor with faster and smoother traffic flows more reliable travel times, and vehicle operating cost saving.

4. A structural model for employment impact assessment in Malawi

This section focuses on the method used to obtain the temporary and permanent employment effects. The direct effects will be discussed in the next section. To obtain the temporary and permanent employment effects we use a simulation method[1]. This method requires the construction of a macroeconomic model to simulate the employment effects of the M1 investment project. Current model is a representation of the Malawian economy based on the country's Social Accounting Matrix (SAM), and contains well-specified causal and adjustment mechanisms in the form of a system of equations. The SAM provides the fundamental accounting structure of the model as well as the "base year" data for the calibration and simulation.

In comparison with econometric methods, simulations methods are generally less data demanding and it allows the modeler to take into account key features of developing countries such as export commodity dependence, high unemployment and sectoral constraints. However, a model based on a poorly represented economy might yield meaningless simulation results. Given the complexity of this type of models the lack of transparency is a common criticism. For the two reasons mentioned above, we dedicate the following sections to explain the components of the macroeconomic model constructed for this study.

4.1. The Social Accounting Matrix (SAM) for Malawi

The Social Accounting Matrix (SAM) is an economy-wide data framework that captures economic transactions among different "actors" of the economy (e.g., households, businesses, and the government) over a period of time. These transactions are captured in a squared matrix where each account is represented by a row and column. Each cell of the matrix reflects a payment flow from the column account to the row account (elements on the corresponding row are expenditure flows to other accounts and elements on the corresponding column are income flows from other accounts). Thus, a SAM is a snapshot of the socio-economic structure of an economy represented by set of interlinked accounts that record the incoming and outgoing resources of different actors in the economy (European Commission 2003). This framework is a valuable tool for analyzing the economy-wide impacts of policies and shocks.

The 2014 Malawi SAM was constructed as part of the Nexus Project, an initiative led by the International Food Policy Institute (IFPRI) and national statical agencies to improve the quality, establish common data standards, and classification systems for constructing and updating national SAMs. The accounts contained in the 2014 Malawi SAM are "activities and commodities", where the domestic production is separated in 70 activities[2]. Activities and commodities have a one-to-one mapping based on a concordance between ISIC industries and Harmonized System products version 2007 (World Customs Organization, 2007). Activity accounts are valued at producer prices and commodity accounts are valued at market prices.

The "factors of production" account contains three broad categories: labour (rural and urban, disaggregated by level of education), land, and capital (disaggregated by crops, livestock, mining, and other sectors). The "households" account is separated into 15 household groups, first broken-down in to urban and rural. Rural households are further disaggregated into farm households and non-farm households. Households are further disaggregated into per capita expenditure quintiles. The remaining accounts in the SAM include the transaction costs of moving goods between producers, domestic markets, and national borders, as well as the various indirect taxes imposed on marketed commodities.

The Malawi Macro SAM is constructed using three main data sources: national accounts rebased using a 2010 base year, government finance using Government Finance Statistics manual 2014 (GFS2014), and the balance of payments derived from the Balance of Payments and International Investment Position Manual, sixth edition (BPM6) database. The national accounts provided GDP estimates for 19 Nexus sectors, which were disaggregated into 70 sectors using crop production and price data from FAOSTAT and industrial GDP estimates published in the 2011-2012 Annual Economic Survey. The national accounts also provided sufficient detail for service sector GDP. The commodities were derived from expenditure groups of the national accounts disaggregated using IHS3 survey data, COMTRADE database, and other sources. Labour

[1] See Gibson and Flaherty (2017) for a review of other methods/techniques.

[2] Some countries' national accounts capture how activities can produce multiple commodities – this information is discarded in Nexus SAMs.

value-added and household incomes and expenditure were disaggregated across representative sectors and household groups using the IHS3 survey data.

To conduct our analysis, we used the IFPRI SAM and not GTAP SAM to leverage the household group disaggregation (rural and urban) contained in the in the former. This allows us to obtain the temporary and permanent effects of the M1 project on real household income. Since our model is based on the GTAP-consistent sectoral employment data, the information contained in the IFPRI SAM was mapped to the GTAP sectors for modelling purposes.

4.2 The model for Malawi

The 2014 Malawi SAM provides the key set of macro accounting relationships for the Malawi model. Hence, the model is rooted in the accounting identities expressed in the SAM (incomes equal to expenditures), representing the existing productive and distributive structure of the economy. This is also supplemented with additional behavioural relationships and adjustment mechanisms (closure rules) to build the model. In the following paragraphs we provide a brief description of the key elements and adjustment mechanisms for the model.

The model has three types of sectors:

1. The **agricultural sectors** are assumed to be constrained by the availability of capital and fertile land; hence they have a fixed domestic supply. As demand changes, prices adjust to clear the market with flexible profit share.

