Foreign Aid through Domestic Tax Cuts? Evidence from Multinational Firm Presence in Developing Countries*

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August 12, 2021

Abstract

This paper studies how corporate tax cuts in developed countries affect economies in the developing world. We focus on one of the most prominent fiscal policies – the corporate income tax regime – and study a major U.K. tax cut as an exogenous shock to foreign investment in Africa. Difference-in-differences estimates show that multinational U.K. firms increase their subsidiary presence in sub-Saharan Africa by 12-24% following the U.K. tax rate reduction after 2009. Exploiting location-specific nighttime luminosity as well as local African survey data from the African Demographic and Health Surveys, we document that these increases in U.K. subsidiary presence are also associated with increased economic activity and higher employment rates of African citizens within close proximity (10km) of local U.K.-owned subsidiaries. Our findings imply that, beyond the goal of motivating home country investment, developed countries' corporate tax cuts are a channel for economic impact in developing countries.

Keywords: Multinational Firms, Tax Reform, Foreign Investment, Economic Development

JEL classifications: D22, D25, F14, F21, F23, F63, J23, O1

*We thank Alex Edwards (discussant), Daphne Armstrong, Douglas Jean Laporte, Stacie LaPlante, Elias Papaioannou, Thomas Rauter, David Samuel and Lydia Wang for helpful comments. We acknowledge helpful feedback from workshop participants at the University of Wisconsin-Madison and conference participants at the 2021 EIASM Conference on Current Research in Taxation. We thank Julian Marenz for excellent research assistance. We acknowledge valuable research support from Zhiyan Chen, Inga Schulz, and Lydia Wang. Marcel Olbert gratefully acknowledges financial support from the Wheeler Institute for Business and Development at London Business School. Daniel Klein and Marcel Olbert acknowledge funding from the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – Project-ID 403041268 – TRR 266 (Accounting for Transparency).

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1 Introduction

This paper studies whether corporate tax cuts in developed countries stimulate foreign investment in developing countries. A large literature demonstrates that business investment is influenced by tax policy (e.g., Devereux and Griffith, 1998; Desai et al., 2004; Djankov et al., 2010; Ohrn, 2018; Suárez Serrato and Zidar, 2018; Giroud and Mueller, 2019), but generally this work focuses on the role of corporate taxes in stimulating investment activity within the home jurisdiction. While prior work generally documents a positive association between corporate tax cuts and investment in the same jurisdiction, we examine whether tax rate reductions in one country are also associated with *foreign* investment. We focus on developing nations in particular to evaluate whether domestic corporate tax cuts indirectly serve as a form of indirect foreign aid. We show that major corporate tax cuts in the U.K. result in greater multinational firm investment in sub-Saharan Africa, ultimately increasing economic activity and employment in the local markets.

Understanding the role of developed countries' investment in developing nations is important for a variety of reasons. First, while FDI contributes to economic growth, the extent to which this is effective in developing countries with weak institutions is unclear (Alfaro et al., 2004; Lensink and Morrissey, 2006). Thus, empirical evidence is essential for better understanding the role of FDI in developing countries such as those in Africa (Barro, 1991; Englebert, 2000; Ghura and Hadjimichael, 1996; Savvides, 1995). Second, the potential consequences of multinational firm presence for developing countries is ambiguous. If FDI and domestic investment are complements (Desai et al., 2004, 2005), multinational firm investment could stimulate economic growth and have large spillover effects in the local economy. However, multinational firms have been accused of exploiting local markets through natural resource extraction or the use of sweatshops and thus may provide little overall benefit (e.g., Bond, 2006; Harrison and Scorse, 2010). Further, foreign firms may simply compete with local firms for a fixed market base, contributing little to the overall economic well-being of the country aside from the indirect effects of increased competition. Third, while direct development transfers to developing countries provide aid, there are limits to the effects such direct policies can have. Quantifying the extent of other fiscal policies, as well as the role of private sector investment in disseminating capital (Cravino and Levchenko, 2017), informs the amount and type of spillover effects that

can occur in these countries.

Our empirical tests focus on a major tax cut in the U.K. as a shock to multinational firms' investment in developing African nations. We use this particular tax change for three reasons. First, the U.K. tax system underwent a variety of changes, with planned rate reductions announced in 2010. These rate reductions were passed explicitly to stimulate domestic corporate investment in the U.K, with policymakers committing to reduce the corporate tax rate from 28% to 20% by 2015 (Bowers, 2010; Liu, 2020).[1] Thus, the tax cut was salient and substantial enough to have a significant impact on corporate investment. Second, because the primary focus was to encourage domestic investment in the U.K., the rate change provides a powerful and exogenous setting to study foreign investment activity. While domestic tax policy is often endogenous to corporate decisions and growth in domestic markets (Romer and Romer, 2010; Giroud and Rauh, 2019), our study does not face this challenge because tax policy is likely not endogenous to corporate decisions in markets outside the home jurisdiction. Third, the U.K. is home to hundreds of multinational firms and has close historical and colonial ties with Africa. Thus, the presence of multinational U.K. firms in Africa is a plausible and economically meaningful channel through which spillover effects in developing economies can be realized.

We construct panel data on multinational firms' global subsidiary network for each year from 2005 to 2018 by accessing Bureau van Dijk's Orbis historical database. We focus on majority-owned subsidiary links and track subsidiaries across hierarchical layers in nearly all countries of the world.[2] Our multinational firm data covers nearly 20,000 unique multinational firms headquartered in 139 countries. From these multinational firms, we observe 47,306 unique subsidiaries in 46 African countries, with a total of 263,704 subsidiary-years in the period 2005-2018. Our first set of tests study changes in multinational firm subsidiary presence as a proxy for multinational firms' investment in Africa.[3] We then hand-collect the GPS coordinates of

[1] U.K. policymakers committed to lowering the corporate income tax rate from 28% in 2009 to 20% in 2015, first lowering to 26% in 2011, 24% in 2012, 23% in 2013, 21% in 2014, and 20% in 2015. These rate drops were legislated in advance, so firms could anticipate and make investments that anticipated these new, lower rates (Ivanov et al., 2020).

[2] While financial accounting data is typically only available for subsidiaries in developed countries that mandate the publication of financial reports, particularly in Europe, Orbis carefully collects data on legal entity ownership from business registers and various database providers worldwide. Further, the database providers use both a bottom-up and top-down approach to identify corporate ownership links. We can thus track firm-level FDI in terms of equity ownership in foreign subsidiaries in over 46 African countries over time. See De Simone and Olbert (2021) and Olbert (2021) for details of constructing multinational firms' subsidiary networks.

[3] We observe an increase in the number of foreign-owned subsidiaries in our sample countries over time, reflecting both an increase in multinational investment and improved coverage in the database. In supplementary tests, we validate that subsidiaries in the dataset that are used in the main analysis are true subsidiaries. Based on

multinational firm subsidiary locations to link multinational firm presence to local economic outcomes. Using nighttime satellite imagery and local survey data, we study how economic activity and employment changed around the U.K. tax reform conditional on U.K. multinational firms being present in local areas.

Our first set of tests compare the presence of U.K.-owned subsidiaries in Africa around the U.K. tax cut with that of subsidiaries owned by comparable multinationals headquartered in other developed countries. We find that U.K. multinational firms increased their number of subsidiaries in African countries by 12% after the tax cut relative to the control group. This increases to 24.3% in the sample conditioned on multinational firms already operating in a given African country. Limiting the control group to (i) multinationals from OECD countries, (ii) multinationals from countries with former colonial ties to Africa, or (iii) multinationals from France yields consistent results. Throughout all specifications, host country-by-year fixed effects control for the economic and political development in the specific African countries, and thus hold key determinants of FDI constant (Asiedu, 2006). Further, results are robust to controlling for time-variant multinational firm and headquarter country characteristics. We also confirm that the parallel trends assumption is likely to be met, as foreign-owned subsidiary presence was not statistically different between treated and control firms prior to the reform. The U.K. tax cut-induced investment effect is present immediately in 2010 and becomes stronger in later years as the corporate tax rate further declines.

Additional analyses demonstrate predictably larger effects in important cross-sections, mitigating concerns that other U.K. policies or events drive the observed results. Those firms that should benefit the most from the U.K. tax cut, measured based on having relatively higher pre-change tax rates, exhibit the greatest increase in subsidiary presence post-reform. Moreover, former U.K. African colonies are especially likely to receive additional U.K. investment following the U.K. tax cut, with larger increases equivalent to 27.4-29.8%. We also observe effects in the labor-intensive industries of Manufacturing and, to a lesser extent, Construction, implying large potential employment spillovers in the local economy. Firms active in the natural resource

the legal entities available in Orbis throughout the sample period, we hand-collect detailed industry, location, and legal information on all U.K. subsidiaries in Africa (outside South Africa, as the number of South African entities would make the handcollection exercise much more costly). We use this hand-collected information to a) validate the existence of U.K. firms' African subsidiaries, b) match their exact location to local employment data and c) exploit location-specific nighttime satellite image data to test for changes in economic activity in the area of the U.K. subsidiaries around the U.K. tax reform. We conduct and discuss several tests to validate the data further.

extraction sector do not drive our results.

We then examine the broader effect of the U.K. tax change on local economic outcomes around the multinational firm facilities. We first assess whether economic activity – including that of both new establishments as well as existing establishments that may have benefited from tax-related investment – surrounding U.K. subsidiaries changes following the U.K. tax reform. To proxy for local economic activity, we use geo-coded nighttime luminosity obtained from the United States Air Force Defense Meteorological Satellite Program (DMSP) (Henderson et al., 2011, 2012; Chen and Nordhaus, 2011; Gennaioli et al., 2013; Michalopoulos and Papaioannou, 2013). We construct 10 km grid-cell radii around each subsidiary location and measure changes in luminosity from the pre to post-reform period. Estimation requires us to identify the address of the U.K. subsidiaries in Africa, which necessarily reduces the sample. We find a 4.5-9.7% greater increase in luminosity following the tax cut in those grid-cells containing a U.K. subsidiary as compared to both i) relatively near grid cells with similar pre-reform luminosity values but no U.K. firm presence, and ii) other grid-cells with a French subsidiary.

Second, while luminosity data proxy for a variety of economic outcomes, we explicitly test whether employment increased in the local surrounding area. We use Demographic and Health Survey (DHS) survey data for African countries, which permits us to link the precise geographic location from each individual respondent survey to the closest U.K.-owned subsidiary in the same country.[4] We then test whether a surveyed individual living closer to the U.K. subsidiary (within 10 kilometers (km)) was more likely to be employed after the U.K. tax cut as compared to individuals living in the same general area but further away from the U.K. subsidiary. We find that employment increases by 2 to 3 percentage points relative to individuals living further away from U.K. subsidiaries. Evaluated at the sample mean, this effect represents a 4% increase in total local employment. When further refining the control sample to include only French firms, we continue to find positive effects ranging from 1.8-3.9 percentage points.

We contribute to two streams of literature. First, we build on work studying the spillovers of fiscal policy (Auerbach and Gorodnichenko, 2013; Faccini et al., 2016) and externalities of corporate tax policy in particular (e.g., Gaertner et al., 2020). Suárez Serrato (2019) shows that

[4]The DHS survey is funded by the United States Agency for International Development (USAID) and collects information from African citizens about their employment and health status. These data are used as a common measure of social outcomes in Africa (e.g., Kingdon and Knight, 2007; Hjort and Poulsen, 2019) because they do not suffer from reliability concerns that plague other available unemployment data (Jerven, 2013).

U.S. regulation aimed at reducing tax avoidance through foreign tax havens has the unintended effect of lower domestic investment due to higher overall tax burdens. Several recent studies provide evidence that international tax competition, i.e., lower corporate taxes in foreign countries, can impact investment and employment in domestic markets of developed countries (Donohoe et al., 2020; Glaeser et al., 2021; Kim et al., 2021). Only a few studies provide evidence on how domestic tax cuts affect foreign investment of multinational firms. Lester (2019) shows that U.S. firms increased foreign investment after 2004 when domestic tax burdens decreased. Glaeser et al. (2021) and De Vito et al. (2021) provide consistent evidence using large samples of European multinationals and exploiting several tax cuts. On the U.K. tax reform in particular, Liu (2020) shows that U.K. MNEs invest more abroad after the reform, and in particular the investment occurs in low tax countries. To the best of our knowledge, no studies exist on the potential externalities of corporate tax cuts originating in the developed world for developing economies.[5] We offer novel evidence on investment effects in the developing world associated with fiscal policies originating in the industrial world.

Second, we add to the work on foreign investment in developing countries, in particular on the integration of developing countries in the global economy (for reviews, see Goldberg, 2015; Paul and Singh, 2017). While host country characteristics, including corporate tax rates, have been studied in the prior literature (e.g., Hartman, 1985; Alfaro et al., 2004),[6] the role of factors in investor countries are relatively unknown. We provide novel evidence on an unexplored determinant of FDI in the developing world, namely corporate tax cuts in developed countries, adding to the literature on the integration of these developing countries in the global economy.[7] Our results suggest that multinational firm presence is a likely channel through which FDI enters and alters the African economy.

[5] Recent work finds spillover effects of OECD countries' corporate governance and disclosure regulations on the private sector natural resource extraction industry (Christensen et al., 2020*a*,*b*).

[6] See Feld and Heckemeyer (2011) for a review and meta-study on taxation and FDI.

[7] For example, Hjort and Poulsen (2019) show that the arrival of fast internet has a positive impact on employment and average incomes, and Goldberg et al. (2010) show that domestic firms in India benefit from product imports from richer countries.

2 Background

2.1 Taxes and Corporate Investment

The literature on the relation between taxes and investment generally examines increased investment within a firm's home jurisdiction (for example, U.K. investment in the U.K.). This is because the underlying policy motivation of investment tax incentives and tax rate reductions is often to motivate domestic spending. For example, Edgerton (2010) and Zwick and Mahon (2017) document U.S. corporate investment responses to changes in U.S. depreciation rules. Ohrn (2019) and Lester (2019) find corporate investment following U.S. manufacturing incentives. Studies have also examined U.S. state tax changes and international tax changes, finding semi elasticities of -0.5 for employment and business establishments at the state level (Giroud and Rauh, 2019) and notable foreign investment effects across borders (Devereux and Griffith, 1998; Feld and Heckemeyer, 2011). The implication of this literature is that corporate investment in a home jurisdiction occurs following home jurisdiction tax rate reductions.[8]

However, theoretical work demonstrates that firms should invest in the highest after-tax net present value project, regardless of jurisdiction (Modigliani and Miller, 1958; Jorgenson, 1963; Hall and Jorgenson, 1967; Hayashi, 1982). Two factors suggest that these projects may not necessarily occur in a firm's home market. First, firms were increasingly expanding their global footprint during the sample period, implying a saturated domestic market, favorable foreign growth opportunities, or both. Such foreign investment may generate a higher return given the relatively higher risk of projects, particularly in developing markets characterized by weaker institutions.

Second, firms are often not required to demonstrate increased domestic investment spending to claim corporate tax savings. Rather, firms may receive cash tax savings due to lower domestic statutory tax rates without having to demonstrate incremental domestic investment. Even in the limited case in which restrictions were imposed on the use of corporate tax savings, prior work shows that only a subsample of financially constrained multinational firms increased domestic investment (Faulkender and Petersen, 2012). Other unconstrained multinational firms in the

[8]U.K government analysis confirms that the U.K. tax rate reductions announced in 2010 intended to stimulate domestic investment. The U.K. report concludes their analysis is "broadly consistent with the wider academic literature, which finds that reductions in Corporate Tax boost investment leading to higher [domestic] GDP and partial revenue recovery" (HM Treasury and HM Revenue & Customs, 2013).

same setting instead used the cash tax savings for other corporate purposes, including non-investment activities such as corporate payout (Blouin and Krull, 2009; Graham et al., 2010).

Thus, it is plausible that new investment spending may occur offshore following a domestic tax rate change (Lester, 2019; Glaeser et al., 2021; Liu, 2020; De Vito et al., 2021). Whether and to what extent this investment occurs in developing countries is unknown but is distinct from investment in developed nations due to the welfare benefits of the direct and spillover effects. We focus on African investment in particular because of the social importance of understanding the development factors in this continent.

