Measuring Total Employment Effects: a lean data methodology for a portfolio of investments in developing countries

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Abstract

This paper describes a methodology developed by CDC Group plc and Steward Redqueen to measure the total number of jobs and livelihoods that are likely to be supported by businesses in a large and diverse investment portfolio in Africa and South Asia. The theory of change behind the methodology is that private sector investment, as provided by development finance institutions (DFIs), helps a business to grow. This growth requires more inputs. The additional inputs, be they direct labour or intermediary products and services, result in additional employment opportunities. Outputs such as power and loans also enable businesses to grow. The methodology, trialled by CDC for three consecutive years, is a 'lean data' approach: basic headcount and financial data (revenues, earnings, taxes and wages) from the business are fed into a set of multipliers derived from social accounting matrices (SAMs) and labour force data to yield an estimate of the total number of jobs and livelihoods likely to have been supported by the financial flows through the business and its supply chain in a given year. The change year on year gives an estimate of potential job and livelihood creation. The researchers find that indirect employment effects are at a multiple of 7.5 to one direct job in 100 African businesses, supporting the anecdotal literature than indirect multipliers are greater in emerging markets than in the OECD. Indirect effects from power and loans have still greater multipliers. However, data quality at both national level and as reported by businesses to foreign investors in Africa and South Asia leaves much to be desired. Employment multipliers derived from SAMs are static and do not take account of structural changes. Currency effects when converting company data in to US dollars can cause aberrations in the model. The model, finally, is too generic to provide insight on the quality of the notional jobs and livelihoods supported. Given these caveats, the authors conclude that the effort has provided interesting insights but that it is uncertain whether the model provides enough granular certainty to enable impact investors to manage their portfolios to increase job creation.

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Contents

Introduction

CDC Group PLC, the UK's development finance institution (DFI), has the mission of supporting the building of business throughout Africa and South Asia to create jobs and make a lasting difference to people's lives in some of the world's poorest places.

The Department for International Development (DfID), CDC's 100% shareholder, has the ambition *"to create an unprecedented increase in the number and quality of jobs in poor countries; enable businesses to grow and prosper; and support better infrastructure, technology, connectivity and a skilled and healthy workforce"* (DfID, 2017).

CDC has a large and diverse portfolio of around 800 private sector investments across multiple sectors in 38 African and South Asian countries. The investments are a mix of direct equity, debt and indirect equity and indirect debt through local fund managers.

To meet its job creation mission, CDC directs its capital towards labour-intensive sectors such as food processing, and infrastructure and financial institutions that support labour-intensive businesses. Steward Redqueen, an economic impact consultancy, helped CDC and DFID identify these sectors by amalgamating national-level social accounting matrices (SAMs) and labour force surveys, an approach they had previously developed for multinational clients (Kapstein & Kim, 2011).

CDC collects annual data from its investee companies on their direct workforce, and has over the last decade reported year-on-year changes in the total headcount (Lerner *et al.*, 2015).

However, the jobs literature suggests that direct employment is a fraction of the indirect employment effect in supply chains and the induced effect from the spending of wages (IFC, 2013). There is also a large economy-wide effect from electricity and financial services (ODI, 2015). Measuring direct employment alone, therefore, is likely to be a poor measure of total job creation.

From 2014 to 2017, CDC worked with Steward Redqueen to develop a methodology to measure the indirect employment effects of as many businesses as possible within its Africa and South Asia portfolios. There was a minimal amount of employment and financial data available to work with. The methodology has been trialled for three consecutive years with interim results published in CDC's *Annual Reviews* (CDC, 2015; CDC, 2016). This paper explains the methodology in greater detail.

Methodology

The theory of change behind the methodology is simple: a financial investment allows a business to grow. The additional output requires more direct employment and intermediary inputs. This in turn leads to expansion among existing and new suppliers, thereby supporting and/or creating jobs. Some products and services – notably electricity and finance - remove constraints for other businesses, enabling them also to expand and again support and/or create jobs. In emerging markets, firm expansion is assumed not to displace employment in competing businesses to a significant extent.

The total employment effects that the methodology is intended to capture are five-fold[2]:

1. *Direct job effects*: at investee-level, i.e. the company or project that CDC has invested in (directly or through a fund);
2. *Supply chain effects*: within the investee's direct and indirect suppliers;
3. *Induced effects*: due to the spending of wages earned by employees of the investee and its direct and indirect suppliers;
4. *Economy-wide effects*: of financial institution lending to businesses and individuals; and
5. *Economy-wide effects*: of power generators and distributors supplying electricity to businesses to increase productivity.