2. **Utility and transport sectors** are constrained by fixed capacity; hence their domestic output is fixed. However, an investment operation would most likely build capacity in these sectors, which ultimately pushes the economy to a higher steady state generating long-term or permanent employment.[3]

3. **Other sectors'** (including manufactures, construction, and other services) domestic products are free to adjust to demand, in other words their production is "demand-driven". This is so, due to firms in these sectors operating with excess capacity due to the existence of a large pool of un- and underemployed workers, and firms would determine their selling price based on a mark-up over the cost of production. Any changes in production costs (e.g., wage or price of intermediate inputs) would affect the price in these sectors via a cost-push.

Since Malawi has persistent high levels of unemployment and underemployment, we assume that labour supply is unlimited at an exogenously determined wage rate. Productivity is considered fixed, while employment and income are generated by additional levels of domestic industrial activity, which depend on the demand for domestic products and the product mix of each industry. Prices and the distribution of income determine the demand for goods and services in this model. Tax rates are assumed to be fixed, so the government budget balance adjusts in response to an intervention. The current account adjusts freely assuming a fixed nominal exchange rate, whereas the real exchange rate still adjusts with price. In response to an intervention, the saving–investment balance is restored with incomes adjusting to generate the right amount of savings to meet investment.

Another key feature of the model is that the investment operation can build additional capacity for sectors with fixed short-run output (e.g., the transport sector). The additional capacity can increase the output level of that sector, hence removing the output constraint. This feature allows to capture the long run economy-wide (including employment) effects of the investment operation.

4.3. Setting the parameters in the model

The model is constructed based on the 2014 Malawi SAM and most of the model parameters are set endogenously in such a way that the base line solution to the model reproduces the values in the SAM. In other words, the model is "calibrated"

[3] To discussed in the next section.

to the 2014 SAM. Parameter values such as the nominal exchange rate, foreign price and basic price are normalized to one, which is equivalent to rescaling the quantity to a conforming unit of measure. Prices such as, the unitary price of activities and purchaser's price are obtained from the SAM data. Employment-related parameters are mostly obtained from the GTAP satellite account containing employment data by skill levels and occupational profiles of labour income. Labour statistics from ILO's ILOSTAT database expands the GTAP-consistent sectoral employment data to include gender, age and informality.

Estimating the elasticity of substitution between domestic and foreign products (the Armington elasticity) can be a challenging task for a developing economy such as Malawi. The Armington elasticities used in computable general equilibrium (CGE) models are often substantially higher than those found in empirical studies, in order to generate the level of trade that is high enough to match reality (Gallaway, McDaniel, and Rivera 2003). For example, the Global Trade Analysis project (GTAP) sets it at around 3.1 on average, which is substantially above the empirical average (around 1.4). Studies have also found that the Armington elasticity is correlated with the level of development of the country, such as per capita GDP and degree of urbanization (Mijnen 2013). Since Malawi is a small developing economy, we set elasticity to 3, take from the GTAP. The export price elasticity in this model is set to be 0.75, as in Raza, Taylor, and von Arnim's (2016) model for sub-Saharan African countries.

The demand functions that capture households' consumption are of the LES (Linear Expenditure System) type. We follow (Taylor, 1979) for calibrating the LES, which requires first obtaining the Frisch parameter and Engle's elasticity, and then these parameters are used to calibrate the floor consumption levels and the supernumerary income shares. The Frisch parameters for the 15 households are assumed to range between –10 (for the poorest households) and –1.5 (for the richest households), these values are based on the findings by Chuku et al. (2019) and Golberg (2010). The by-sector by-household Engel's elasticities are taken from micro-econometric analysis based on the study for Zambia conducted by (Jiang and La Marca, 2023).

5. The direct, temporary and permanent employment effects of the M1 project

5.1. The intervention, direct, temporary, and permanent impacts

Following the M1 road rehabilitation project documents, the cost dedicated to the rehabilitation of the four different sections of the M1 road amounts to €120 million. Using project documents and information collected from the construction companies we obtained total labour costs as well as monthly employment reports which was the main source of information to calculate the direct employment effects. At the time the data was collected, the project had lasted 6 months. We used this information to project the direct employment generated during the duration of the project (36 months).

The bill of quantities allowed us to determine how the total project cost is distributed between different sectors in the SAM. This expenditure breakdown did not contain the total labour costs since this information was already reflected in the direct employment effects. Instead, we focused only on the cost of purchasing intermediate goods (except labour) to calculate the temporary and the permanent employment effects. The cost contained in the expenditure breakdown was first converted to the same base year as the SAM using both GDP deflator and exchange rate, and then the expenditure breakdown was modelled as a shock – additional purchase of capital goods from different sectors of the economy to build additional capacity for the transport sector. The project cycle lasts 36 months according to the project documents. Hence, in the dynamic simulation, the project cost is injected in the economy over a time horizon of three years.