2.2 U.K. Corporate Tax Reform

To study the effects of corporate tax rate reductions on multinational African presence, we focus on the U.K. tax rate reductions announced in 2010. In 2008, the year prior to the corporate tax rate change, the U.K. corporate income tax rate was 28%. While lower than other developed countries at the time (for example, the U.S. corporate income tax rate was 35%), the U.K. rate was widely viewed as uncompetitive on the basis that it was above the average OECD rate of 23.98% and much higher than the low or 0% tax rates afforded by tax haven countries. Consequently, U.K. firms engaged in substantial tax planning activities to shift income, and in some cases, a firm's "real" geographic presence, to other lower-taxed jurisdictions (Tax Gap Reporting Team, 2009; Trades Union Congress, 2010; Goodley, 2010; Chapman, 2019). For example, several prominent U.K. firms reincorporated outside of the U.K. during this period, primarily to lower their tax burdens (Killgren, 2008; Kollewe, 2008; Armitage, 2008).[9]

Furthermore, the U.K. had a "worldwide" tax system wherein the profits of U.K. multinationals were taxed in the U.K. as well as in the country where they were earned.[10] By comparison, almost all other developed countries, except Japan and the U.S., had converted to a "territorial" system, in which earnings were taxed only where earned and were not subject to a second tax in the parent's home country.

In 2009, the U.K. switched to a territorial tax system. In 2010, a coalition government in

[9]Regus created a new U.K.-listed, Jersey-incorporated holding company with head office and residency in Luxembourg. Other U.K. firms, including the Henderson Group, Charter, Shire, and United Business Media, switched their tax base or residency to Ireland.

[10]To mitigate immediate double taxation of foreign-earned profits, U.K. tax regime permitted the tax to be deferred until the foreign subsidiaries paid dividends to the U.K. parent. U.K. firms also could use foreign tax credits to reduce the U.K. tax liability. This system was similar to the U.S. tax system prior to 2017 (Egger et al., 2015).

the U.K. committed to lowering the corporate income tax rate to 20% by 2015 through gradual tax rate reductions: first lowering the rate to 26% in 2011, then 24% in 2012, 23% in 2013, and 21% in 2014. These changes were perceived as substantial shifts in the U.K. corporate tax regime. For example, the British press reported that the corporate tax rate "is to be slashed by more than 14% over four years" and that "phased reductions in corporate tax will leave Britain offering companies the lowest rate of profit tax ever as well as the best in the G7 and the fifth lowest in the G20" (Bowers, 2010). The Coalition Government itself noted in 2010 that its goal was to "create the most competitive corporate tax regime in the G20."

While other countries also had tax rate reductions during the sample period, we focus on the U.K. tax rate change for several reasons.[11] First, the rate change was substantial, providing an almost 30% decline in the corporate tax burden. Such a large corporate tax rate change likely had a meaningful effect on U.K. firms' user cost of capital, a necessary condition for stimulating investment spending (Hall and Jorgenson, 1967; Hassett and Hubbard, 2002; Hassett and Newmark, 2008).[12]

Second, the U.K.'s pre-commitment to future corporate tax rates reduced regulatory uncertainty about future tax burdens. Prior work documents that policy uncertainty can affect a wide range of corporate decisions, including the decision to invest and expand (Ivanov et al., 2020; Gallemore et al., 2021). Because the U.K. rate reductions were legislated in advance, firms could more confidently make longer-term investments – such as foreign expansion – with these new, lower rates in mind.

Finally, U.K. multinational firms have a long history of investing in Africa, thereby making it a plausible investment pair to study. More than one dozen African nations were at one time colonies of the U.K., evidence of a close historical relationship shown to be positively correlated with FDI (Makino and Tsang, 2011; Glaister et al., 2020). Furthermore, European companies had a history of investing into Africa, thereby lowering the hurdle rate for businesses to further expand in Africa.

Figure 1 depicts multinational firm investment in Africa proxied by the number of multi-

[11] The Online Appendix shows that results generalize to studying relatively smaller tax changes in the four other countries with changes during the sample period, including Germany (2008), Canada (2008), Japan (2012), and Spain (2015).

[12] Consistent with the negative relation between the user cost of capital and investment, Sir Alan Budd, the Chair of the U.K. Office for Budget Responsibility, stated, "The measures to reform corporation tax, which are estimated to reduce the cost of capital faced by firms by about 3%, should have a positive effect on investment" (Bowers, 2010).

national firms' subsidiaries in a given country. The color coding the total number of foreign-owned MNE subsidiaries in Panel (A) and that of U.K.-owned subsidiaries in Panel (B) By far the most foreign investment overall as well as the most U.K. investment in Africa was in South Africa. Relative to the presence of all multinational firms, U.K. firm presence is relatively strong and particularly pronounced in former U.K. colonial countries (e.g., Kenya). In the Online Appendix, we document a growing foreign presence in sub-Saharan Africa over the sample period. We acknowledge that some of the increase is attributable to improving data coverage over time. Our empirical tests control for this and other factors to study the role of U.K. corporate tax cuts in driving this increased presence.

3 Data, Sample, and Descriptive Statistics

3.1 Multinational firm data from Bureau van Dijk's Orbis

We obtain data on firms' subsidiary structures, as well as financial and industry characteristics, from Bureau van Dijk's Orbis, which includes detailed information on over 400 million companies in the world. While financial information is missing for many legal entities incorporated in countries without regulatory financial reporting mandates, Orbis typically provides ownership links for subsidiaries and shareholders for each entity in the database.[13] This ownership data allows researchers to recreate a fairly complete picture of firms' operations through legal entities across the world and throughout several layers of ownership linkages (Coppola et al., 2021). From this information, we construct a detailed ownership history for firms based on majority equity shareholdings among entities (see De Simone and Olbert (2021) and Olbert (2021) for details of the data construction process).

The data are at the legal entity level. The ownership links in the data permit observation of whether an entity is "standalone" or if it is owned by another firm. We call a legal entity a subsidiary if it is owned by another entity.[14] Because we are focused on studying the destina-

[13] BvD collects this information for legal entities worldwide even if no publicly available financial reports are available. This information is obtained through alternative data sources, including commercial trade registers, legal documentation, M&A intelligence, and even telephone research. As the data provider also connects shareholder and subsidiary data through these various channels, the existence of certain legal entities can be measured through ownership links even if no information is directly provided by the underlying entity.

[14] The term "subsidiary" is typically used for a corporate entity. The data do not permit us to identify which entities are corporations as compared to partnerships or foreign branches, and therefore, we refer to any lower-tier entity as a subsidiary for simplicity. Our inability to observe entity type should not affect the inferences as the

tion countries of business investment, we retain only subsidiaries and use the ownership links in the data to identify each subsidiary's parent company and home country of incorporation. We observe 74,792 unique subsidiaries in 46 sub-Saharan countries, with a total of 263,704 subsidiary-years in the period 2005-2018. These subsidiaries are owned by nearly 30,500 firms from 137 home countries.

We present the number of subsidiaries by each sub-Saharan African country in Table A.1 in the Online Appendix. The greatest number of businesses are in Ghana, Kenya, Liberia, Nigeria, and South Africa. While the increase in the number of observed subsidiaries over time is consistent with the growth in globalization and FDI during the sample period, subsidiary coverage is also improving over time in the database, resulting in many more multinational firm subsidiaries in the post-period years as compared to the pre-period years. This is a concern for our empirical tests because we want to ensure that any effect we detect is attributable to the U.K. tax change and not to other factors, including a mechanical improvement in data coverage over time specific to the U.K. We address this concern about sample coverage by isolating the sample to only those multinationals with some observed presence in an African country in the pre-2009 period. Our tests focus primarily on U.K. multinational firms and their subsidiaries in Africa, comparing their activity to other multinational firms' presence on the continent.[15]

Table A.2 in the Online Appendix presents the sample based on parent firms' home countries. We separately list the countries with the greatest number of parent firms and then report the number of remaining observations across three groups that are formed based on (i) parents in the same African country as the subsidiary ("Domestic African groups"), (ii) parents in a different African country from the subsidiary ("African Multinationals"), and (iii) parents in the remaining countries in the sample ("Rest of World").

construct of interest, FDI in Africa, could occur through any of these entities.

[15]Because our tests compare U.K. multinational firms to other companies, observable changes in subsidiary presence due to changes in data coverage as discussed above would have to disproportionately affect U.K. multinational firm subsidiary coverage as compared to subsidiaries of other multinational firms for it to drive the observed results. Nevertheless, we perform a number of data checks to address concerns that the results are driven by improving coverage in the dataset over time. For example, use of the sample isolated to include only those multinationals with a pre-2009 presence in an African country builds on the assumption that, if a multinational is already reporting in a country prior to 2009, it is likely to be reporting all of its subsidiaries in existence at that time. Thus, we can attribute any newly observed subsidiaries in the dataset after 2009 to those that were newly created, as opposed to those that existed in prior years but were unreported. Section 6.2 discusses analyses of additional tests to validate the sample further.

3.2 Nighttime Luminosity from the United States Air Force Defense Meteorological Satellite Program (DMSP)

While the Orbis subsidiary data permit measurement of multinational firm presence in Africa, they do not allow us to measure important outcomes such as investment and employment spending at the subsidiary level for African subsidiaries. Therefore, we also measure African economic activity using two additional datasets.

We first proxy for local economic activity using the density of nighttime light emissions within narrowly defined regions (grid-cells) around multinational firms' subsidiary locations. The geo-coded nature of these data allows us to study spatial economic outcomes in very specific geographic areas where multinational firms operate. Prior work shows that light emissions are a more reliable, granular, and readily available proxy for economic development in the developing world than, for instance, GDP estimates based on national accounts (Henderson et al., 2012; Michalopoulos and Papaioannou, 2013, 2014). Furthermore, in addition to relatively high data quality, these data capture both the direct effects of increased investment at a foreign-owned subsidiary, as well as indirect effects in the local area (for example, greater use of electricity by an increased number of residential housing units, increased vehicular traffic, etc.). Thus, these data permit estimation of the total local impact of multinational firm presence in discrete African communities.

We obtain luminosity data from the United States Air Force Defense Meteorological Satellite Program (DMSP). DMSP collect satellite images of the planet's surface every night, permitting estimation based on a large number of data points. We download the annualized and processed data published by The National Geophysical Data Center (NGDC), which is purged of the effects of cloud coverage. Our tests use the annual cloud-free-observation-weighted average over all stable nightlight pixels, and we measure the effects for each 10km radius grid-cell (i.e., we construct $0.1 * 0.1$ degree grid-cells from the pixel-level data). As with the Orbis data, we use data starting in 2005. However, we end the data used for this test in 2013 due to the change in satellites in that year and the lack of concordance with earlier imagery. Section 5.2 provides an example based on multinational presence in Kenya and includes a representative figure.

3.3 Employment data from the Demographic and Health Surveys (DHS)

We also study employment levels in the local area surrounding each U.K. African subsidiary. This captures any direct hiring by existing or new U.K. subsidiaries, as well as any local spillover effects resulting from increased economic activity in the area. To do so, we use the Demographic and Health Surveys (DHS) data, which includes information regarding respondents' demographic characteristics, health status, and employment obtained from surveys of nationally representative, repeated cross sections of citizens. The data are collected in numbered areas drawn from census files (regions), where a random sample of individuals is selected from a census-provided list of households. Surveys occur in a random order of sampling clusters, for which DHS provides GPS coordinates for most clusters. We follow Hjort and Poulsen (2019) and construct employment variables using responses to this specific question: "Aside from your own housework, have you done any work in the last seven days?" We access data on 10km grid-cells where individuals were interviewed at least once before and after the U.K. tax reform, and therefore, we use some survey data from 1998 to maximize the sample for this test.[16] We further restrict our sample of countries to those for which GPS coordinates are available so that we can link this data to the U.K. multinational subsidiary addresses. Table A.3 in the Appendix presents the survey years that we use across the countries in the sample.

3.4 Merging Data on Multinational Firms and Local Economic Outcomes

We merge the DMSP satellite data and the DHS survey data to our sample of African companies by mapping the locations of DMSP satellite pixels and DHS survey respondents to the multinational firms' subsidiary addresses. First, we identify the latitude and longitude of each U.K. firm subsidiary by performing an internet search of the nearly 3,300 distinct U.K. subsidiaries. We identify an address for 798 subsidiaries.[17] Although a relatively low percentage of the U.K. sub-

[16] A sampling cluster is at the level of an individual's village or neighborhood. As these rarely appear in survey rounds both before and after the U.K. tax reform, we allocate each sampling cluster into $10 * 10$ km grid-cells using the GPS coordinates. For example, if a 10km grid-cell in Kenya is surveyed in 2008, 2009 and 2014, we include all individual observations of this 10km grid-cell because there are no pre-period observations for that area. However, if another 10km grid-cell in Kenya is only surveyed in 2010 and 2014, we do not include observations of this 10km grid-cell because there are no pre-period observations for that area.

[17] Three individual research assistants manually searched for each African subsidiary address on the Internet using the name listed in the Orbis dataset. If a fuzzy name match is identified, the mailing address is then used to retrieve GPS coordinates. Two authors drew a random sample from the list of the 3,300 distinct U.K. subsidiaries and then verified the search results, thereby further ensuring that all available addresses have been correctly identified. This costly process is the main reason we limit some tests to only U.K. and French firms.

sidiaries (10%), this number appears reasonable given the developing nature of the countries and the overall low level of internet presence by subsidiary companies of largely private firms, as well as the fact that some subsidiaries may not have a physical presence. Subsequent tests use French subsidiaries as a control sample, for which addresses were obtained in the same manner. That is, we search and then obtain addresses for the resulting 1,501 French subsidiaries. We then obtain geo-code all addresses to obtain latitude and longitude coordinates.

We next retrieve GPS coordinates for all relevant pixels in the DMSP satellite data. We also obtain the latitude and longitude provided by the DHS for each administered survey. Because surveys are administered in a central area of an individual's neighborhood or village, the GPS coordinates are in close proximity to a respondent's residence and, therefore, reflective of how close the survey respondent lives to the U.K. company.[18] Finally, we merge the location of the U.K. companies to both the satellite data and to the survey respondents' addresses for our empirical tests.

3.5 Summary Statistics

Table 1 provides descriptive statistics about the sample. We aggregate the 263,704 subsidiary-year observations data to the firm-African country-year level (e.g., Vodafone-South Africa-2011), for a total of 116,225 firm-country-year observations. Approximately 42% (n=49,798) are owned by parents in OECD nations, whereas 34% (n= 39,575) are owned by parents in the same African country.[19] The remaining 23.2% (n=26,918) are owned by parents in other countries, some of which include other African nations. Approximately 7,000 firm-country-year-observations, or 6% of the firm-country-year sample, are subsidiaries of U.K. multinational firms. 67% of the subsidiaries are located in former U.K. colonies.

The median (average) parent firm has 8 (123.5) subsidiaries worldwide and operates in 16.69 countries globally. Sample firms exhibit substantial heterogeneity with respect to tax incentives that may affect the location of investment; the difference in tax rates between the highest and lowest taxed subsidiaries is 18.11%, and the average firm has 9.62 tax haven subsidiaries. Home countries report relative low inflation of 3.67% and have over USD2.3 trillion in average GDP.

[18]The average village or neighborhood consists of 36.6 individuals, confirming the relatively small size of the area used in our tests. Across the 46 African countries in our sample, we observe 23,129 villages or neighborhoods.

[19]This result may well reflect not only the number of OECD firms in Africa, but, also the reporting requirements of subsidiary locations of OECD countries, compared to requirements in African countries.

The sample used for the luminosity analysis include 20,187 10km radius grid-cell-years. Of these grid-cell years, 6,957 include a U.K. subsidiary (capturing 773 subsidiaries that belong to 225 UK firms, which corresponds to 3.25% (=3,780/116,225) of the firm-country-years above) and 13,230 include a French subsidiary (capturing 1,470 subsidiaries that belong to 293 French firms, which corresponds to 6.79% (=7,893/116,225) of the firm-country-years above).[20] The average 10km radius grid-cell in which a multinational firm subsidiary is located exhibits a nighttime luminosity value of 49.2. This value, which is reported in the range between 0 (complete darkness) and 63 (maximum coding in the DMSP data), falls to 26.7 as the grid cell expands to include areas within a 25km radius. These values are higher, as expected, when compared to 7.7 around the relatively more remote extraction sites used in Christensen et al. (2020*b*).