In order to measure such employment effects, there are two options. The first is by direct observation. This works for one-off studies of individual businesses where the researcher has access to detailed personnel and supplier information, and can make site visits to suppliers (IFC, 2013). For larger portfolios, however, the approach is considered to be impractical (KfW, 2015a).

The second option is by developing a set of generic multipliers. Various methods have been proposed for this; this paper describes a method based on input-output models, where the results may be less precise than through direct observation but where results can be aggregated across a large portfolio and applied regularly for impact monitoring.

The multiplier-based methodology developed by CDC and Steward Redqueen relies on the social accounting matrix (SAM), which describes the financial flows of all economic transactions that take place within an economy. Using the SAM, money can be traced as it flows through.. The literature on SAMs originated in developed nations (Leontief, 1951), but recent input-output tables are now available for 120 countries, including developing countries, ranging from Benin to Zambia.[3]

Employment multipliers are now usedin a wide range of applications, from responses to economic depressions and understanding the impact of computers on employment, to global trade negotiations (GTAP, 1996), the immigration and climate change debates, and regional development (Bess & Ambargis, 2011). Job creation models have also been used to inform decisions on large public infrastructure and sporting projects, and for corporate policy (Kapstein & Kim, 2011; BT PLC, 2015). Most recently, the approach has been trialled by development finance institutions to forecast or monitor their indirect employment effects (IFC, 2013; KfW, 2015a, 2015b; FMO, 2015).

The disadvantages of the approach are well recognized in the literature (Miller & Blair, 2009). Fiona Tregenna identifies the following caveats:

"Technical coefficients of production are assumed to be fixed (although these could always be 'manually' altered in the base data should there be valid reasons for doing so). This implies no change in returns to scale and a fixed production structure with no substitution of inputs. It is also assumed that prices do not change. Employment multipliers are thus most

[2] This methodology does not attempt to measure the employment effects of tax payments by the business, nor the effects of knowledge spillovers.

[3] Global Trade Analysis Project, www.gtap.agecon.purdue.edu/databases/regions.asp?Version=9.211, accessed 4/8/2016.

accurate for projecting the employment effects of relatively small and short-term changes in demand. Furthermore, the simplest way of computing employment multipliers assumes that there are no supply or capacity constraints, although these could be built into a model. Another consideration in the calculation of employment multipliers is that, unless imported intermediates are separated out, the backward linkages and thus the employment multipliers are not confined to the domestic economy, and may thus be overstated (with this being uneven across sectors depending on how much of a sector's intermediate inputs are imported). Finally, it should be noted that, unlike for example a computable general equilibrium (CGE) model, IO or SAM analysis does not deal with monetary policy, savings, innovation, and so on. Employment multipliers thus do not account for the effect of changes in demand for the output of a given sector on employment through such channels" (Tregenna, 2015).

Mitigating these drawbacks, for example through direct observation of employment at suppliers or through the use of CGE models, would be a costly exercise and arguably impracticable for investors backing multiple businesses in multiple countries. .

Relevant SAMs were accessed from the Global Trade Analysis Project (GTAP). Contrary to popular conceptions, there are reasonably recent SAMs available for the majority of 31 African and South Asian countries: 31 in the most recent GTAP database. These SAMs cover 57 sectors, across three reference years: 2004, 2007 and 2011. From the GTAP resource, we produced four national and eight regional composite SAMs to cover Africa and South Asia (see Table 1).

Table 1: National and regional SAMs

Country or region	Social Accounting Matrices used (SAMs)
Kenya	Kenya
Nigeria	Nigeria
South Africa	South Africa
Central Africa	Rest of central Africa (Central African Republic, Chad, Congo, Equatorial Guinea, Gabon, Sao Tome and Principe), South Central Africa (Angola, DRC)
East Africa	Ethiopia, Rwanda, Tanzania, Uganda, Rest of Eastern Africa (Burundi, Comoros, Djibouti, Eritrea, Mayotte, Seychelles, Somalia, Sudan)
Indian Ocean	Mauritius, Madagascar
North Africa	Egypt, Morocco, Tunisia, Rest of Northern Africa (Algeria, Libyan Arab Jamahiriya, Western Sahara)
Pan- Africa	All African countries
Southern Africa	Botswana, Malawi, Namibia, Mozambique, Zambia, Zimbabwe, Rest of South African Customs Union (Lesotho, Swaziland)
West Africa	Burkina Faso, Cameroon, Cote d'Ivoire, Ghana, Senegal, Rest of Western Africa (Cape Verde, Gambia, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Saint Helena, Ascension and Tristan Da Cunha, Sierra Leone)
India	India
South Asia	Bangladesh, Pakistan, Sri Lanka

The 57 sectors were amalgamated into 16 broader sectors. For each sector, an employment intensity multiplier (jobs per US$ of output) was calculated, based on GDP and employment per sector derived from the 15 countries for which recent

economic and labour force data was available.