Given the type of information we obtained from project documents and the construction companies, we were able to obtain three kinds of employment impacts: direct, temporary, and permanent. In this framework, a direct employment impact is defined as the employment generated on each section of the M1 road due to the implementation of the project. Temporary employment refers to employment generated indirectly by activities associated with the implementation of the project. For example, jobs could be generated in sectors where intermediate goods for the project are produced (e.g., mining and retail trade sector) to meet the demand from the project. Also, the employment generated is "temporary" because once the project ends, holding everything else constant, the specific jobs will be lost. Permanent employment in this framework is employment generated by longer-lasting outcomes of the project. For example, for the M1 road rehabilitation project, the outcomes of the project are an improved transportation system and higher transportation capacity, which provides the economy cheaper transportation cost (e.g., in terms of time and money) and improved regional trade corridor. Thus, the completion of the project pushes the economy to a higher equilibrium with higher output and employment. [4] It is also important to highlight that the model captures the effect on employment demand (due to the implementation of the project) and not on the actual employment status of the individuals. Thus, "temporary" or "permanent" refers only to employment demand from the perspective of the project duration.[5]

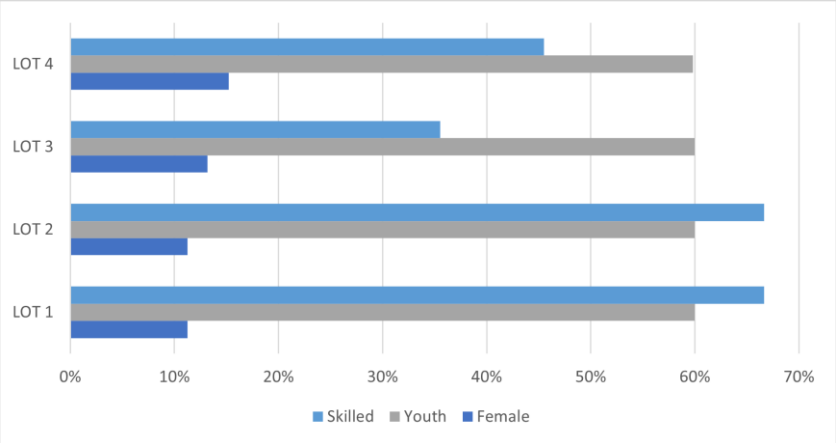
5.2. Direct employment effects

According to our estimates, during the implementation of the M1 rehabilitation project 3,932 workers will be employed directly across the four lots. Approximately 11 per cent of the employees in all the lots are female, as shown in Figure 2. Lot 4 has the largest share of female workers at 15 per cent of the total employment generated. Additionally, workers aged 15 to 35, considered as youth workers, constitute 60 per cent of the total workforce across all the lots. However, when it comes to skilled workers, Lot 1 and Lot 2 have a higher percentage of skilled workers compared to Lot 3 and Lot 4 that are below 50 per cent. Approximately 67 per cent of the workers in Lot 1 and Lot 2 are skilled, while Lot 3 only employs 36 per cent of skilled workers.

[4] The model produces the "temporary" and "permanent" effects assuming a ceteris paribus environment. However, unaccounted exogenous shocks (outside the project intervention) can prevent those effects from truly persisting over time.

[5] Although workers employed in the project will benefit from the skills acquired during the project and increase their employability, the model does not capture this effect.

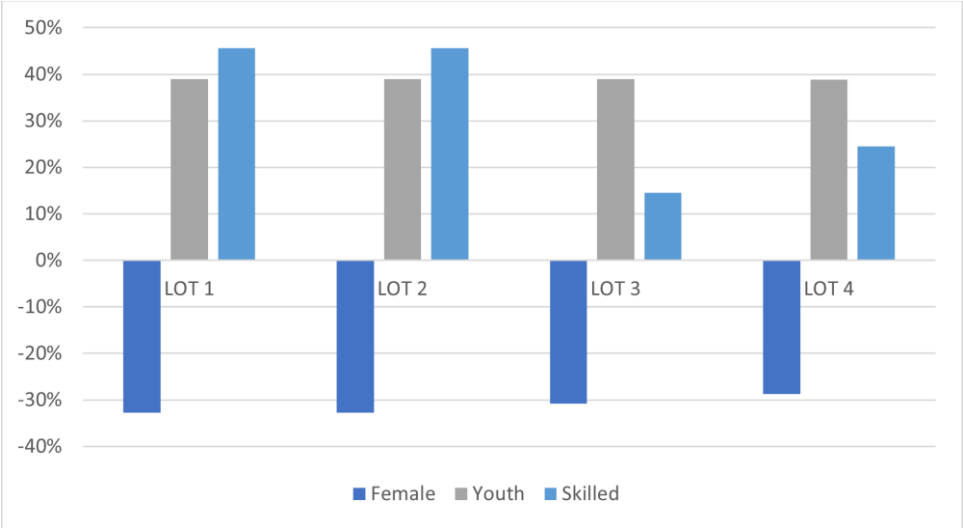
Figure 2: Direct Employment Generated by Gender, Age and Skill.