The sample used for the employment analysis include 741,875 individual respondent-years, of which 157,031 relate to respondents within a 10km radius of the U.K. subsidiary. Approximately 63% of DHS survey respondents reported working outside the home *(Employment (0/1))*. The closest U.K. firm was on average 127 km from a DHS survey cluster. The average respondent was 28.9 years old and lived in a household with 6.7 members. Our empirical tests use varying radii around the survey cluster to compare employment status following an increased U.K. presence.

4 Domestic Tax Reform and Multinational Firm Presence in Africa

4.1 Graphical Evidence

Our first analyses examines the effect of the U.K. tax cut on the total number of African subsidiaries owned by U.K. multinationals. Specifically, we analyze the relationship between the number of subsidiaries a multinational firm owns in a given African country-year and whether the parent firm is incorporated in the U.K. Figure 2 graphically depicts the average number of U.K. African subsidiaries across the sample period (green solid line). The average number of

[20]The number of subsidiaries used in the luminosity analysis is lower than the number of subsidiaries for which we obtained address information because we exclude subsidiaries that have ownership changes from UK firms to French firms or vice versa.

subsidiaries in 2008 is 1.21, which increases to 2.35 in 2010, and further increases and peaks at 3.24 in 2014.

We compare the development of U.K. multinational firm presence to that of three alternative groups of non-U.K. multinational firms that are likely to have similar incentives for sub-Saharan African investment. Figure 2 also presents the three lines for each of these three groups. The orange dashed line represents multinational firms from other OECD countries. The tan dotted line captures multinationals from four other former colonial empires, including Belgium, France, Germany, Italy, Portugal, and Spain (Michalopoulos and Papaioannou, 2020). The maroon dash-dotted line captures French multinational firms only, who are most similar given their prominent and substantial African presence through the same period as British firms (Jeppesen and WM Smith, 2017; Fichter, 2019). From 2005 to 2009, the trends across the groups are relatively similar, but we observe that the OECD, Empire, and French firms report only a minor increase after 2009, consistent with firms growing their geographic presence over time and with relatively smaller tax cuts in some of these countries (see Online Appendix Table A.8). The similarity in the lines prior to 2009 provides strong support for the parallel trends assumption key to the empirical strategy outlined below. The divergence in the green line after 2009 suggests an increased U.K. presence following the relatively large announced U.K. tax cuts.

4.2 Empirical Strategy

To estimate the effect of the U.K. tax cuts on U.K. multinationals' African presence, we estimate the following difference-in-differences model using OLS:

$$Log.\ Number\ Subsidiaries_{f(i)c(i)t} = \alpha + \beta U.K.\ Firm_{f(i)} * Post_t + Controls\,\gamma + \eta_{f(i)c(i)} + \zeta_{c(i)t} + \epsilon_{if(i)c(i)t} \quad (1)$$

The dependent variable *Log. Number Subsidiaries* is the natural logarithm of the number of subsidiaries i a multinational firm f has in a given African nation c in year t. *U.K. Firm* is an indicator variable equal to one if a multinational firm f that owns the African subsidiary is incorporated in the U.K. and zero otherwise. *Post* is an indicator variable equal to one for years 2010 and later to capture the effects of the U.K. tax changes announced in the summer of that year. We estimate Eq. 1 at the multinational firm-country-level ($n = 116,225$) after aggregating

all subsidiaries of each firm within a given African country by year to construct the dependent variable.

The nature of our data, where we have observations across many years, from many host countries, and from many industries, allows us to leverage fixed effect structures that help control for unobservable factors affecting investment in Africa. $\eta_{f(i)c(i)}$ denote firm fixed effects and control for time-invariant factors at the firm level, such as the general propensity to invest in an African country during the sample period. Country-year fixed effects, $\zeta_{c(i)t}$,control for macroeconomic shocks that affect all subsidiaries within a given African country across time. That is, these fixed effects control for regulatory and institutional changes in each African nation and allow for differential responses of African economies to shocks such as the global financial crisis in 2008. In some models, we also include industry-year fixed effects (defined at the firm level) that absorb average industry effects within a year (such as an oil price surge in 2008 affecting oil-reliant industries) and country-pair fixed effects that absorb non-time-varying characteristics between the country of the parent and the affiliate country (such as historical ties between the U.K. and former U.K. colonies). We include two sets of control variables. The first set of variables controls for time-varying effects at the parent country level and includes inflation as well as the natural logarithms of population and GDP. The second set controls for time-varying differences in firms' multinational presence and includes the number of worldwide countries where the firm operates, as well as the tax differential and the natural logarithms of the total number of subsidiaries and subsidiaries in tax havens.[21] Including a measure of the tax differential controls for differences in tax rates within a multinational group and the corresponding investment incentives

4.3 Empirical Results - Multinational Firm Subsidiary Presence in Sub-Saharan African

4.3.1 Average Effects of Tax Reform

Table 2 tabulates the results from estimating model 1. Based on the logarithmic transformation of the dependent variable, we interpret β_1 as the percentage increase in the number of U.K. sub-

[21] We cannot include subsidiary-level controls, as our dataset only provides the name, location, and (for a subset of observations) the date of incorporation of the subsidiary.

sidiaries in Africa after U.K. tax reform. The comparison set of firm-country-year observations include those from all other non-U.K. firms in the sample; that is, it includes African affiliates of firms from 149 countries, including parents from the same or other African countries. We list the distribution of subsidiary observations across African countries for the top ten home countries of the multinational firms in Table A.2 in the Online Appendix. In Table 2, the odd columns present results for the largest samples with requisite data. The even-numbered columns present results after imposing the additional sample restriction that the multinational firm must be observed within a country as of 2009, the last year preceding the U.K. tax change announcement, or earlier in the pre-reform period (indicated by the label for "Balanced Presence"). Use of this sample mitigates concerns that the results are driven entirely by data coverage over time, as it requires a firm to be reporting in the African country prior to the U.K. tax change period. Thus, any new entity observed in those same countries post-reform can more confidently be attributed to the tax change as compared to improving coverage in the dataset.[22]

The coefficient of 0.201 in Column (1) means that there is an approximately 20.1% increase in the number of U.K. multinational African subsidiaries after tax reform, relative to the increase in the number of subsidiaries owned by firms incorporated in other countries. Estimation on alternative samples, with alternative fixed effects structures, and with differing control variables in Columns (2) through (6) produces results of a similar significance that provide a range of estimates. These coefficients suggest a 12.0 to 24.3% increase in the number of U.K. subsidiaries as compared to other multinationals. Given that the average U.K. multinational firm had 1.59 subsidiaries in an African country before the reform (untabulated), this is equivalent to an increase of 0.19 - 0.39 subsidiaries per country-firm and 1.2-2.4 total African subsidiaries given that firms operate in 6.2 African countries on average. Figure 3 plots results of an event study test estimating annual treatment coefficients with 2009 as the base year before the reform. The dots plot the point estimates that correspond to Table 2, Column 6, and the green shading provides the 95% confidence interval. The figure provides support for the validity of the common trends assumption. It demonstrates an effect that begins one year following the announced U.K. tax change and then persists throughout the sample period. The increasing effects in the later years reflect that the tax rate continued to decline later in the sample period.[23]

[22] Section 6.2 discusses robustness tests that address concerns about the underlying data used.

[23] In untabulated analyses, we dissect our post indicator into the periods 2009, 2010-2011, 2012-2014, and post 2014, with years before 2009 as the omitted base period. We find no anticipation (or territorial tax reform) effect in

One concern is that the results in Panel A are due in part to comparing African subsidiaries of U.K. companies to subsidiaries of other multinationals that may differ for unobservable reasons, thereby driving the increased U.K. presence after 2009. The inclusion of firm control variables, firm country control variables, and several fixed effects when estimating Eq. 1 helps to mitigate this concern. However, we further address this by limiting the set of control observations to the three groups outlined above: i) multinationals from other OECD countries; ii) multinationals from other former colonial empires (Belgium, France, Germany, Italy, Portugal, and Spain); and iii) multinationals from France.

Table 2, Panel (B) presents robustness of results to using these three refined control samples. We report results for two samples, one that includes all U.K. and control observations (corresponding to the sample from Panel A, Column (5)), and one that includes all U.K. and control observations with an observed African presence prior to 2010 (corresponding to the sample from Panel A, Column (6)). Across each of these tests, we continue to observe an increased U.K. affiliate presence, with the coefficients implying an increase of 18.0-22.1% in the odd columns and a larger 28.8-34.7% increase on the more restrictive samples in the even columns. These effects imply increases of 0.29-0.35 (0.45-0.55) subsidiaries on average, and 1.9-2.1 (2.8-3.4) across Africa.[24]

4.3.2 Heterogeneous Treatment Effects

Table 3 examines heterogeneous effects. We first study whether results vary based on a firm's geographic presence. Panel (A) presents results from partitioning the sample based on the colonial history of the African country in Columns (1) and (2), with the expectation that the results are likely to be concentrated in those countries that were previously British colonies. We observe, as expected, that the results are strongest in those countries; furthermore, the 20.7 percentage point difference in coefficients across Columns (1) and (2) is statistically significant, confirming the greater increase in those jurisdictions. Columns (3) and (4) present results after refining

2009, moderate and statistically significant effects in 2010-2011 and stronger effects in 2012-2014. After the full tax rate cut has phased in in 2015, the effect size remains stable at the highest level. These effect dynamics lend further support to our inference that the U.K. corporate tax rate cuts explain our findings of increased multinational firm investment in Africa and that mitigate the concern that other omitted factors such as U.K. multinationals firm recovering stronger after the financial crises than other multinationals are the sole driver of our documented effects.

[24]Panel A of Table A.5 in the Online Appendix reports robust results when varying the fixed effects structure. In Panel B of Table A.5, we use alternative control samples, including those with multinational firms from (i) all other foreign countries, (ii) the U.S., and (iii) Japan. Results remain qualitatively unchanged.

the set of control observations to include only those of French multinationals. We continue to observe that the effects occur primarily in the U.K. colonies, with a 21.6 percentage point difference across the partitions. Untabulated tests show a similar, but slightly weaker, pattern of results when partitioning based on the extent of the pre-2010 U.K. presence.

We further study how the results vary based on industry in Panel (B). We first study the Manufacturing and Construction industries, given that they are generally more labor-intensive and have the greatest potential for job growth and spillover effects. We indeed find increased investment by manufacturing firms, with the coefficient implying a 23% increase in foreign manufacturing subsidiaries. We observe a weaker effect in the Construction industry (t-statistic of 1.56), which may be due in part to the relatively smaller sample. In addition to confirming that the effects occur in these labor-intensive industries, untabulated results also suggest that effects are not driven by multinational firms in the service sector, where subsidiary locations (or offices) are typically located in large cities. Finally, we study whether the effects occur in the Mining and Quarrying sectors. We examine this sector because resource extraction is a key industry studied extensively in the prior literature and to assess the extent to which this industry is driving the documented effects. We find no evidence that the U.K. tax cut affected investment in this industry based on the coefficient estimate in Column (3) (t=0.38). Thus, the phenomena documented in this manuscript extend beyond the resource extraction activity studied in prior work.

A key identifying assumption is that the tax policy changes were the primary economic event occurring in the U.K. during this sample period. To further validate that the effects can be attributed to the U.K. tax cut, we also examine heterogeneous effects related to the U.K. parent's tax position. Table 4 presents results after partitioning the sample based on firms' effective tax rate prior to the U.K. tax cut. Firms with the highest tax rates prior to the tax cut are presumably those that can benefit the most from the U.K. tax cut and thus should have the greatest tax savings to use for investment purposes. The U.K. tax cuts were motivated by U.K. firms not being competitive abroad, and, those firms whose tax burdens were the highest should predictably experience the largest competitive increases. The sample size for this test is much smaller, given the requirement to observe consolidated financial statements, tax expense, and positive pre-tax income in the pre- and post-reform period. We observe that the effects appear strongest in the firms with relatively higher effect tax rates pre-reform; the coefficient of

0.22 in Column (1) means that those firms had a 22% increase in subsidiary presence after the reform, whereas those firms with lower effective tax rates had no statistically significant change (Column (2)). We find a similar pattern of results in Columns (3) and (4), which partition on the three year average effective tax rate that minimizes annual fluctuations introduced by accounting rules (Dyreng et al., 2008). This suggests that the results appear strongest in those firms that could benefit the most from the U.K. corporate tax change. However, while the coefficients for the high-ETR firms appear approximately twice the size of the coefficients for the lower-ETR firms, we note that the coefficients are not statistically different.

Collectively, the results in Tables 2 through 4 provide evidence that U.K. presence in Africa increased after 2010, that such increase is robust to controlling for the (potentially) endogenous decision by multinational firms to begin operating in a given country and that it is also robust to use of varying control samples. We observe heterogeneity in predictable subsamples, providing further evidence to support the inference about the relation between U.K. tax cuts and African investment.

5 U.K. Tax Cuts, Multinational Firm Presence, and Net Economic Activity in Africa

5.1 Empirical Strategy

We next analyze the effects of the increased U.K. expansion on local economic activity in Africa. Using the nighttime luminosity and DHS survey employment data, we estimate the following model using OLS:

$$\begin{aligned} Local\ Economic\ Activity_{ig(i)c(i)t} = \alpha + \beta U.K.FirmPresence_i * Post_t + \\ Controls\,\gamma + \delta_{g(i)} * U.K.FirmPresence_i + \zeta_{c(i)t} + \epsilon_{ig(i)c(i)t} \end{aligned} \quad (2)$$

The dependent variable *Local Economic Activity* is the natural logarithm of average annual nighttime luminosity of grid-cell $g(i)$ with firm i in its center (*Log. Luminosity*) when using the nighttime luminosity data. When using the DHS survey data, the dependent variable *Employment (0/1)* is an indicator equal to one for each survey respondent i in grid-cell $g(i)$ that is

employed, and zero otherwise, in year t. In all models, we include country-year fixed effects, $\zeta_{c(i)t}$, to control for natural changes in employment levels and economic activity over time for each country.

When *Log. Luminosity* is the outcome variable, the model is estimated at the grid-cell level in a given country-year (i.e., $i = g$). The treatment indicator *U.K. Firm Presence* is equal to one if a grid-cell hosts a U.K. multinational firm subsidiary in that year based on our manual search for addresses and GPS coordinates of U.K.-owned subsidiaries. We use two distinct control groups, both of which include the same-sized grid-cell observations without any U.K. firm presence. The first control group consists of nearest-neighbor matched grid-cells within the same country and with similar average luminosity values (within $\pm 20\%$ range of the treated cell in 2009), but they are at least 10 km away from the next U.K-owned subsidiary. That is, we measure luminosity effects in the 10 km grid cell around each U.K. subsidiary as compared to other grid cells within the same country and with a similar preceding luminosity level. The second control group includes only those with subsidiaries of French firms in the same country, as France also has strong historical ties with Africa and French firms also account for a large share of multinational investment. *Post* is an indicator variable equal to one for years after 2009. We cluster standard errors at the grid-cell level.

We expect that, if the U.K. corporate tax cut motivates foreign direct investment into Africa, we should observe greater light emission attributable to both direct and spillover effects. That is, not only does this test capture any new affiliates over the sample period, but it also captures increased investment activity at pre-existing affiliates.[25] We predict that β will be positive. However, we may observe little benefit if the subsidiary is unsuccessful or if it produces little substantive economic activity.