The methodology then applies these multipliers to data on financial flows generated by each business operating in that country/region and sector, to estimate the indirect employment effects.

Calculations

As indicated in section 2.1 we distinguish between direct, supply chain and induced effects.

3.1 Direct effects

The direct employment at the business itself uses hard data reported to CDC annually by the investee business, in full-time equivalents and broken down by gender where this is reported.

3.2 Supply chain effects

Supply chain expenditure is based on the cost of goods sold (COGS).[4] Where COGS is not reported by companies, as it often isn't, it can be estimated as the residue of sales revenue minus earnings minus wages minus taxes. The proportion of COGS directed domestically is derived from the SAM. The domestic COGS estimate is routed through the SAM in order to calculate the output generated at its direct suppliers and their suppliers. These outputs are multiplied by the relevant sector-specific employment multipliers to estimate the jobs and livelihoods effect in the supply chain.

$$\left[\begin{matrix}\text{Related}\\ \text{indirect output}\end{matrix}\right] \times \left[\frac{\text{Employment}}{\text{Output}}\right]$$

3.3 Induced effects

To calculate the induced effects resulting from the spending of wages the methodology takes business-level data on actual wages paid in the business and prevailing wages earned in the relevant sectors of the supply chain and routes these through the SAM to determine where wages are spent. Multiplying the resulting output by the applicable sector-specific employment multipliers gives an estimate of the jobs and livelihoods resulting from the spending of wages.

3.4 Effects of loans from financial institutions

The methodology here is derived from work first developed for Standard Chartered Bank plc, by treating the loan book of a financial institution (FI) as a series of financial flows into specific sectors which the FI lends to (Kim & Kapstein, 2014). The sectoral allocation of the loan portfolio is normally reported by FIs in their annual reports as part of their risk reporting. Bank loans to government are not routed through the model. Because of leverage, the employment effects are expected to be quite significant.

3.5 Effects of electricity from power generation and distribution companies

The methodology here involves calculating what amount of GDP is attributable to an increase in gigawatt hours (GWh) of electricity supplied to the national system. A recent study in Uganda found that a 1% increase in electricity in the period 2011-14 was responsible for an increase of 0.06% in GDP (Steward Redqueen, 2016). This additional GDP is then allocated sectorally according to the prevailing economic structure of the host country. Because

[4] Where COGS is not available, it can be estimated as the residue of sales revenue minus earnings minus wages. The proportion of COGS directed domestically is derived from the SAM.

power generators tend to operate at maximum efficiency, the model tends to show large numbers of jobs supported but little incremental job creation unless new capacity is added or unless electricity distributors can decrease technical and non-technical losses.

3.6 Effects from other activities

The methodology does not attempt to model employment effects from other goods and services such as improved logistics. Nor does it attempt to model the employment effects of payments to government (taxes, royalties etc.).

3.7 Total employment effects

The total jobs and livelihoods likely to be supported by the business is then the sum of the direct employment, the supply chain effect, the induced effect and, if a power or financial sector investment, the economy-wide effect.

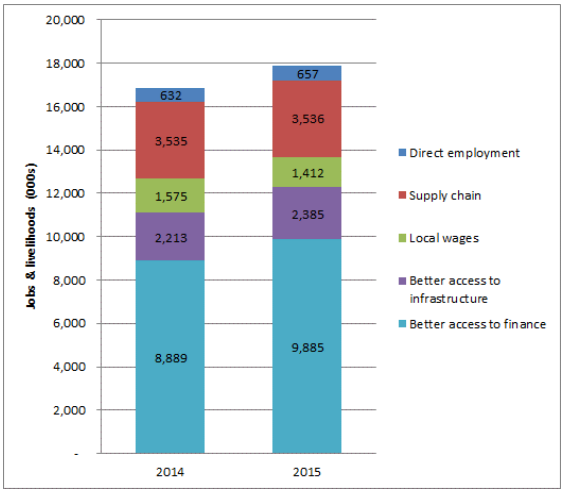
When the exercise is repeated annually, the difference in the total employment effect year-on-year gives one way of estimating 'job creation': the increase in the total jobs and livelihoods footprint of the group of businesses.