Source: Authors' calculation

When comparing the demographic distribution shown in Figure 2 with their corresponding national shares, we can acquire an overall understanding of the degree of bias in the jobs generated. It is evident that the implementation of the M1 project results in a positive bias towards youth and skilled workers, since the percentage of youth and skilled employment generated by the project is higher than their national share. This is highlighted in figure 3, where all Lots show a 39 per cent higher employment of youth relative to the national share, and Lot 1 and 2 exhibit a 46 per cent higher employment of skilled workers. Lot 3, on the other hand, shows a comparatively lower increase of just 15 per cent in skilled workers' employment relative to the national share. However, concerning female workers, all Lots show a negative bias of approximately 30 per cent in comparison to the average national female employment. This is indicative of the gender employment gap in the construction sector.

Figure 3: Employment Bias by Gender, Age and Skill.



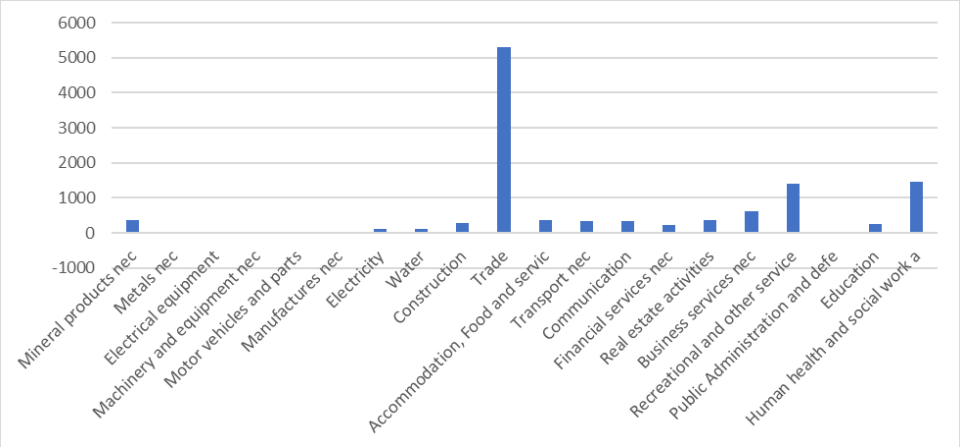
Source: Authors' calculation

5.3. Temporary Employment Effects

The M1 project has a notable impact on temporary employment, resulting in the creation of 11,977 temporary jobs. This increase in employment is primarily driven by the direct expenditure of the project in the Malawian economy, through the increased demand for intermediate goods and services utilized in road construction. As can be observed in Figure 4, most

of these jobs are generated in the retail trade sector with 5,300 jobs, followed by the Human health and social work sector and the Recreational and other service sectors with 1,465 and 1,400 jobs respectively.

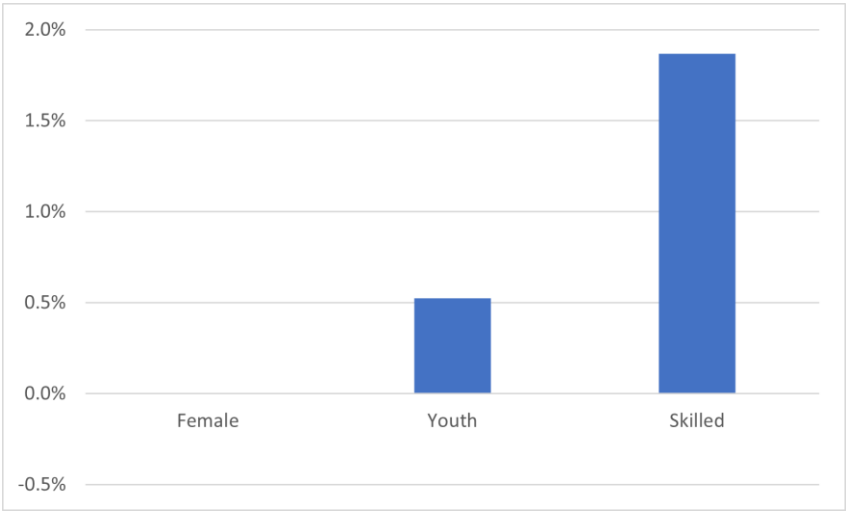
Figure 4: Temporary Employment Generation by Sectors.



Source: Authors' calculation

Out of the total temporary employment generated, 44 per cent are expected to be female, 22 per cent are young workers aged 15 to 35 years old, and 23 per cent are skilled workers. To assess the degree of bias in the jobs generated, we compare the percentages of female, youth, and skilled employment generated by the M1 project with their corresponding national shares. It is found that the M1 project maintains a similar ratio of female employment in comparison to the national average. However, the project generates more temporary jobs for youth and skilled workers compared to the national average, an increase of 0.5 per cent and 1.87 per cent, respectively.