When *Employment* is the outcome variable, we estimate the model at the surveyed individual level in year *t*, where grid-cell *g* can include multiple respondents. The treatment indicator *U.K. Firm Presence* is equal to one if the residence of the survey respondent is equal or less than 10 km away from the closest U.K. subsidiary in the same country. This design assumes that individuals who live closer to the multinational subsidiary will be more likely to be employed

[25]The data introduce two empirical challenges. First, because we manually search for addresses and match those to luminosity data, we are not able to identify addresses or change in addresses over time and thus must rely on the current address returned. Second, because of the necessity of having a U.K. address, the sample used for this test is substantially diminished.

by that subsidiary, or by other companies in the area that benefit from the U.K. multinational presence. Consistent with the approach in Hjort and Poulsen (2019), we include 10 km grid-cell fixed effects interacted with the treatment indicator, $\delta_{g(i)} * U.K.FirmPresence_i$, which control for any time-invariant differences at the local level that may be correlated with U.K. multinational firm subsidiary presence. We construct the cells by allocating subsidiaries and survey respondents based on their location into $0.1 * 0.1$ degree (approx. $10 * 10$ km) grid-cells.[26] We again use two distinct control groups, both of which are grid-cell observations with *U.K. Firm Presence* equal to zero. The first control group consists of individual respondents living in the same country but relatively further away from the U.K. subsidiary, using distances of 10 and 50 km. The second control group consists of individuals living at least 10 (or 50) km away from the next U.K. owned subsidiary but equal or less than 10 (or 50) km away from the next French multinational firm subsidiary. Specifically, we match individuals living close to French-owned subsidiaries but at least 10 (or 50) km away from a U.K.-owned subsidiary within the same country, year, region, urban versus rural area, and gender with replacement. *Post* is an indicator variable equal to one for years after 2009.

To further ensure a high comparability of treated and control individuals when studying employment levels, we control for the average employment rate in a given region (i.e., survey cluster) as last measured before the U.K. tax reform. Some specifications also include additional demographic control variables obtained from the DHS data, such as Male, Household Members, Marital Status, Age, and whether the geographic area is in an Urban Region. We cluster standard errors at the enumeration area.

5.2 Empirical Results - Economic Activity proxied by Nighttime Luminosity

Figure 4 provides an example of the geo-coded luminosity data and the effects we study formally based on Eq. (2) when *Log. Luminosity* is the outcome variable. We first depict the luminosity data using an area in Kenya with both U.K. and French multinational presence. Panel A com-

[26] We create these grid-cells because an individual's location is reported at the level of an individual's village or neighborhood, and these rarely appear in survey rounds both before and after the U.K. tax reform, prohibiting the inclusion of location-specific fixed effects. However, $10 *$ 10km grid-cells almost always appear prior and after the tax change and therefore permit better measurement of changes in the local area. To further mitigate concerns about the time-series coverage of the underlying data, we retain only those grid-cells that have observations in the dataset both before and after the U.K. tax reform.

pares the location of the U.K. and French subsidiaries in 2008 to the same location in 2012. The red (green) dot denotes the U.K. (French) subsidiary. A comparison of the two panes in Panel A demonstrates a marked increase in the luminosity pixels around the U.K. affiliate, with little change around the French subsidiary. Panels (B) and (C) show this effect in more detail by isolating the 10 km grid cell around each location. We then plot the 10km radius grid-cells around the U.K. and French subsidiaries in 2008 and 2012 in Panels (B) and (C). While there is some increased luminosity around the French affiliate, the change appears much greater near the U.K. subsidiary in this example.

Table 5 reports formal regression results from estimating the effects of U.K. tax cuts on nighttime luminosity. The sample size is limited because of the necessity of observing the address of the U.K. affiliate (which we observe for only 24% of the U.K. subsidiary observations) and matching with the luminosity data. The control sample used in Panel A includes those grid cells further than 10 km from the U.K. subsidiary with similar preceding levels of luminosity. The sample in Panel B is higher due to the inclusion of grid-cells with French subsidiaries. In Column (1) of Panel A, we observe a 9.7% increase in luminosity in the local area surrounding U.K. subsidiaries in the years following the U.K. tax reform. In column (2), we replace the year fixed effects with country-year fixed effects to further absorb time-varying country characteristics and find that the point estimate is unchanged. Finally, Column (3) shows results without country-year fixed effects but explicitly controlling for the country's population and overall level of economic activity. The size and significance of the coefficient is again unchanged.

Panel (B) shows results for comparing luminosity across cells with a centered U.K. subsidiary to cells with a centered French subsidiary. Inclusion of these cells with a French subsidiary ensures we are not merely comparing more industrialized areas that may naturally attract foreign presence to less industrialized areas. When including French subsidiaries in our control group, we continue to observe that areas surrounding U.K. subsidiaries exhibit greater luminosity following U.K. tax cuts. As expected when including this additional set of control grid-cells, the size of the coefficients is smaller but still suggests a notable effect. Specifically, the coefficients imply a 3.7-4.6% increase in luminosity following U.K. firm presence as compared to any increase in French presence over the time period.

Figures 5 and 6 provide further evidence of the documented effects. Figure 5 plots results of an event study test estimating annual treatment coefficients with 2009 as the base year before the

reform. Point estimates for each year with luminosity around U.K. subsidiaries as the outcome are presented in dots, 95% confidence intervals are shaded in green. Panel A plots results using only other within-country grid cells with similar pre-reform luminosity values; Panel B plots effects relative to grid-cells with a French multinational presence. Both figures demonstrate a clear change in luminosity in the years following the U.K. tax change, which captures both the increased number of U.K. affiliates (captured in our original tests using the Orbis data) as well as additional investments in pre-existing U.K. companies. Figure 6 further show how effects vary based on differing radii around each location (5 km, 10 km, and 25km). Panel A shows that the results are robust across these radii when comparing effects relative to other within-country grid cells; Panel B show that the effects are still positive but diminish as the radii approaches 25 km.

5.3 Empirical Results - Individual-level Employment

We next test whether employment increased in the local area surrounding the U.K. subsidiary presence after 2009. Figure 7 graphically depicts the data used in this test. Panel (A) plots both the DHS survey clusters in blue across sub-Saharan Africa. The map also plots the location of U.K. and French multinational firm subsidiaries in red and green, respectively. We observe the most U.K.-owned subsidiaries in the west African countries of Nigeria, Ghana, and Sierra Leone, as well as in the east African countries of Kenya, Tanzania, Mozambique, and Zimbabwe. The figure shows that there is sufficient overlap between the countries with a U.K. presence and the countries where DHS surveys are conducted. Panel (B) presents a more detailed depiction of one particular region, the Kisumu Area, in Kenya. The U.K. subsidiary is marked with the red triangle, and the dashed circle shows the 5km radius for the treated area around this U.K. subsidiary. Each of the blue dots denotes a DHS interview location from which employment status is measured. Our empirical tests compare individuals surveyed within areas with a U.K. subsidiary to those individual surveyed outside of the area, and to similar respondents in the same area prior to the tax rate reduction. As with the luminosity data, these tests capture both the effects in the pre-existing affiliates, as well as any new affiliates post-U.K. change (such as those tested using the Orbis data).

Table 6 reports results from estimating Eq. 2 for employment outcomes. As the employment

outcome at the surveyed individual level is binary, the estimates can be interpreted as changes in probability. Column (1) estimates that individuals living proximate to a U.K. multinational subsidiary after the tax rate cut (UK Firm Presence $*$ Post) were 2.9 percentage points more likely to be employed as compared to individuals living in grid cells without a U.K. firm presence. Compared to a baseline employment rate of 63%, this is a substantial change, implying a 4% increase in the likelihood of having worked outside the home. We find similar effects in Column (2) after including control variables and country-year fixed effects, as well as in Columns (3) and (4) when altering the control group to include respondents within a 50 km radius. Untabulated analyses further confirms that the effects appear to be incremental employment, as we observe no decline in employment in the control regions that would otherwise be suggestive of employees switching from one firm to the next.[27]

Table 6, Panel (B) reports results using respondents living close to French-owned subsidiary locations as the control group. This strategy ensures we are not mechanically comparing changes in employment in more versus less industrialized areas and explicitly controls for the endogenous location choice of multinational firms. Across all specifications, we document a 1.8 to 3.9 percentage point increase in employment for individuals living close to a U.K.-owned subsidiary as compared to those living close to a French-owned subsidiary. Again using the 63% baseline employment rate, this implies a change of 2.8-6.2% change.

Figure 8 presents these effects graphically using three different radii (5km, 10km, and 25km). As expected, we continue to observe a positive but decreasing effect as the radii increases and the average respondent's distance to the subsidiary increases. However, even at 25km, Figure 8 still shows an effect that is statistically different from zero.

6 Supplementary Analyses and Robustness Tests

6.1 Tax Changes in Other Countries

Throughout the paper, we focus on the U.K. tax reform for the reasons we elaborate on above. However, we also expect that any major tax reform in a developed country may result in in-

[27] One concern is that large metropolitan areas are the most likely destination for a U.K. multinational firm subsidiary and that, over this sample period, individuals living in large metropolitan areas were more likely to become employed. Explicitly controlling for Urban Region and including grid cell fixed effects helps to mitigate these concerns.

creased outbound FDI to less developed countries, assuming that the rates of return offered in the developing countries make these investment attractive for use of newfound tax-cut-induced corporate capital. In this section, we examine the effect on subsidiary presence in Africa of four other major corporate tax reforms over the last 20 years: Germany (2008), Canada (2008), Japan (2012), and Spain (2015).

Figure A.2 in the Online Appendix graphs, in event time, the average number of total African subsidiaries of multinational firms headquartered in these four countries around the tax law change. The raw data, absent consideration of control variables, show a stark increase in the number of African subsidiaries after the tax rate change (green line). In contrast, we find that multinational firms from other nations that did not lower their corporate tax rate have a relatively consistent number of subsidiaries (orange dotted line).

While Figure A.2 provides descriptive evidence that corporate tax cuts may lead to FDI in Africa, we acknowledge that other factors not controlled for in this analysis could drive an increased African presence. For example, the tax rate changes may be accompanied by other tax and policy changes in the home country that could alter firms' foreign investment. Table A.8 presents results from a staggered difference-in-differences setting testing whether the total number of African subsidiaries of multinational firms changed after a tax rate reduction in their home country. The variable *Tax Reform* is an indicator equal to one for the years following the tax change. We document a positive and statistically significant coefficient that is robust to the inclusion of different controls and fixed effects.

6.2 Database Sample Expansion

Another concern is that the effects we document are attributable to improving subsidiary coverage over time in the dataset and not to increased foreign investment by U.K. firms. Use of the sample that requires a pre-existing presence of the firm in a country helps to mitigate this concern, but we also conduct two additional tests to further validate that the effects we observe relate to actual investment and not simply changes in data coverage. Table A.4 in the Online Appendix further validates our measure by testing the correlation between our dependent measure of U.K presence, *Log. Number Subsidiaries*, and the pairwise amount of foreign direct investment between the U.K. and the corresponding African country based on data from OECD. For

example, we study whether the number of U.K. subsidiaries in Kenya in 2007 is correlated with the amount of FDI from U.K. to Kenya based on OECD Statistics on Globalisation data. We confirm a strong and positive correlation when using both the level and stock of FDI, thereby helping to mitigate concerns about the underlying data used.

Second, we plot the ratio of a firm's consolidated total assets to its number of subsidiaries over the sample period. If establishing a new subsidiary represents an expansion of a firm's operations accompanies with real growth, we would expect to observe little change in this ratio over time. In contrast, a line that decreases over time could reflect an increase in the average number of subsidiaries due to improved coverage in the Orbis database or that the number of subs per unit asset is actually decreasing. Consistent with the latter explanation, Figure A.1 suggests a decreasing trend in the ratio of consolidated total assets to the number of subsidiaries, which is undiagnostic of the data quality. However, importantly, we note that this trend does not appear to differ for U.K. firms as compared to firms more generally, including those from other OECD countries, former colonial empire countries, or France.[28] This suggests that even if the increased number of subsidiaries is due to disclosure, it is not systematically different for UK than other countries, further mitigating concerns that the Orbis data coverage is driving the results or that the U.K. is disproportionately represented or affected by any possible data coverage issue.

6.3 Robustness Tests

An additional challenge is that the U.K. had other changes to its corporate tax policy in our sample period. While previously a worldwide tax system, in 2009, the U.K. converted to a territorial system. While previously a worldwide tax system, in 2009, the U.K. converted to a territorial system. This means that previous to 2009, all U.K. profits earned by foreign subsidiaries that were repatriated back to the U.K. were subject to U.K. corporate tax, whereas after the change, they were not subject to any additional tax. First, it is important to note that Matheson et al., 2013 find negative changes in FDI associated with the switch in the U.K. to territorial tax system. This result obtains because previous to the switch, firms were penalized for repatriating income earned abroad, so, would reinvest it in host countries. In a territorial system, there is no penalty for repatriation, so, FDI decreases, especially in low-tax countries.

[28]The relatively higher ratio for U.K. firms in 2010 could suggest an general increase in U.K. firms' total assets due to additional investment and raised capital following the tax reform, which was also welcomed by capital market investors.

Next, we verify that our observed results seem unlikely due to conversion to a territorial by examining the counterfactual of a Japan corporate tax reform. Recall that Japan also had a substantial change in tax policy during the sample period which involved conversion to a territorial system in 2009. However, unlike the U.K., it retained its existing statutory corporate income tax rate. In Panel B of Table A.5, we use only Japanese firms in our control sample, permitting us to attribute the results to the corporate income tax rate cuts, not to the transition from the worldwide to a territorial system of taxation of multinational firm profits. This finding is of importance when considering how the results may apply to U.S. observations following the decrease in the U.S. tax rate and the switch to a territorial-like system following the 2017 U.S. Tax Cuts and Jobs Act.

Next, we show that the effect of the U.K. tax reform on foreign subsidiary presence obtains at the extensive margin. To this end, we estimate a linear probability model and report results in Table A.6 in the Online Appendix. The outcome variable is an indicator taking on the value of one once a subsidiary is established during our sample period (i.e., once it becomes observable in the database). Estimates suggest that a newly formed subsidiary in Africa is approximately 1.5 percentage points more likely to be formed by a U.K. multinational firm after the U.K. tax reform than by firms from other countries. As the baseline probability that an African subsidiary was U.K.-owned had a mean value of 6.88% (untabulated), this results suggest a 21% increase in the likelihood of an African subsidiary belonging to a U.K. firm. These effects occur when using a number of other control samples, including those with all foreign multinationals, multinationals from OECD countries, multinationals from Empire countries, and multinationals from France, the U.S., and Japan.

Finally, we examine whether our results vary with the tax rate of the host African country. Under a worldwide tax system, countries generally grant credit for taxes paid in the host countries, and only charge a tax rate on the profits equal to the U.K. rate less the foreign rate. This means that the switch to territorial should have only affected African nations with statutory tax rates above the U.K. tax rate in the same year and would have had the most effect where the host country tax rate was the lowest.[29] We retrieve annual information on tax rates from the Tax

[29] As Matheson et al., 2013 note, "the impact on FDI into host LIC countries should depend upon the differential in effective tax rates among the home and host countries with respect to earnings in the host (source) country." Metheson et al support this assertion empirically. If country A's tax rate was 10%, and country Bs tax rate was 40%, with a U.K. rate of 28%, a switch to territorial amounted to a 18% rate cut on repatriated profits from country A, whereas it would produce less benefit in country B. We abstract away from cross-crediting of foreign tax credits.

Foundation and note that only subsidiaries located in Comoros and Somalia still faced a lower local tax rate than the U.K. tax rate after the U.K. rate was reduced in 2014. In the total sample period, subsidiaries in country-years with local rates lower than the U.K. rate account for less than 3% of all observations. This fact mitigates the concern that the switch to the territorial system drives our results. In untabulated tests, we then estimate our main model, interacting $Post * U.K.$ with the tax rate of the African nation, and we find that the post-tax cut expansion did not favor low-tax African nations. This evidence is consistent with our effect not merely being the result of a switch to territorial taxation.

In Table A.7 in the Online Appendix, we more generally study whether the U.K. tax rate change is associated with investment in other countries. We find only positive effects on U.K. firm subsidiary presence in developed European countries (Germany, Ireland) and in the broader group of OECD, but the coefficient size appears much smaller, ranging from 4.2-7.1%. This effect size is consistent with U.K. firms already being widely invested in these markets. Finally, we document a negative effect of the U.K. tax reform on the number of U.K .firms' domestic subsidiaries relative to the number of foreign-owned subsidiaries in the U.K. This result is consistent with the U.K. tax reform succeeding in attracting foreign investment and domestic firms investing through their existing establishments.