Results

As hypothesised in the literature (IFC, 2013), we discover that the indirect and induced employment effects are indeed substantial in a sample of 484 African and South Asian businesses. As expected, the largest effects were from power and, particularly, from loans.

The results for 2014 and for 2015 are shown in Figure 1 below.

Figure 1: Jobs and livelihoods estimated across 484 businesses in Africa and South Asia, 2014 and 2015



Across the portfolio, we found that on average each direct worker is associated with over five supply chain jobs and a further two jobs resulting from the wage effect of the firm and its supply chain.

Across both effects, each direct worker is associated with 7.8 jobs and livelihoods (see Table 2).

Table 2: Employment multipliers: average indirect jobs & livelihoods associated with each direct worker across 484 businesses

	Supply chain	Wages	Supply chain and wages
2014	5.59	2.49	8.09
2015	5.38	2.15	7.53
Average	5.49	2.32	7.81

These multipliers are indeed larger than those typically found in OECD countries, as hypothesized in the literature. While the supply chain effect is greater, the wage effect is also significant.

The difference in multipliers between 2014 and 2015 is primarily as a result of currency effects, rather than illustrating any structural change in the host economies. Over time, however, we would expect these multipliers to shrink and converge towards OECD norms.

But this would require economic growth to be shared broadly across economies. If growth were to be concentrated in certain sectors of the economy and in the high-performing businesses that DFIs invest in, then employment multipliers would remain stable or even grow.

Discussion

Despite some challenges in data quality and completeness, the methodology does allow for the aggregation of direct and indirect employment effects across an investment portfolio that encompasses many hundreds of businesses across multiple regions and sectors, a task that could otherwise appear daunting to investors like DFIs that may wish to aggregate results for impact monitoring and reporting.

It is important to emphasize the following limitations inherent in the methodology:

a) Employment effects are driven by the total productivity of the business, deriving from capital, labour and residuals. DFI investment is one among many inputs to business growth and so the results should only be attributed to the individual businesses in their entireties.;

b) Business growth impacts on the inter-relationships between sectors within an economy (for example, through competitive effects and displacement), but our methodology is not dynamic and does not take into account likely changes in employment intensity;

c) Supply chain impacts are calculated using sectoral averages. In reality, each business has a unique way of procuring its goods and services, and businesses backed by DFIs are likely to be atypical of their sectors (they may be more capital intensive, for example);

d) Other firm-level development impacts (e.g. from tax contributions, product innovations, foreign exchange savings from exports, knowledge spill-overs) are not accounted for, even though they likely create further employment impacts; and

e) The methodology is dependent on the quality of firm-level data and national statistics, both of which can be unreliable in Africa (Jerven, 2013) and South Asia. The results in this paper are generated from 484 businesses, which is 83% of the eligible businesses in the portfolio.

f) The methodology can estimate the proportion of jobs and livelihoods likely to be available to women, based on sectoral averages. But it does not otherwise give any indication as to whether the modelled jobs are likely to be good quality jobs as envisaged in global goal 8 on decent work and economic growth. The most that can be said is that the jobs are likely to be typical of average labour standards in the relevant sectors and countries included.

Further research is clearly required to test the many assumptions in the model. After the third year of results, CDC will evaluate the suitability of the model for ongoing monitoring of employment effects across its portfolio. In the mean time we invite we invite critique and comment on the methodology.

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Appendix A: Data sources

Investment-related data are retrieved directly from CDC which in turn are collected either by the client or CDC itself, but macroeconomic data are retrieved from various public sources. See Appendix B for background information on the data used by the tool per indicator.

Source	Description
GTAP Data Base	The Global Trade Analysis Project (GTAP) is a global database describing bilateral trade patterns, production, consumption and intermediate use of commodities and services consisting of over 100 tables for individual countries or a group of countries and 57 sectors. The database uses input from a global network of institutes, researchers and policy makers conducting quantitative analysis of international policy issues. It is coordinated by the Center for Global Trade Analysis in Purdue University's Department of Agricultural Economics.
World Bank Development Indicators Databank	These are the primary World Bank collection of development indicators which are compiled from officially-recognised international sources. It presents the most current and accurate global development data available, and includes national, regional and global estimates.
National Statistics	Country-based statistical information are compiled and produced by National Statistical Offices and Central Banks.
IEA Energy Statistics	The International Energy Agency (IEA) coordinates a database with statistical information on energy production, consumption and prices across various regions and countries.