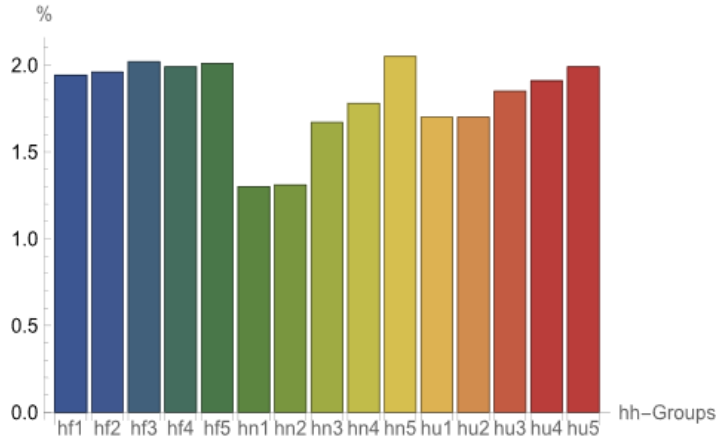
Figure 5: Temporary Employment Bias by Gender, Age and Skill.



Source: Authors' calculation

Since our model contains household level and macroeconomic data, we can examine the temporary effects of the M1 project on real household income and other macroeconomic variables. Figure 6 shows the effects (in percentage change) of the M1 project on real income growth by various household categories (rural farm: hf, rural nonfarm: hn and urban: hu, by income quintiles).

▶ **Figure 6: Temporary effects on household real income growth.**



Source: Authors' calculation

From figure 6, it is evident that the M1 project generates a real income growth of about 2 per cent across all rural farm household categories. A 2 per cent increase is also observable in rural non-farm households and urban households only in the highest quintile. Finally, table 1 presents the effects on key macroeconomic variables.

▶ **Table 1: Macroeconomic effects.**

Indicator	% Change
Real GDP	1.76
Inflation	0.52
Employment	0.19
Government balance	8.06
Trade balance	0.82
Household (private) balance	2.07

Source: Authors' calculation

The results of the simulations shows that M1 project will generate real GDP growth and employment growth accompanied with inflation. The GDP growth is relatively large due to the various goods and services required to implement the project. However, the employment effect is not that large, this could be because the expenditure on labour cost in the construction sector was not entered in the model to obtain the direct employment effects of the project. The results also show an improvement in the real government and private balances as well as an improvement in the trade balance.

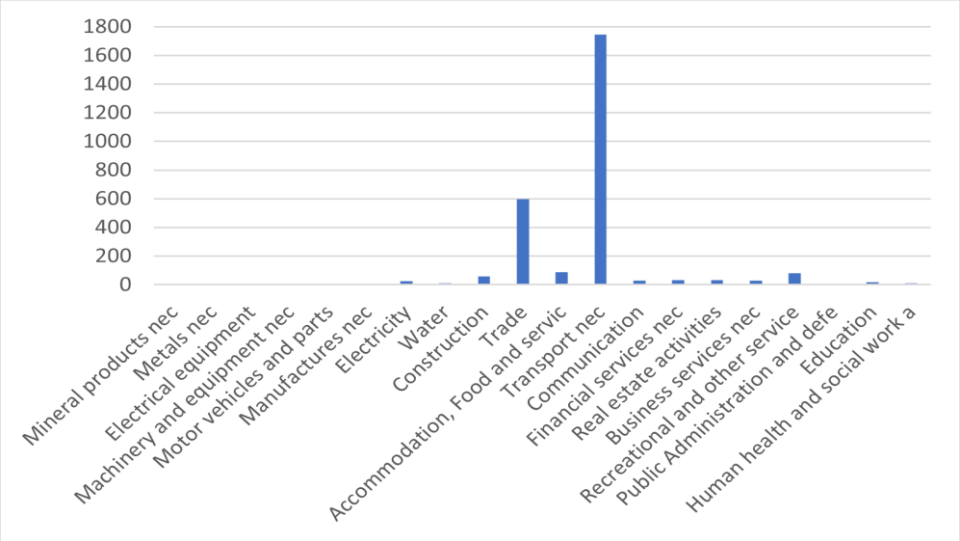
5.4. Permanent Employment Effects

As mentioned in section 5.1, the permanent effect of the project materializes once the road has been rehabilitated and is in full use. This situation increases the capacity of the transport sector (where output was constrained in the short run). Estimating the permanent effects requires linking the investment to the increase in capacity ("capacity effect"), which can be a challenging task. To do this, we use the well-established concept of Incremental Capital Output Ratio (ICOR), which measures how much additional capital is required to produce an additional unit of output. Thus, the inverse of this variable captures how much output capacity can be obtained with an additional unit of investment in the sector under study.