7 Conclusion

The drivers and consequences of FDI in developing countries is a central policy question. A large literature examines the role of home country taxes on domestic investment and the attraction of foreign direct investment. We examine whether multinational firms respond to major tax rate cuts in their home countries by investing in foreign developing countries, thereby causing important fiscal policy spillovers originating in the developed world and affecting developing economies. We specifically focus on the substantial U.K. corporate tax rate reduction and study U.K. multinational firms' presence in sub-Saharan Africa.

We find that the corporate tax rate reduction is associated with an increased scope and an increased likelihood of U.K. multinational firms' presence in Africa. This result holds after using alternative comparison groups of other multinational firms, such as French and U.S. companies

Even allowing for these strategies, assuming there are limits on the use of the credits, lower tax jurisdictions should still be benefited more than high-tax jurisdictions by a move to territorial.

that should have similar investment interests and experience similar patterns in global demand and investment opportunities. Furthermore, we find that the effects are concentrated in those African countries with prior colonial ties to the U.K., as well as countries with a relatively higher existing U.K. multinational firm presence. Our evidence that links local residents to the local address of the U.K. facility, validated using luminosity data, points to a positive employment effect. These results are confirmed when studying employment in African countries affected the most by increases in U.K. multinational firm presence.

The results extend a literature that has typically focused on home country effects of corporate tax rate reductions. Thus, we extend the public economics literature on the relation between taxes and investment, and do so by studying activity in countries where multinational presence has the greatest potential to improve local economies – but also where such presence has been met with the most skepticism. We thereby also contribute to the literature in development economics and add to the scant evidence on the drivers and consequences of multinational firm investment in the developing world.

References

Alfaro, L., Chanda, A., Kalemli-Ozcan, S. and Sayek, S. (2004), 'Fdi and economic growth: the role of local financial markets', *Journal of international economics* **64**(1), 89–112.

Armitage, J. (2008), 'Regus joins the rush of companies to quit UK', *Evening Standard* .
URL: *https://www.standard.co.uk/business/regus-joins-the-rush-of-companies-to-quit-uk-6894957.html*

Asiedu, E. (2006), 'Foreign direct investment in africa: The role of natural resources, market size, government policy, institutions and political instability', *World Economy* **29**(1), 63–77.

Auerbach, A. J. and Gorodnichenko, Y. (2013), 'Output spillovers from fiscal policy', *American Economic Review* **103**(3), 141–46.

Barro, R. J. (1991), 'Economic growth in a cross section of countries', *The Quarterly Journal of Economics* **106**(2), 407–443.

Blouin, J. and Krull, L. (2009), 'Bringing it home: A study of the incentives surrounding the repatriation of foreign earnings under the american jobs creation act of 2004', *Journal of Accounting Research* **47**(4), 1027–1059.

Bond, P. (2006), *Looting Africa: The economics of exploitation*, Zed books.

Bowers, S. (2010), 'Budget 2010: corporation tax slashed to 24p', *The Guardian* .
URL: *https://www.theguardian.com/uk/2010/jun/22/budget-2010-corporation-tax-slashed-to-24p*

Chapman, B. (2019), 'UK by far the biggest enabler of global corporate tax dodging, groundbreaking research finds', *Independent* .
URL: *https://www.independent.co.uk/news/business/news/uk-corporate-tax-avoidance-havens-justice-network-dodging-a8933661.html*

Chen, X. and Nordhaus, W. D. (2011), 'Using luminosity data as a proxy for economic statistics', *Proceedings of the National Academy of Sciences* **108**(21), 8589–8594.

Christensen, H. B., Maffett, M. G. and Rauter, T. (2020*a*), 'Policeman for the world: The impact of extraterritorial fcpa enforcement on foreign investment and internal controls', *Available at SSRN 3349272* .

Christensen, H. B., Maffett, M. G. and Rauter, T. (2020*b*), 'Reversing the resource curse: Foreign corruption regulation and economic development', *Available at SSRN 3712693* .

Coppola, A., Maggiori, M., Neiman, B. and Schreger, J. (2021), 'Redrawing the Map of Global Capital Flows: The Role of Cross-Border Financing and Tax Havens*', *The Quarterly Journal of Economics* .

Cravino, J. and Levchenko, A. A. (2017), 'Multinational firms and international business cycle transmission', *The Quarterly Journal of Economics* **132**(2), 921–962.

De Simone, L. and Olbert, M. (2021), 'Real effects of private Country-by-Country disclosure', *Available at SSRN 3398116* .

De Vito, A., Jacob, M. and Xu, G. (2021), 'How do tax increases affect investment allocation within multinationals?', *Available at SSRN 3643481* .

Desai, M. A., Foley, C. F. and Hines Jr, J. R. (2004), 'Foreign direct investment in a world of multiple taxes', *Journal of Public Economics* **88**(12), 2727–2744.

Desai, M. A., Foley, C. F. and Hines Jr, J. R. (2005), 'Foreign direct investment and the domestic capital stock', *American Economic Review* **95**(2), 33–38.

Devereux, M. P. and Griffith, R. (1998), 'Taxes and the location of production: Evidence from a panel of us multinationals', *Journal of public Economics* **68**(3), 335–367.

Djankov, S., Ganser, T., McLiesh, C., Ramalho, R. and Shleifer, A. (2010), 'The effect of corporate taxes on investment and entrepreneurship', *American Economic Journal: Macroeconomics* **2**(3), 31–64.

Donohoe, M. P., Jang, H. and Lisowsky, P. (2020), 'Competitive externalities of tax cuts', *Available at SSRN 3265532* .

Dyreng, S. D., Hanlon, M. and Maydew, E. L. (2008), 'Long-run corporate tax avoidance', *The accounting review* **83**(1), 61–82.

Edgerton, J. (2010), 'Investment incentives and corporate tax asymmetries', *Journal of Public Economics* **94**(11-12), 936–952.

Egger, P., Merlo, V., Ruf, M. and Wamser, G. (2015), 'Consequences of the new uk tax exemption system: evidence from micro-level data', *The Economic Journal* **125**(589), 1764–1789.

Englebert, P. (2000), 'Solving the mystery of the africa dummy', *World development* **28**(10), 1821–1835.

Faccini, R., Mumtaz, H. and Surico, P. (2016), 'International fiscal spillovers', *Journal of International Economics* **99**, 31–45.

Faulkender, M. and Petersen, M. (2012), 'Investment and capital constraints: Repatriations under the American Jobs Creation Act', *The Review of Financial Studies* **25**(11), 3351–3388.

Feld, L. P. and Heckemeyer, J. H. (2011), 'Fdi and taxation: A meta-study', *Journal of economic surveys* **25**(2), 233–272.

Fichter, J. R. (2019), *British and French colonialism in Africa, Asia and the Middle East: connected empires across the eighteenth to the twentieth centuries*, Springer.

Gaertner, F. B., Hoopes, J. L. and Williams, B. M. (2020), 'Making only America great? non-us market reactions to US tax reform', *Management Science* **66**(2), 687–697.

Gallemore, J., Hollander, S., Jacob, M. and Zheng, X. (2021), 'Tax policy beliefs and investment: Evidence from the 2016 us election and the tax cuts and jobs act', *Available at SSRN* .

Gennaioli, N., La Porta, R., Lopez-de Silanes, F. and Shleifer, A. (2013), 'Human capital and regional development', *The Quarterly journal of economics* **128**(1), 105–164.

Ghura, D. and Hadjimichael, M. T. (1996), 'Growth in sub-saharan africa', *Staff Papers* **43**(3), 605–634.

Giroud, X. and Mueller, H. M. (2019), 'Firms' internal networks and local economic shocks', *American Economic Review* **109**(10), 3617–3649.

Giroud, X. and Rauh, J. (2019), 'State taxation and the reallocation of business activity: Evidence from establishment-level data', *Journal of Political Economy* **127**(3), 1262–1316.

Glaeser, S., Olbert, M. and Werner, A.-C. (2021), 'Tax competition and employment', *Available at SSRN 3485551* .

Glaister, K. W., Driffield, N. and Lin, Y. (2020), 'Foreign direct investment to Africa: Is there a colonial legacy?', *Management International Review* **60**, 315–349.

Goldberg, P. (2015), *Trade and Inequality*, Edward Elgar Publishing.

Goldberg, P. K., Khandelwal, A. K., Pavcnik, N. and Topalova, P. (2010), 'Imported intermediate inputs and domestic product growth: Evidence from India', *The Quarterly Journal of Economics* **125**(4), 1727–1767.

Goodley, S. (2010), 'Moving cadbury hq to switzerland could save kraft millions in uk tax', *The Guardian* .
URL: *https://www.theguardian.com/business/2010/dec/03/moving-cadbury-management-tax*

Graham, J. R., Hanlon, M. and Shevlin, T. J. (2010), 'Barriers to mobility: The lockout effect of us taxation of worldwide corporate profits', *Available at SSRN 1316576* .

Hall, R. E. and Jorgenson, D. W. (1967), 'Tax policy and investment behavior', *The American Economic Review* **57**(3), 391–414.

Harrison, A. and Scorse, J. (2010), 'Multinationals and anti-sweatshop activism', *American Economic Review* **100**(1), 247–73.

Hartman, D. G. (1985), 'Tax policy and foreign direct investment', *Journal of Public economics* **26**(1), 107–121.

Hassett, K. A. and Hubbard, R. G. (2002), Tax policy and business investment, *in* 'Handbook of public economics', Vol. 3, Elsevier, pp. 1293–1343.

Hassett, K. and Newmark, K. (2008), 'Taxation and business behavior: A review of the recent literature', *Fundamental tax reform: Issues, choices and implications* pp. 191–214.

Hayashi, F. (1982), 'Tobin's marginal q and average q: A neoclassical interpretation', *Econometrica: Journal of the Econometric Society* pp. 213–224.

Henderson, J. V., Storeygard, A. and Weil, D. N. (2012), 'Measuring economic growth from outer space', *American Economic Review* **102**(2), 994–1028.

Henderson, V., Storeygard, A. and Weil, D. N. (2011), 'A bright idea for measuring economic growth', *American Economic Review* **101**(3), 194–99.

Hjort, J. and Poulsen, J. (2019), 'The arrival of fast internet and employment in Africa', *American Economic Review* **109**(3), 1032–79.

HM Treasury and HM Revenue & Customs (2013), 'Analysis of the dynamic effects of corporation tax reductions'.
URL: *https://www.gov.uk/government/publications/analysis-of-the-dynamic-effects-of-corporation-tax-reductions*

Ivanov, I., Pettit, L. and Whited, T. M. (2020), 'Taxes depress corporate borrowing: Evidence from private firms', *Available at SSRN 3694869* .

Jeppesen, C. and WM Smith, A. (2017), *Britain, France and the Decolonization of Africa: Future Imperfect?*, UCL Press.

Jerven, M. (2013), *Poor numbers: how we are misled by African development statistics and what to do about it*, Cornell University Press.

Jorgenson, D. W. (1963), 'Capital theory and investment behavior', *The American Economic Review* **53**(2), 247–259.

Killgren, L. (2008), 'Regus latest to leave UK for tax reasons', *Financial Times* .
URL: *https://www.ft.com/content/23e58540-7596-11dd-99ce-0000779fd18c*

Kim, J., Nessa, M. L. and Wilson, R. J. (2021), 'How do reductions in foreign country corporate tax rates affect US domestic manufacturing firms?', *The Accounting Review* .

Kingdon, G. and Knight, J. (2007), 'Unemployment in South Africa, 1995–2003: Causes, problems and policies', *Journal of African Economies* **16**(5), 813–848.

Kollewe, J. (2008), 'Tax avoidance: Regus quits Britain for Luxembourg', *The Guardian* .
URL: *https://www.theguardian.com/business/2008/aug/29/regusgroup.taxavoidance*

Lensink, R. and Morrissey, O. (2006), 'Foreign direct investment: Flows, volatility, and the impact on growth', *Review of International Economics* **14**(3), 478–493.

Lester, R. (2019), 'Made in the usa? a study of firm responses to domestic production incentives', *Journal of Accounting Research* **57**(4), 1059–1114.

Liu, L. (2020), 'Where does multinational investment go with territorial taxation? evidence from the united kingdom', *American Economic Journal: Economic Policy* **12**(1), 325–58.

Makino, S. and Tsang, E. W. (2011), 'Historical ties and foreign direct investment: An exploratory study'.

Matheson, M. T., Perry, V. J. and Veung, M. C. (2013), *Territorial vs. worldwide corporate taxation: implications for developing countries*, International Monetary Fund.

Michalopoulos, S. and Papaioannou, E. (2013), 'Pre-colonial ethnic institutions and contemporary african development', *Econometrica* **81**(1), 113–152.

Michalopoulos, S. and Papaioannou, E. (2014), 'National institutions and subnational development in africa', *The Quarterly Journal of Rconomics* **129**(1), 151–213.

Michalopoulos, S. and Papaioannou, E. (2020), 'Historical legacies and african development', *Journal of Economic Literature* **58**(1), 53–128.

Modigliani, F. and Miller, M. H. (1958), 'The cost of capital, corporation finance and the theory of investment', *The American economic review* **48**(3), 261–297.

Ohrn, E. (2018), 'The effect of corporate taxation on investment and financial policy: Evidence from the DPAD', *American Economic Journal: Economic Policy* **10**(2), 272–301.

Ohrn, E. (2019), 'The effect of tax incentives on us manufacturing: Evidence from state accelerated depreciation policies', *Journal of Public Economics* **180**, 104084.

Olbert, M. (2021), 'The impact of tax shields on bankruptcy risk and resource allocation', *Available at SSRN 3467669* .

Paul, J. and Singh, G. (2017), 'The 45 years of foreign direct investment research: Approaches, advances and analytical areas', *The World Economy* **40**(11), 2512–2527.

Romer, C. D. and Romer, D. H. (2010), 'The macroeconomic effects of tax changes: estimates based on a new measure of fiscal shocks', *American Economic Review* **100**(3), 763–801.

Savvides, A. (1995), 'Economic growth in Africa', *World Development* **23**(3), 449–458.

Suárez Serrato, J. C. (2019), 'Unintended consequences of eliminating tax havens'.
URL: *https://www.nber.org/papers/w24850*

Suárez Serrato, J. C. and Zidar, O. (2018), 'The structure of state corporate taxation and its impact on state tax revenues and economic activity', *Journal of Public Economics* **167**, 158–176.

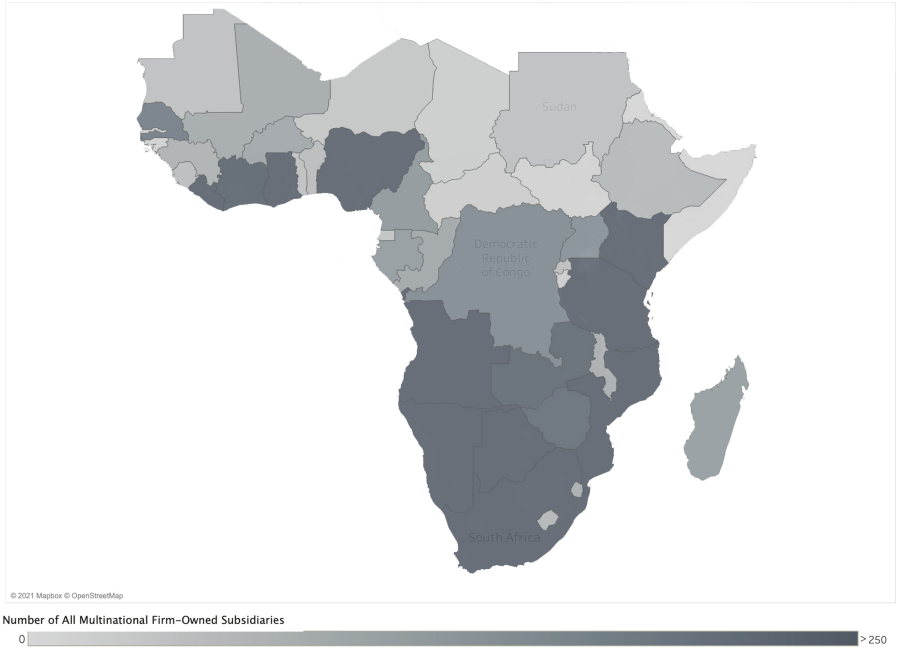
Tax Gap Reporting Team (2009), 'How to save a packet', *The Guardian* .
URL: *https://www.theguardian.com/business/2009/feb/05/tax-gap-walkers*

Trades Union Congress (2010), 'The corporate tax gap'.
URL: *https://www.tuc.org.uk/sites/default/files/extras/corporatetaxgap.pdf*

Zwick, E. and Mahon, J. (2017), 'Tax policy and heterogeneous investment behavior', *American Economic Review* **107**(1), 217–48.