GTAP		
Data	**Base year**	**Input to**
Firms' domestic purchases (in mln USD)	2011	SAM
Household & government domestic purchases, exports (in mln USD)	2011	SAM
Firms' expenses on endowments (in mln USD)	2011	SAM, capital intensities
Corporate income tax, payroll tax, import duties, commodity tax, consumption tax, other taxes (in mln USD)	2011	SAM
Firms' imports (in mln USD)	2011	SAM
Total capital stock (in mln USD)	2011	Capital intensities

WORLD BANK DEVELOPMENT INDICATORS DATABANK		
Data	**Base year**	**Input to**
Gross fixed capital formation, private sector, per country (% of GDP)	2007-2011	Capital intensities

Gross fixed capital formation, per country (% of GDP)	2007-2011	Capital intensities
Electric power consumption, per country (in kWh)	2007-2013	Forward effects
Electric power transmission and distribution losses (% of output)	2007-2013	Forward effects
Total GDP , per country (in current USD)	2007-2013	Forward effects

NATIONAL STATISTICS

Data	Base year	Input to
Total employment per sector for Algeria, Angola, Bangladesh, Egypt, Ghana, India, Kenya, Nigeria, Pakistan, South Africa, Sri Lanka, Tanzania, Uganda, Zambia	2012-2014	Employment intensities
Total GDP per sector for Algeria, Angola, Bangladesh, Egypt, Ghana, India, Kenya, Nigeria, Pakistan, South Africa, Sri Lanka, Tanzania, Uganda, Zambia	2012-2014	Employment intensities
Credit to private sector, per sector for Ghana, India, Kenya, Nigeria, Tanzania, Uganda (in %)	2012-2014	Sector breakdown of loan portfolio of FIs

IEA ENERGY STATISTICS

Data	Base year	Input to
Total electricity net consumption, per country (in bln kWh)	2010-2011	Forward effects

Appendix B: Definitions

Term	Definition
Capital-intensity	The amount of output per US $ 1 of capital.
Direct employment	Total FTEs at the investee business/end-beneficiary of CDC's investment.
Employment-intensity	The number of jobs per US $ 1 of output.
Forward employment	Jobs that are supported at direct consumers of electricity that can be related to CDC's investments.
Full-time equivalent (FTE)	The equivalent of one person working full time as defined by local laws.
GDP- intensity	The amount of output per US $ 1 of GDP.
Induced employment	Total FTEs related to the re-spending of salaries earned by employees of the CDC investee/end-beneficiary investee and its (in)direct suppliers that are related to CDC's investment.
Job multiplier	The number of jobs per US $ 1 million invested.
Jobs created	The difference of jobs supported between two years, indicating a net or incremental change.
Jobs supported	Total number of jobs supported in a specific year.
Supply-chain employment	Total FTEs at the investee/end beneficiary's direct and indirect suppliers that are related to CDC's investments.
Total employment	Sum of all jobs related to CDC investment at a particular moment in time per annum. Expressed in full-time equivalent (FTE).

Appendix C: Assumptions

In order to have a consistent methodology, the tool uses a number of assumptions. However, to make it fit the full range of CDC's portfolio there also some exceptions required.

Assumptions	
Employment	1. Country-specific employment intensities are used for India, Kenya, Nigeria and South-Africa. For all other countries we make use of employment proxies specific to the region in which the country resides.
	2. Employment intensities differ per formal/informal investee type as the formal sector is considered to be 70% more productive than country average of the formal and the informal sector.[5] • Rule is applied to Manufacturing, Construction, Trade, Communication, Transport and Other services • Mining, utilities and financial and business services are considered to employ only formal jobs • Agriculture is considered to employ only informal jobs
	3. Formal SMEs are considered to generate 33% and formal corporates 67% of formal GDP. Distinction between SMEs and corporates based on output per employee.
	4. Formal SMEs are considered to employ 45% and formal corporates 55% of formal employment.
	5. CDC investees are considered to operate in the formal sector meaning the following intensities per round of impact: • Direct based on formal intensities per investee type (exc. Micros) • Indirect based on country average • Induced based on country average
Spending patterns	6. Micros/SMEs and corporates in the same sector and country/region have the same spending patterns.

[5] Source: *IFC SME Access to Finance in the Developing World*