The increase in capital stock in a sector (a stock variable) can be approximated by the investment in that sector (a flow variable), called "investment by destination". However, the data available from national accounts and input-output tables provide "investment by sources", which is the total demand of capital goods by each sector instead of "investment by destination" (how much capital accumulation each sector is receiving). This type of information can be found in a SAM with a disaggregated Gross Fixed Capital Formation (GFCF) account where the relationship between the demand of investment

goods by source can be captured on the rows and by destination in the columns. Unfortunately, this information was not available in the Malawi IFPRI nor the GTAP SAMs. For this reason, we used the estimation from UNCTAD (2014), which sets the ICOR for Malawi to 3.84. The additional transport capacity built by the M1 project pushes the economy towards a higher level of output and employment, permanently in the sense that the economy is at higher equilibrium level of activities. This employment effect amounts to 2,950 jobs which are considered "permanent" since they will remain after the project's conclusion. Figure 7 shows the sectors in which these "permanent" jobs will be created. The majority of the jobs, about 80%, are generated in the transport and trade sectors where 599 and 1,747 jobs are created respectively. This result is not surprising because retail trade sectors tend to depend heavily on the transport sector.

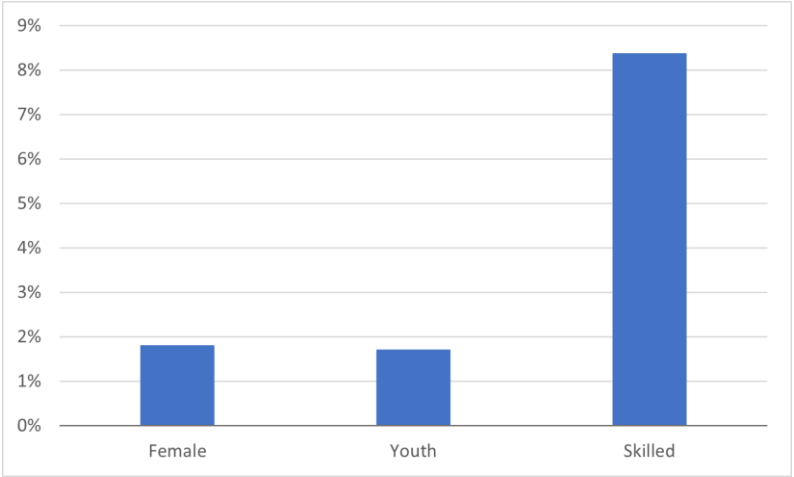
Figure 7: Permanent Employment Generation by Sectors.



Source: Author's calculations

As indicated in Figure 8, the bias patterns for age, gender, and skilled workers are similar for both the temporary and permanent employment effects of the project. This suggests that the permanent employment effects tend to benefit female, young, and skilled workers relative to the national shares. Furthermore, the biases towards female and skilled workers are more prominent in the employment generated by the permanent effects than in the temporary ones (1.8 per cent compared to 0 per cent for female workers, and 1.7 per cent compared to 0.5 per cent for youth workers). The most significant difference in bias is for skilled employment, which increases from 1.87 per cent to 8.4 per cent.

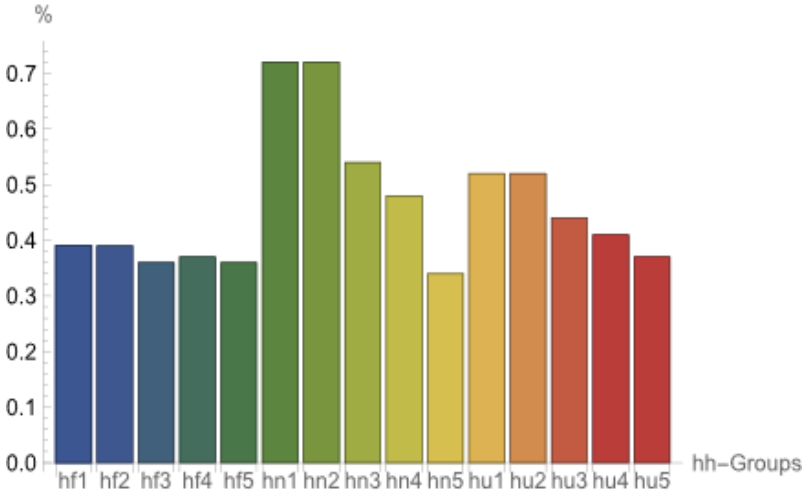
Figure 8: Permanent Employment Bias by Gender, Age and Skill.



Source: Authors' calculation

As illustrated in Figure 9, the project affects the real income growth of households with a real income growth of about 0.4 per cent for the farming rural households, as well as for the higher quintiles of urban households. The higher effect is observed among the lower quintiles of the non-farming rural households and urban households (0.7 and 0.5 growth, respectively).

▶ Figure 9: Permanent effects on household real income growth.



Source: Authors' calculation

On the macroeconomic effects, the completion of the project expands the transport sector's capacity and reduces transportation costs which stimulates economy-wide activities allowing the real GDP to grow by 0.42 per cent and employment by 0.04 per cent. This growth is accompanied by a slight downward pressure on the price level, caused by the reduced transportation costs of goods and services, a cost-pull deflation for all other sectors. Other macroeconomic effects include an improvement in the real government and private balances and slight worsening of the current account balance.