Figure 1: Foreign-Owned Multinational Firm Subsidiaries in Sub-Saharan Africa

(A) All Multinational Firm Subsidiaries

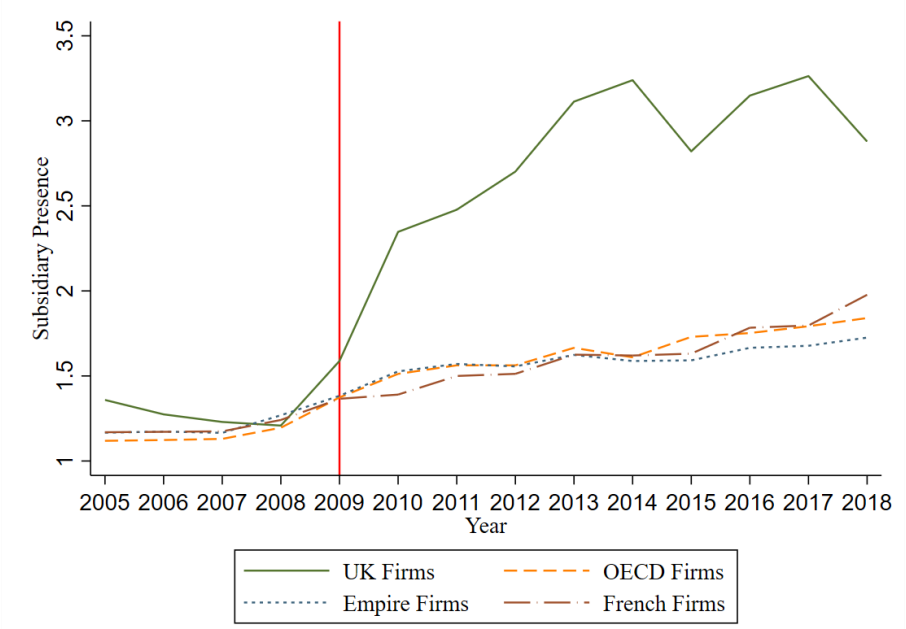


(B) U.K.-owned Subsidiaries



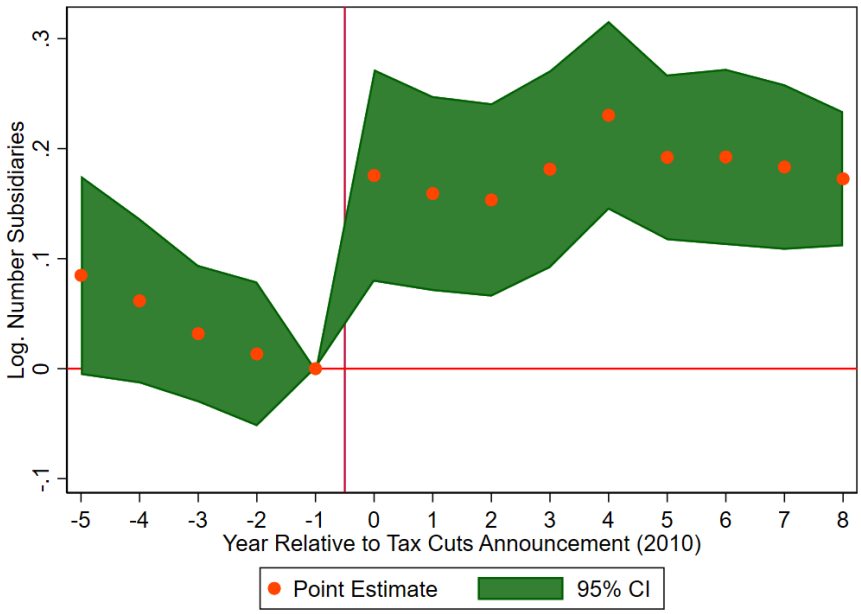
Notes: This figure shows the average number of all foreign-owned multinational firm subsidiaries (Panel (A)) and the number of UK multinational firm subsidiaries (Panel (B)) in sub-Saharan African countries across sample years. The color-coding is capped at 250 subsidiaries in a given year to improve readability. The following countries exhibited more than 250 foreign subsidiaries in the sample period: South Afircа with 724 U.K.-owned and 3,259 all multinational firm-owned subsidiaries. Angola, Botswana, Ghana, Kenya, Liberia, Mozambique, Namibia, Nigeria, and Tanzania with 285, 275, 441, 964, 439, 388, 403, 626, and 295 all multinational firm-owned subsidiaries, respectively.

Figure 2: UK Tax Reform and Multinational Firm Presence in Sub-Saharan Africa



Notes: This figure plots the mean number of subsidiaries owned by UK multinational firms (green solid line) in comparison to mean number of subsidiaries owned by multinational firms with parent entities incorporated in OECD countries (orange dashed line), multinational firms with parent entities incorporated in former colonial empire countries (blue dotted line), and French multinational firms (maroon dash-dotted line) in sub-Saharan African countries from 2005 to 2018. The mean number of subsidiaries is calculated on the multinational firm -African country-year level. The vertical line marks the major UK tax reform event year in 2009.

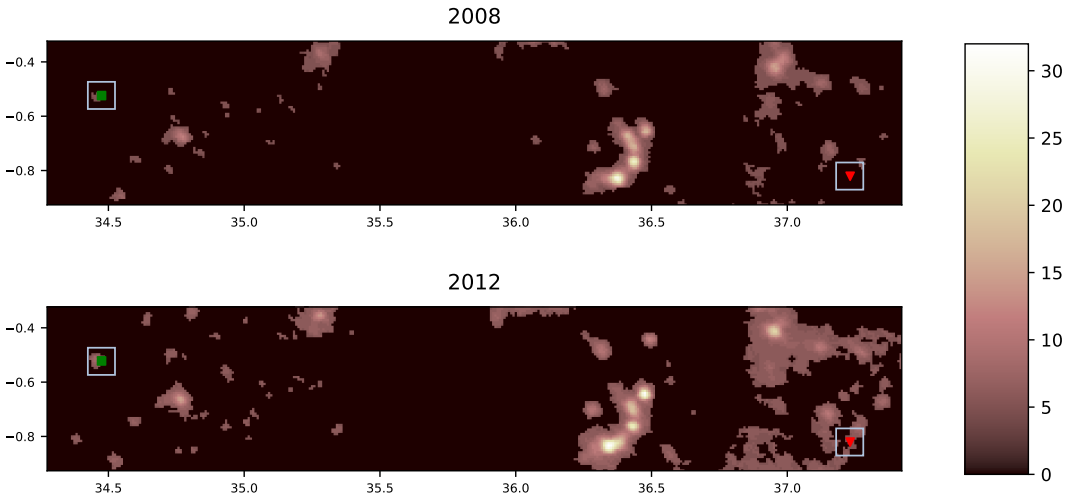
Figure 3: Event Study Results: UK Presence in Sub-Saharan Africa



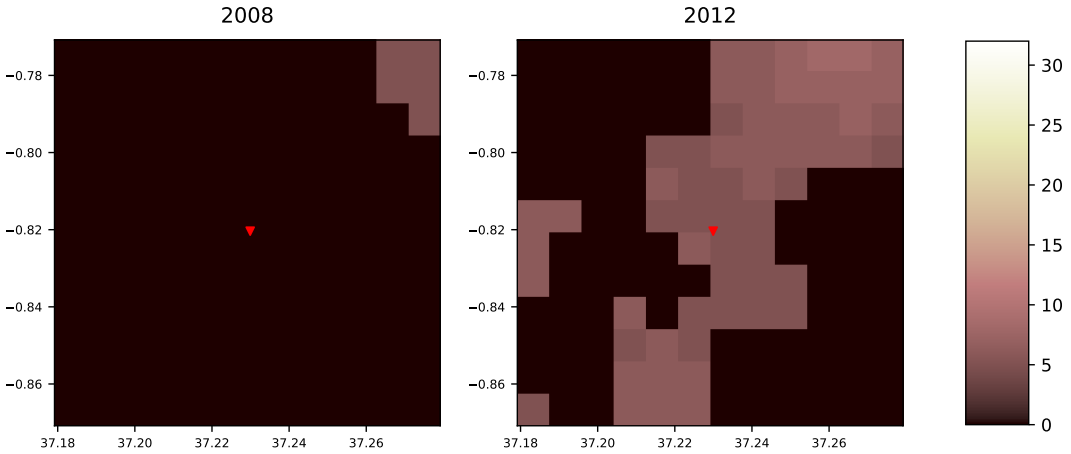
Notes: This figure displays the coefficient estimates and 95% confidence intervals for the event study regressions estimating the difference in the natural logarithm of the number of subsidiaries between UK firms and non-UK multinational firms over time relative to the first year before the UK tax cuts announcement. The regressions include calendar year fixed effects. Standard errors are clustered at the firm level.

Figure 4: Exemplary Visualization of Nighttime Luminosity around Multinational Firm Presence in Africa

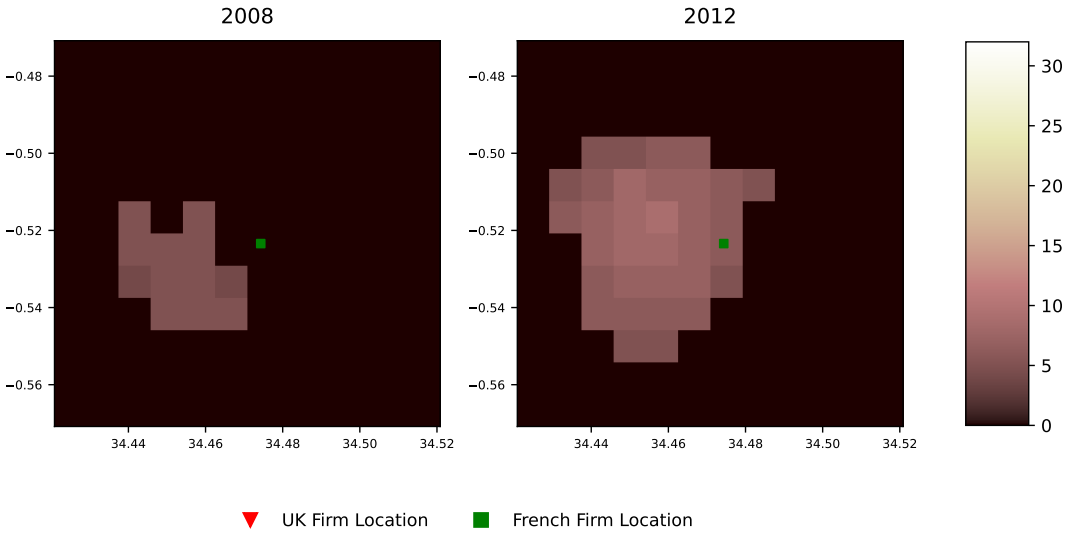
(A) Area in Kenya with U.K. and French Multinational Firm Presence



(B) Pixel-level Luminosity within 10km Grid-cell of U.K. Firm Location



(C) Pixel-level Luminosity within 10km Grid-cell of French Firm Location

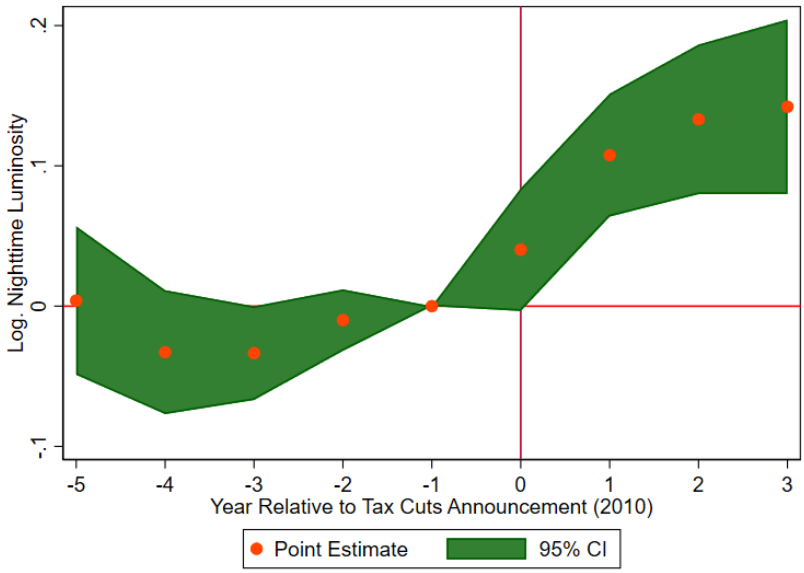


Notes: see on next page.

Notes: This figure shows the nighttime luminosity and the locations of a UK multinational firm subsidiary (red triangles) and French multinational firm subsidiary (green squares) in an exmplary region in Kenya. Panel (A) presents the geographic distribution of pixel-level luminosity in 2008 and 2012. Panel (B) presents the pixel-level luminosity in the 10km grid-cell around the UK firm in 2008 and 2012. Panel (C) presents the pixel-level nighttime luminosity in the 10km grid-cell around the French firm in 2008 and 2012.

Figure 5: Event Study Results: Effect of UK Presence in Sub-Saharan Africa on Local Economic Activity

(A) UK Presence within 10km Radius Grid-cells versus Placebo Regions



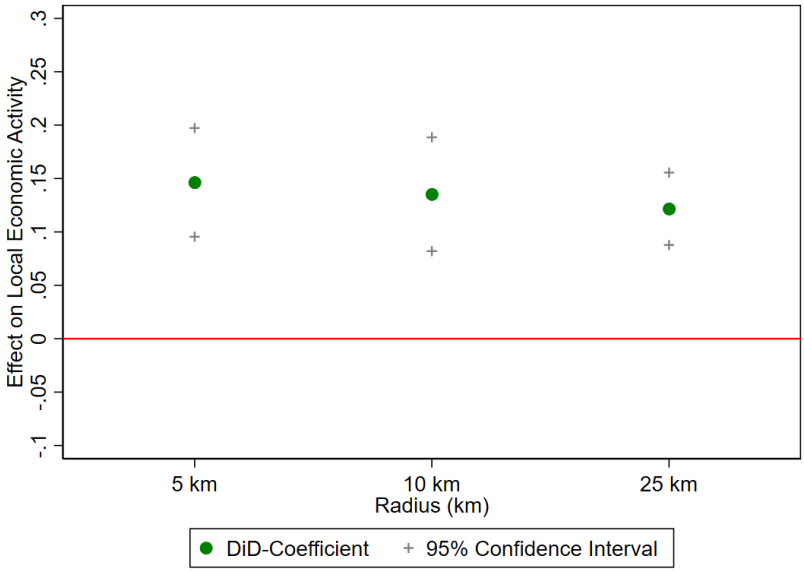
(B) UK Presence within 10km Radius Grid-cells versus French Presence within 10km Radius Grid-cells



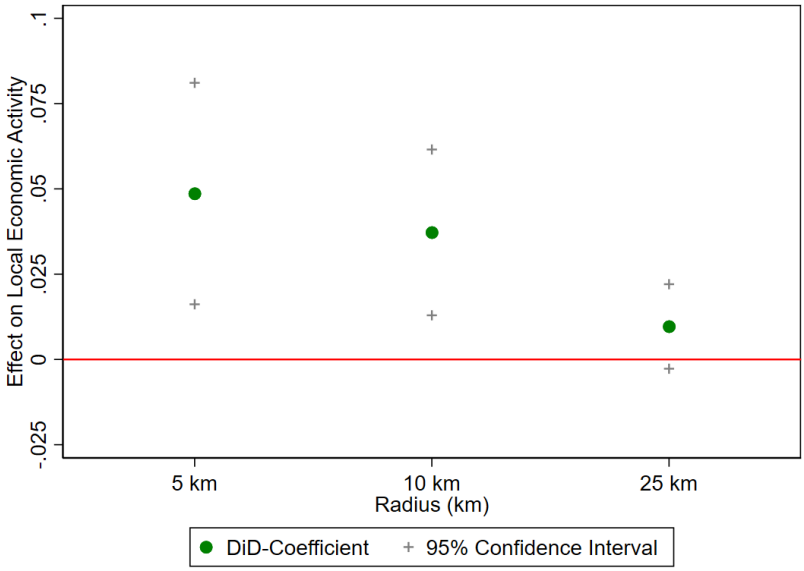
Notes: This figure displays the coefficient estimates and 95% confidence intervals for the event study regressions estimating the difference in the natural logarithm of average nighttime luminosity between 10km radius grid-cells with UK multinational firm presence and without UK multinational firm presence over time relative to the first year before the UK tax cuts announcement. In Panel (A), we match 10km radius grid-cells with UK multinational firm presence to control grid-cells within the same country that are at least 10km away from the next UK-owned subsidiary and that exhibited average luminosity values within a $\pm 20\%$ range of the treated observation in 2009. In Panel (B), control observations are 10km radius grid-cells with French multinational firm presence. The regressions include calendar year and firm-by-country (i.e., unit of observation) fixed effects. Standard errors are clustered at the grid-cell level.

Figure 6: Treatment Effects of Multinational Firm Presence on Local Economic Activity by Grid-cell Size

(A) UK Firm Presence within 10km and Placebo Control Regions



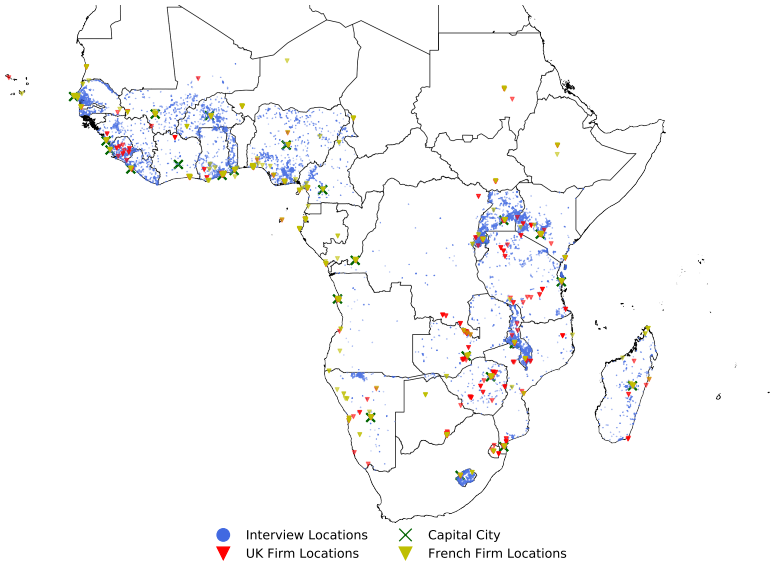
(B) UK Firm Presence vs. French Firm Presence



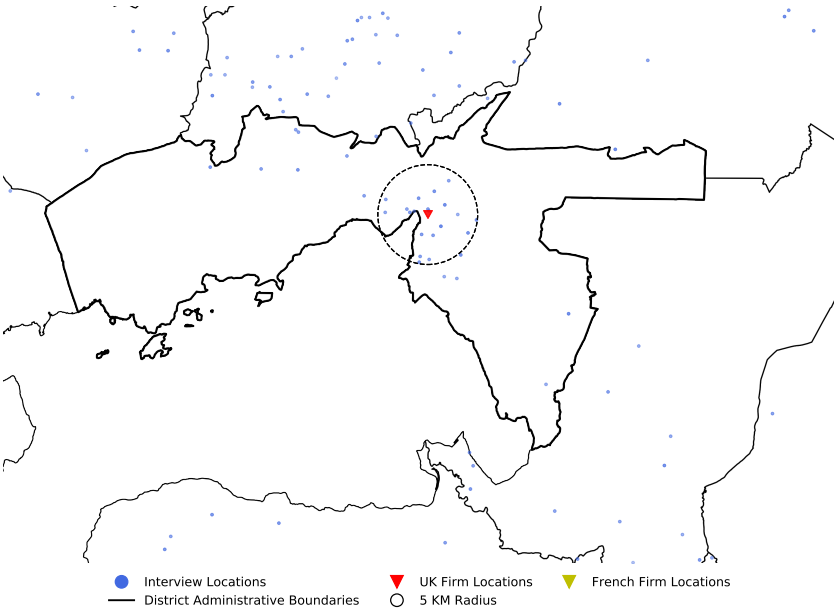
Notes: This figure plots coefficient estimates of *UK Firm* * *Post* and 95% confidence dence intervals for grid-cells with radii of 5km, 10km, and 25km, respectively. We estimate the models from Column (1) of Table 5 but use different radii to construct our dependent variable *Log. Luminosity*. In Panel (A), we match 10km radius grid-cells with UK multinational firm presence to control grid-cells within the same country that are at least 10km away from the next UK-owned subsidiary and that exhibited average luminosity values $\pm 20\%$ range of the treated observation in 2009. In Panel (B), control observations are 10km radius grid-cells with French multinational firm presence.

Figure 7: DHS Survey Locations and U.K. Firm Subsidiaries in Sub-Saharan Africa

(A) DHS Survey Clusters and Multinational Firm Subsidiaries in Sub-Saharan Africa

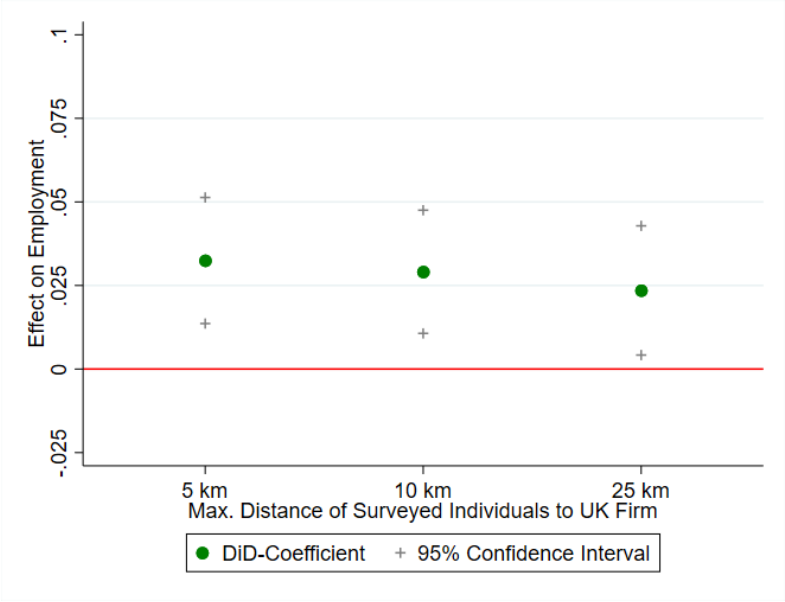


(B) DHS Survey Clusters and Multinational Firm Subsidiaries in the Kisumu Area (Kenya)



Notes: This figure shows the locations of DHS interviews (blue dots) and U.K. or French multinational firm subsidiaries (red or green triangles). Panel (A) presents the geographic distributions across all countries in sub-Saharan African. Panel (B) presents the geographic distributions in Kenya. Panel (B) also presents a 5km radius around the U.K. multinational firm subsidiary located in Kisumu.

Figure 8: Treatment Effects of Multinational Firm Presence on Local Employment by Grid-cell Size



Notes: This figure plots coefficient estimates of *UK Firm * Post* and 95% confidence intervals for grid-cells with radii of 5km, 10km, and 25km, respectively. We estimate the models from Column (1) of Table 6 but use different radii to identify treated DHS survey participants when studying *Employment* as the outcome. Control observations are from survey clusters at least 10km away from the next UK-owned subsidiary.

Table 1: Summary Statistics

Variable	Obs	Mean	P10	P25	Median	P75	P90	SD
Subsidiary Presence Variables (Firm-Country-Year)								
Log. Number Subsidiaries (in Africa)	116,225	0.37	0.00	0.00	0.00	0.69	1.10	0.67
UK Firm	116,225	0.06	0.00	0.00	0.00	0.00	0.00	0.24
No. Subsidiaries (worldwide)	116,225	123.51	2.00	2.00	8.00	74.00	346.00	447.95
No. Subsidiary Countries (worldwide)	116,225	16.69	1.00	2.00	3.00	21.00	55.00	26.03
Tax Differential within Firm (%)	116,225	18.11	0.00	0.00	12.00	33.99	55.00	19.02
Tax Haven Subsidiaries	116,225	9.62	0.00	0.00	0.00	4.00	22.00	53.63
UK Colonies	116,225	0.67	0.00	0.00	1.00	1.00	1.00	0.47
ETR	13,584	0.26	0.12	0.19	0.25	0.30	0.38	0.12
3y ETR	10,055	0.26	0.14	0.20	0.24	0.32	0.40	0.11
Firm Country Controls (Firm-Country-Year)								
Population (in million)	103,426	98.02	5.39	15.84	54.55	65.66	201.04	213.96
Inflation (%)	100,760	3.67	0.29	1.15	2.44	5.18	7.26	4.40
GDP (current USD in billion)	102,733	2,315.61	31.27	296.36	396.33	2,595.15	3,744.41	4,590.38
Nighttime Luminosity Analysis (Grid Cell-Year)								
Nighttime Luminosity (5km)	20,178	49.21	18.69	44.43	57.06	61.11	62.62	17.37
Nighttime Luminosity (10km)	20,187	43.37	13.69	34.99	48.85	57.03	60.29	17.44
Nighttime Luminosity (25km)	20,187	26.74	4.78	14.68	25.43	38.31	50.25	16.19
African Country Controls (Grid Cell-Year)								
GDP (current USD in billion)	20,187	42.68	5.32	9.92	17.09	28.68	62.41	87.51
Population (in million)	20,214	28.79	2.02	11.09	18.75	27.68	56.58	37.57
Local Employment (DHS) Analysis (Individual-Year)								
Employment (0/1)	741,875	0.63	0.00	0.00	1.00	1.00	1.00	0.48
UK Firm Presence (km)	741,875	127.53	3.33	16.80	72.77	193.73	327.48	146.67
Male	741,875	0.28	0.00	0.00	0.00	1.00	1.00	0.45
Household Members	741,875	6.70	3.00	4.00	6.00	8.00	11.00	4.44
Marital Status	734,677	0.98	0.00	0.00	1.00	1.00	2.00	1.11
Age	741,875	28.90	17.00	20.00	27.00	36.00	44.00	10.24
Urban Region	741,875	0.51	0.00	0.00	1.00	1.00	1.00	0.50

Notes: This table presents descriptive statistics of our different regression samples. We report the unit of observation for each group of variables in parentheses. Grid-cells are 0.1*0.1 decimal degrees, which is roughly 10*10 km. We construct equally-sized grid-cells for the nighttime luminosity analysis and local DHS analysis.

Table 2: Domestic Tax Cuts and Foreign Subsidiary Presence in Sub-Saharan Africa

	(1)	(2)	(3)	(4)	(5)	(6)
Panel (A)	*Log. Number Subsidiaries*					
*UK Firm * Post*	0.187***	0.186**	0.187***	0.186**	0.234***	0.230***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.07)
Obs.	91,996	20,049	91,996	20,049	74,404	18,508
Adj. R2	0.812	0.763	0.807	0.757	0.857	0.841
Balanced Presence	No	Yes	No	Yes	No	Yes
Firm Controls	No	No	No	No	Yes	Yes
Firm Country Controls	No	No	No	No	Yes	Yes
Firm-Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Pair FE	No	No	Yes	Yes	Yes	Yes
Industry-Year FE	No	No	No	No	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel (B)	*Log. Number Subsidiaries*					
	OECD		Empires		UK vs. FR	
*UK Firm * Post*	0.337***	0.338***	0.299***	0.298***	0.289***	0.291***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
Obs.	47,621	12,490	25,867	7,731	13,845	5,270
Adj. R2	0.739	0.682	0.746	0.694	0.733	0.682
Balanced Presence	No	Yes	No	Yes	No	Yes
Firm-Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports coefficient estimates of difference-in-differences regressions estimating the effect of the UK tax reform in 2009 on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*). *UK Firm* is a binary variable equal to one if a multinational firm's parent entity is incorporated in UK. *Post* is a binary indicator equal to one for years after 2009. Panel (A) presents results using all firms in our sample. Panel (B) presents results restricting the sample of control firms to multinational firms from OECD countries, from former colonial empires (Belgium, France, Germany, Italy, Portugal, Spain) and French multinational firms. The models in odd-numbered columns include all firm-by-African country-year observations. The models in even-numbered columns only include firm-by-African country-year observations for firms that already had a subsidiary presence in a given African country in the pre-period (balanced presence). The sample period is from 2005 to 2018. Firm data are from BvD Orbis. The list of control variables is displayed in Table 1. Standard errors are clustered at the firm level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3: Domestic Tax Cuts and Foreign Subsidiary Presence by African Country Characteristics and Industry

Panel (A)	(1)	(2)	(3)	(4)
	Log. Number Subsidiaries			
	Full Sample		UK vs. FR	
	UK Colonies	Non-UK colonies	UK Colonies	Non-UK colonies
*UK Firm * Post*	0.274***	0.060	0.297***	0.063
	(0.06)	(0.06)	(0.07)	(0.06)
Difference	0.214***		0.235***	
	(0.08)		(0.08)	
Obs.	60,568	34,903	6,927	7,630
Adj. R2	0.604	0.499	0.477	0.378
Firm FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Panel (B)	(1)	(2)	(3)
	Log. Number Subsidiaries		
	Manufacturing	Construction	Mining & Quarrying
*UK Firm * Post*	0.234***	0.250	0.057
	(0.07)	(0.16)	(0.15)
Difference vs. (1)		0.016	-0.176
		(0.17)	(0.16)
Obs.	20,204	3,005	4,932
Adj. R2	0.514	0.504	0.480
Firm FE	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes

Notes: This table reports coefficient estimates of difference-in-differences regressions estimating the effect of the UK tax reform in 2009 on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*). *UK Firm* is a binary variable equal to one if a multinational firm's parent entity is incorporated in UK. *Post* is a binary indicator equal to one for years after 2009. In Panel (A) the sample is split on sub-Saharan country level based on whether the subsidiary is located in a fomer UK sub-Saharan colony or not. Columns (1) and (2) present results using all firms in our sample. Columns (3) and (4) present results restricting the sample to French and UK multinational firms. Panel (B) presents estimates for splitting the sample into different industry categories based on NACE Rev. 2 sections. *Manufacturing* refers to section "C", *Construction* to section "F", and *Mining & Quarrying* to sections "B". The sample period is from 2005 to 2018. Standard errors are clustered at the firm level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Domestic Tax Cuts and Foreign Subsidiary Presence by Multinational Firm Characteristic

	(1)	(2)	(3)	(4)
	Log. Number Subsidiaries			
	Pre-period Effective Tax Rate		Pre-three-year Effective Tax Rate	
	High	Low	High	Low
*UK Firm * Post*	0.218**	0.095	0.301**	0.132
	(0.09)	(0.09)	(0.12)	(0.12)
Difference		0.123		0.169
		(0.13)		(0.17)
Obs.	7,998	7,531	4,684	5,309
Adj. R2	0.556	0.528	0.570	0.556
Firm FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Notes: This table reports coefficient estimates of difference-in-differences regressions estimating the effect of the UK tax reform in 2009 on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*). *UK Firm* is a binary variable equal to one if a multinational firm's parent entity is incorporated in UK. *Post* is a binary indicator equal to one for years after 2009. In columns (1) and (2), the sample is split on the multinational firm level based on the median of firms' consolidated effective tax rates in 2009. In columns (3) and (4) the sample is split based on the median of multinational firms' three-year (2007-2009) average consolidated effective tax rate. The sample period is from 2005 to 2018. Standard errors are clustered at the firm level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Multinational Firm Presence and Local Economic Activity