▶ Table 2: Macroeconomics effects.

Indicator	% Change
Real GDP	0.42
Inflation	-0.34
Employment	0.05
Government balance	0.21
Trade balance	-0.02
Household (private) balance	0.37

Source: Authors' calculation

6. Conclusion and Recommendations

Through the External Investment Plan, the European Union is supporting Malawi's M1 road rehabilitation project. The project aims at improving access to trade and essential services, fostering regional integration, strengthening growth, and reducing the time and cost of transport along the Common Market for Eastern & Southern Africa (COMESA) North-South Corridor. This ex-ante employment impact assessment has produced three kinds of employment impacts: direct, temporary, and permanent. Direct employment effects were obtained from projections using information provided by the construction companies across the rehabilitated sections of the M1 road. The temporary and permanent job effects were obtained conducting a simulation exercise using the ILO's Structural Model for Sustainable development (SMSD), which was calibrated based on the 2014 Malawi IFPRI SAM.

The assessment finds that 3,932 direct jobs can be created by the implementation of the M1 road project. Most of them are male young workers with varying skill levels across the different lots. A sizeable impact on temporary employment is found, resulting in the creation of 11,977 temporary jobs. Most of these jobs are generated in the retail trade sector, followed by the Human health and social work sector. The temporary jobs tend to favour young and skilled workers, while no bias is found for female workers. The permanent employment effect of the M1 project amounts to 2,950 jobs. Most of them are generated in the transport sector followed by the retail trade sector. The permanent jobs tend to favour female, young and skilled workers, however the extent of this positive bias is bigger for skilled workers.

Although the M1 road rehabilitation project is estimated to provide a substantial positive employment impact, certain aspects of this job generation are worth discussing. For example, most of the jobs generated by the implementation of the project fall in the category of "temporary". However, this does not need to be the case if those workers gain the necessary experience and skills that can make them employable in projects with similar labour needs. Thus, one recommendation from this study is that infrastructure projects such as the M1 road could incorporate skill building initiatives to strengthen the employability of workers in future projects where their experience and skills are needed.

The negative gender bias in the direct jobs generated by the project is a source of concern, while not entirely surprising since these jobs belong to the construction sector typically male-intensive. The gender bias observed in the direct employment could be address by promoting gender-sensitive hiring policies and workplace policies that encourage female workers to opt for jobs in this sector.[6] The permanent employment effects obtained in this study might be encouraging since they are likely to be long-term and relatively formal. Since these jobs already tend to favour female and young workers, we recommend that the sectors where the permanent jobs creation takes place, labour policies should focus on transforming those jobs into decent jobs.

It is important to mention that the model used in this study assumes that labour is abundant in every sector. That is for every amount of labour demanded there will always be available workers to do the job. However, for some sectors the labour demanded might not be available due to skill constrains. Thus, a skill gap analysis can complement this study, and once the skill constraints have been identified, skill-building policies can be implemented at a sectoral level.[7]

The SMSD modelling framework allows us to capture structural features of low-income developing countries like Malawi. Features such as commodity dependence, sector constraints, uneven distribution of income and high un and underemployment levels are well captured by the SMSD model. However, certain aspects of the modelling can be improved. For example, the reference SAM utilized in this study dates to 2014 (the latest available). Although the model generates results based on the structure (shares) and not on levels data represented in the SAM, the results could be improved using a more recent SAM. The model also assumes a constant productivity, which might result in an upward bias in estimating employment outcomes. Empirical studies on the evolution of labour productivity in Malawi could help overcome this limitation. Currently, the model assumes that labour supply is abundant with a fixed nominal wage. However, labour abundance and sluggish wage growth does not have to be the case for all labour categories. For example, some sector might have a labour shortage due to the lack of skilled workers. Hence, adjustment mechanism based on different and occupational categories can be incorporated in the model. Finally, the level of aggregation of the sectors in the model does not allow to capture the details of the sector where the project is implemented. However, disaggregating the sector in a SAM can be extremely costly, hence careful interpretations of the results are in order. Perhaps complementing the study with a sector specific analysis can also be of help. However, with the present model, we obtain

[6] For examples of labour policies in this area. See: Employment Policy Brief: Building a gender-equitable future through Employment Intensive Investment Programmes (ilo.org) (ILO 2019); and Illustrated guidelines for gender-responsive employment intensive investment programmes (ilo.org) (ILO 2016).

[7] The ILO has experience providing technical assistance for its constituents in these areas.

useful insights on the potential employment and macroeconomic impacts for the M1 road rehabilitation project. Which has allowed us to methodically assess the temporary, permanent, and macroeconomic effects of the project.

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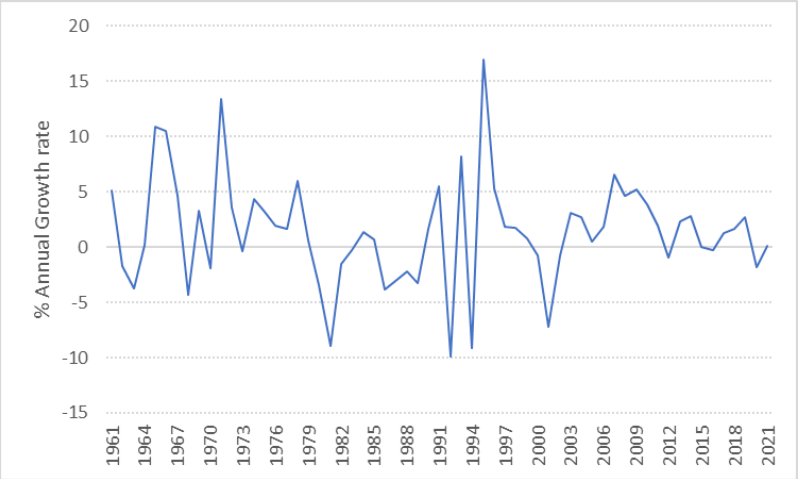
Annex 1

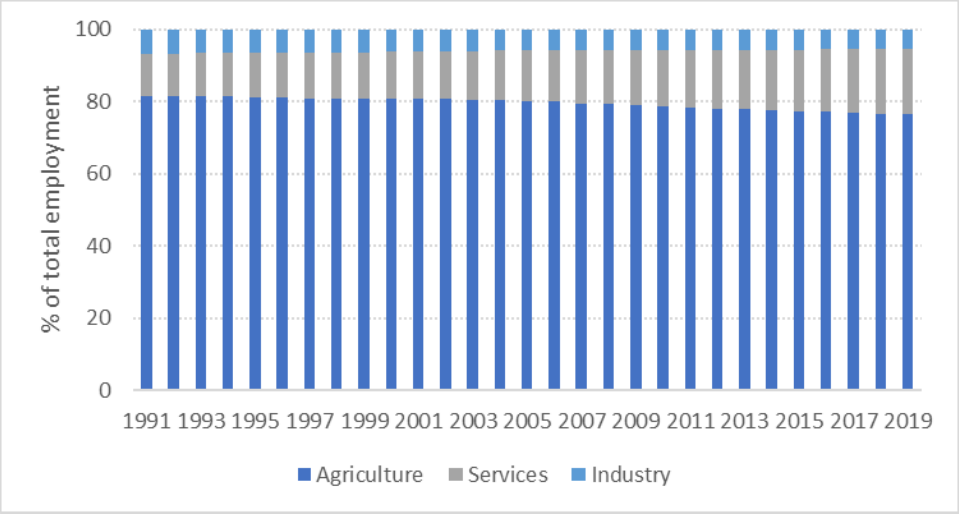
Figures

Figure A1: Malawi GDP per capita growth (annual %).



Source: Authors' construction using World Bank data (2023)

Figure A2: Malawi Employment by Sector.



Source: Author's construction using World bank data (2023) (Modelled ILO estimate)

Tables

▶ Table A1: Malawi road network.

Road Class	Paved		Unpaved		Total	
	km	% Share	km	% Share	M	% Share
Main	2,976	69.0%	381	1.8%	3,357	13.5%
Secondary	513	11.9%	2,612	12.7%	3,125	12.5%
Tertiary	14	0.3%	4,077	19.8%	4,121	16.5%
District	8	0.2%	3,492	16.9%	3,500	14.0%
Urban	771	17.9%	577	2.8%	1,348	5.4%
Community Roads	-	0.0%	9,478	46.0%	9,478	38.0%
Total Road network	4,312		20,617		24,929	

Source: RA Five Year Strategic and Business Plan 2017 – 2022

▶ Table A2: Malawi Economic Indicators.

	2019	2020	2021	2022	2023
GDP (Current, US$-Billion-Bn)	11.0	11.8	12.2	12.0	11.8
GDP per capita (Current, US$)	544	568	566	544	521
Total Investment (% of GDP)	7.8	7.5	8.4	9.8	9.6
Gross National Savings (% of GDP)	-4.8	-7.8	-6.3	-4.2	-2.5
General Government Total Expenditure (% GDP)	19	23	22	23	23
General Government Gross Debt (% GDP)	45	55	59	65	70
GDP at Constant Market Price	5.6	2.9	2.4	4.0	3.0
Inflation rate (%)	9.4	8.6	9.3	10.7	7.1
Current Account (US$-Billion)	-1.31	-1.68	-1.92	-1.82	-1.79
Current Account (in % of GDP)	-11.9	-14.2	-15.8	-15.1	-15.1

Source: Author's construction using data from International Monetary Fund, World Development Indicators (2023), and World Economic Outlook Database

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