	(1)	(2)	(3)
Panel (A)	*Log. Nighttime Luminosity (10km)*		
	UK Firm Presence within 10km		
*UK Firm * Post*	0.045***	0.045***	0.045***
	(0.02)	(0.01)	(0.01)
Log. GDP	0.037		
	(0.04)		
Log. Population	-0.898***		
	(0.34)		
Obs.	9,810	9,810	9,810
Adj. R2	0.983	0.987	0.987
Grid-cell FE	Yes	Yes	.
Grid-cell-U.K. FE	No	No	Yes
Year FE	Yes	.	.
Country-Year FE	No	Yes	Yes

Panel (B)	*Log. Nighttime Luminosity (10km)*		
	UK Firm Presence vs. French Firm Presence		
*UK Firm * Post*	0.022***	0.026***	0.023**
	(0.01)	(0.01)	(0.01)
Log. GDP	0.038***		
	(0.01)		
Log. Population	1.176***		
	(0.14)		
Obs.	27,934	23,247	27,954
Adj. R2	0.978	0.981	0.982
Grid-cell FE	Yes	Yes	.
Grid-cell-U.K. FE	No	No	Yes
Industry FE	No	Yes	No
Year FE	Yes	.	.
Country-Year FE	No	Yes	Yes

Notes: This table reports coefficient estimates of difference-in-differences regressions estimating the effect of increased UK multinational firm subsidiary presence after the tax reform in 2009 on local economic activity measured by nighttime luminosity in sub-Saharan Africa. The unit of observation is a grid-cell with a 10km radius in a given country in a given year. *UK Firm Presence* is equal to one if a UK firm's subsidiary is located within a grid-cell. *Post* is a binary indicator equal to one for years after 2009. In Panel (A), we match 10km radius grid-cells with UK multinational firm presence to control grid-cells within the same country that are at least 10km away from the next UK-owned subsidiary and that exhibited average luminosity values within a $\pm 20\%$ range of the treated observation in 2009. In Panel (B), control observations are 10km radius grid-cells with French multinational firm presence. Luminosity data are obtained from the United States Air Force Defense Meteorological Satellite Program (DMSP). We use the annualized, processed (cloud-free-observation-weighted) average over all stable nightlight pixels from The National Geophysical Data Center (NGDC) from 2005 to 2013. We use the natural logarithm of the annualized mean luminosity value as the dependent variable *Log. Luminosity*. Robust standard errors are clustered at the grid-cell level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Multinational Firm Presence in Sub-Saharan Africa and Local Employment

	(1)	(2)	(3)	(4)
Panel (A)	*Employment (0/1)*			
	UK Firm Presence vs. Non-UK Presence			
	Control Group $>$ 10km		Control Group $>$ 50km	
*UK Firm Presence * Post*	0.029***	0.025***	0.029***	0.025**
	(0.009)	(0.009)	(0.010)	(0.010)
Regional Employment (Pre-period)	0.136***	0.146***	0.134***	0.150***
	(0.039)	(0.035)	(0.041)	(0.037)
Male		0.139***		0.140***
		(0.010)		(0.010)
Household Members		-0.006***		-0.006***
		(0.001)		(0.001)
Marital Status		0.038***		0.038***
		(0.001)		(0.001)
Age		0.014***		0.014***
		(0.000)		(0.000)
Urban Region		-0.013*		-0.013*
		(0.008)		(0.008)
Obs.	567,995	560,801	525,667	519,098
Adj. R2	0.079	0.210	0.081	0.212
Grid-cell FE * UK Firm Presence	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Panel (B)	*Employment (0/1)*			
	UK Firm Presence vs. French Firm Presence (Matched)			
	French Firm $\leq$ 10km		French Firm $\leq$ 50km	
*UK Firm Presence * Post*	0.018**	0.029***	0.030***	0.039***
	(0.008)	(0.008)	(0.007)	(0.007)
Regional Employment (Pre-period)	0.954***	0.853***	0.290***	0.315***
	(0.152)	(0.121)	(0.066)	(0.056)
Male		0.165***		0.175***
		(0.003)		(0.003)
Household Members		-0.008***		-0.009***
		(0.000)		(0.000)
Marital Status		0.046***		0.043***
		(0.001)		(0.001)
Age		0.016***		0.016***
		(0.000)		(0.000)
Urban Region		0.036***		-0.012
		(0.010)		(0.007)
Obs.	97,276	95,916	146,136	144,776
Adj. R2	0.036	0.219	0.050	0.222
Grid-cell FE * UK Firm Presence	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Notes: see on next page.

Notes: This table reports coefficient estimates of difference-in-differences regressions estimating the effect of increased UK multinational firm subsidiary presence after the tax reform in 2009 on local employment in sub-Saharan Africa. The unit of analysis is the surveyed individual. *UK Firm Presence* is equal to one if a UK firm's subsidiary is located within a 10km radius of the survey respondents' residence. *Post* is a binary indicator equal to one for years after 2009. Individual-level data are obtained from Demographic and Health Surveys (DHS). We use DHS data for countries that had survey rounds both before and after the UK tax reform. The sample period is from 1998 to 2019. The dependent variable *Employment (0/1)* indicates whether an individual is employed. In Panel (A), the control group consists of individuals living more than 10 or 50km away from the nearest UK-owned subsidiary. In Panel (B), the control group are individuals living within a 50km or 10km radius of French-owned subsidiary and not living within a 10km radius of a UK-owned subsidiary. In Panel (B), for each treated observation, one control observation was selected based on a matching algorithm with replacement that selected individuals as controls within the same country, year, region and that are also living in a rural (urban) region and that have the same gender. The control observation which is living closest to the next French-owned is kept. In Panel (A), robust standard errors are clustered at the survey region level and presented in parentheses. In Panel (B), robust standard errors are clustered at matched observation pair level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Online Appendix

A.1 Data

A.2 Data Validation

A.3 Supplementary Analyses

A.1 Data

Table A.1: Subsidiaries by Sample Country and Year

Country	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Angola	9	35	46	59	69	143	227	283	390	599	672	787	822	760	4,901
Benin	4	4	7	7	31	48	55	63	75	79	98	114	135	130	850
Botswana	6	7	8	9	43	156	271	302	448	516	819	868	921	886	5,260
Burkina Faso	3	5	12	14	29	48	73	97	153	167	193	220	266	254	1,534
Burundi	3	3	2	2	7	14	17	29	29	30	44	50	62	63	355
Cameroon	14	20	23	28	96	133	153	166	200	210	223	244	297	289	2,096
Cape Verde	3	13	18	16	24	56	70	89	102	177	192	195	208	206	1,369
Central African Republic	0	0	1	2	11	13	19	27	35	26	35	36	42	38	285
Chad	1	2	3	6	17	19	23	27	36	41	42	48	59	61	385
Comoros	0	0	1	1	1	4	8	12	17	16	14	15	11	21	121
Congo	1	6	8	9	46	64	87	97	119	136	189	220	284	254	1,520
Cote d'Ivoire	22	38	42	50	149	191	230	253	321	359	472	527	646	670	3,970
Democratic Republic of Congo	4	10	17	15	47	92	126	161	217	244	308	349	470	473	2,533
Equatorial Guinea	0	2	1	3	15	29	32	38	51	59	75	82	99	91	577
Eritrea	0	0	1	2	2	3	3	8	13	15	12	15	14	16	104
Eswatini	3	3	3	3	12	51	78	97	115	140	209	219	258	262	1,453
Ethiopia	0	2	3	4	5	15	25	52	83	96	144	176	254	280	1,139
Gabon	6	13	22	23	73	92	123	128	189	209	235	271	313	288	1,985
Gambia	1	1	2	3	11	13	21	27	29	43	45	57	65	66	384
Ghana	25	39	44	43	87	190	258	308	446	508	652	2,575	2,629	2,649	10,453
Guinea	1	3	7	11	27	44	65	90	108	114	150	174	206	202	1,202
Guinea-Bissau	0	2	2	1	2	8	13	13	20	23	24	36	37	35	216
Kenya	18	71	67	76	105	261	381	481	588	794	1,008	1,142	4,761	6,453	16,206
Lesotho	3	3	3	3	5	36	48	58	70	72	111	385	386	583	1,766
Liberia	2	2	2	5	20	156	225	560	737	785	845	1,050	1,153	2,963	8,505
Madagascar	7	14	19	20	64	86	110	129	192	181	234	260	294	303	1,913
Malawi	8	10	11	12	21	69	89	117	159	167	224	248	298	297	1,730
Mali	1	2	4	6	29	50	85	110	153	154	179	195	238	244	1,450
Mauritania	0	3	3	5	16	42	52	62	69	83	110	128	143	134	850
Mozambique	4	25	39	44	48	140	211	289	360	597	828	992	1,126	1,140	5,843
Namibia	6	6	8	9	23	208	330	393	516	646	1,001	1,157	1,254	1,265	6,822
Niger	3	6	5	5	18	22	32	41	61	59	69	74	90	86	571
Nigeria	49	149	107	130	234	477	655	778	1,018	1,263	1,538	2,016	2,183	3,242	13,839
Rwanda	2	3	3	4	10	25	32	38	46	82	119	142	177	194	877
Sao Tome and Principe	1	1	1	1	3	5	7	9	14	36	44	57	61	50	290
Senegal	14	20	24	29	98	142	198	229	290	298	340	378	445	440	2,945
Sierra Leone	2	3	3	4	8	25	33	47	75	78	105	127	152	150	812
Somalia	0	0	0	0	4	4	3	7	8	9	9	10	11	15	80
South Africa	774	836	964	1,065	3,238	6,048	7,941	9,881	11,292	11,248	18,963	20,758	22,069	21,894	136,971
South Sudan	0	0	0	0	0	1	3	4	5	9	16	22	23	26	109
Sudan	2	3	10	13	19	58	76	97	181	182	198	222	231	215	1,507
Tanzania	12	14	20	22	37	156	212	277	419	496	661	737	857	910	4,830
Togo	3	4	4	5	19	32	43	59	76	81	90	103	123	119	761
Uganda	10	22	15	17	27	102	136	184	221	247	303	348	399	401	2,432
Zambia	15	25	34	39	43	122	178	237	333	374	550	611	691	697	3,949
Zimbabwe	25	28	30	35	51	196	239	332	458	527	884	998	1,069	1,082	5,954
Total	1,067	1,458	1,649	1,860	4,944	9,889	13,296	16,786	20,537	22,275	33,276	39,438	46,332	50,897	263,704

Notes: This table presents the number of observations of subsidiaries by African country and year in our sample.

Table A.2: Subsidiaries by Sample Country and Home Country of Multinational Firms

	Multinational Firm Home Country										
Country	Australia	Canada	France	Germany	Italy	Netherlands	Portugal	Switzerland	United Kingdom	United States	Total
Angola	20	10	254	86	135	41	2,064	91	214	186	3,101
Benin	4	0	264	50	13	12	0	29	25	15	412
Botswana	233	119	126	132	18	67	4	35	458	304	1,496
Burkina Faso	199	234	334	42	11	16	0	36	129	36	1,037
Burundi	5	0	47	7	5	25	0	5	8	9	111
Cameroon	65	19	779	43	74	44	4	70	146	105	1,349
Cape Verde	0	2	16	5	100	10	673	4	24	14	848
Central African Republic	0	17	94	22	9	4	0	7	24	6	183
Chad	0	1	157	8	0	0	0	4	11	11	192
Comoros	0	0	41	0	0	0	0	2	3	7	53
Congo	62	23	425	20	78	24	9	41	85	74	841
Cote d'Ivoire	199	46	1,284	85	200	84	13	165	275	147	2,498
Democratic Republic of Congo	99	199	239	52	105	43	6	41	240	77	1,101
Equatorial Guinea	0	0	124	4	7	13	18	12	30	83	291
Eritrea	14	10	11	0	13	3	0	0	14	0	65
Eswatini	9	0	30	34	25	30	9	0	151	64	352
Ethiopia	18	29	16	23	77	48	0	19	105	38	373
Gabon	55	13	834	33	47	47	14	40	112	81	1,276
Gambia	2	0	27	16	6	10	7	6	31	15	120
Ghana	341	264	322	102	101	103	17	147	366	357	2,120
Guinea	58	62	245	9	18	21	12	43	167	74	709
Guinea-Bissau	0	6	15	2	3	11	50	1	0	9	97
Kenya	47	85	279	260	120	121	30	174	1,034	599	2,749
Lesotho	4	10	45	32	4	13	0	0	116	50	274
Liberia	80	35	45	162	54	43	0	27	294	298	1,038
Madagascar	95	30	608	64	54	22	3	27	108	71	1,082
Malawi	47	18	61	39	19	9	43	40	233	134	643
Mali	195	176	299	28	28	16	8	42	93	41	926
Mauritania	62	39	126	23	10	10	0	5	30	19	324
Mozambique	150	52	182	93	229	104	1,776	66	538	139	3,329
Namibia	342	181	126	144	72	64	35	51	619	215	1,849
Niger	22	19	212	12	11	7	0	11	38	38	370
Nigeria	43	78	702	257	321	284	36	222	1,120	1,102	4,165
Rwanda	7	19	45	23	0	29	1	12	54	36	226
Sao Tome and Principe	0	0	9	0	0	9	98	0	1	1	118
Senegal	75	39	982	75	240	47	26	36	119	173	1,812
Sierra Leone	56	34	48	19	15	18	8	20	129	39	386
Somalia	0	0	23	1	0	0	0	0	3	0	27
South Africa	2,210	861	2,937	3,593	1,461	1,727	292	1,268	10,132	7,561	32,042
South Sudan	0	0	10	0	1	0	0	0	17	5	33
Sudan	0	6	41	7	10	2	0	5	72	9	152
Tanzania	420	271	138	127	97	51	9	100	650	263	2,126
Togo	1	9	234	55	14	21	1	30	44	22	431
Uganda	22	33	117	54	38	30	20	51	281	214	860
Zambia	191	159	111	72	49	22	0	80	535	225	1,444
Zimbabwe	35	47	90	111	87	22	8	60	1,110	289	1,859
Total	5,487	3,255	13,154	6,026	3,979	3,327	5,294	3,125	19,988	13,255	76,890

Notes: This table presents the number of observations of subsidiaries by the home country of multinational firms for the top ten multinational firm home countries in our sample.

Table A.3: DHS Survey Waves Used in the Analyses

Country	Years of Survey Rounds											
Burkina Faso	1998	1999	2003	2010	2014	2017	2018					
Democratic Republic of Congo	2007	2013	2014									
Cote d'Ivoire	1998	1999	2011	2012								
Cameroon	2004	2011	2018	2019								
Ghana	1998	1999	2003	2008	2014	2016						
Guinea	1999	2005	2012	2018								
Kenya	2003	2008	2009	2014	2015							
Liberia	2006	2007	2008	2009	2011	2013	2016					
Lesotho	2004	2005	2009	2010	2014							
Mali	2001	2006	2012	2013	2015	2018						
Malawi	2000	2004	2005	2010	2012	2014	2015	2016	2017			
Mozambique	2009	2011	2015	2018								
Namibia	2000	2006	2007	2013								
Nigeria	2003	2008	2010	2013	2015	2018						
Rwanda	2005	2007	2008	2010	2011	2014	2015					
Sierra Leone	2008	2013	2016	2019								
Senegal	2005	2008	2009	2010	2011	2012	2013	2014	2019			
Togo	1998	2013	2014	2017								
Tanzania	1999	2003	2004	2007	2008	2009	2010	2011	2012	2015	2016	2017
Uganda	2000	2001	2006	2009	2010	2011	2014	2015	2016	2018	2019	
Zambia	2007	2013	2014	2018	2019							
Zimbabwe	1999	2005	2006	2010	2011	2015						

Notes: This table presents the years in which DHS surveys were conducted across African countries. The sample is restricted to DHS surveys with available geographic data to match individual respondents' locations to the multinational firm subsidiary locations and to regions that are surveyed at least once before and after the U.K. tax reform.

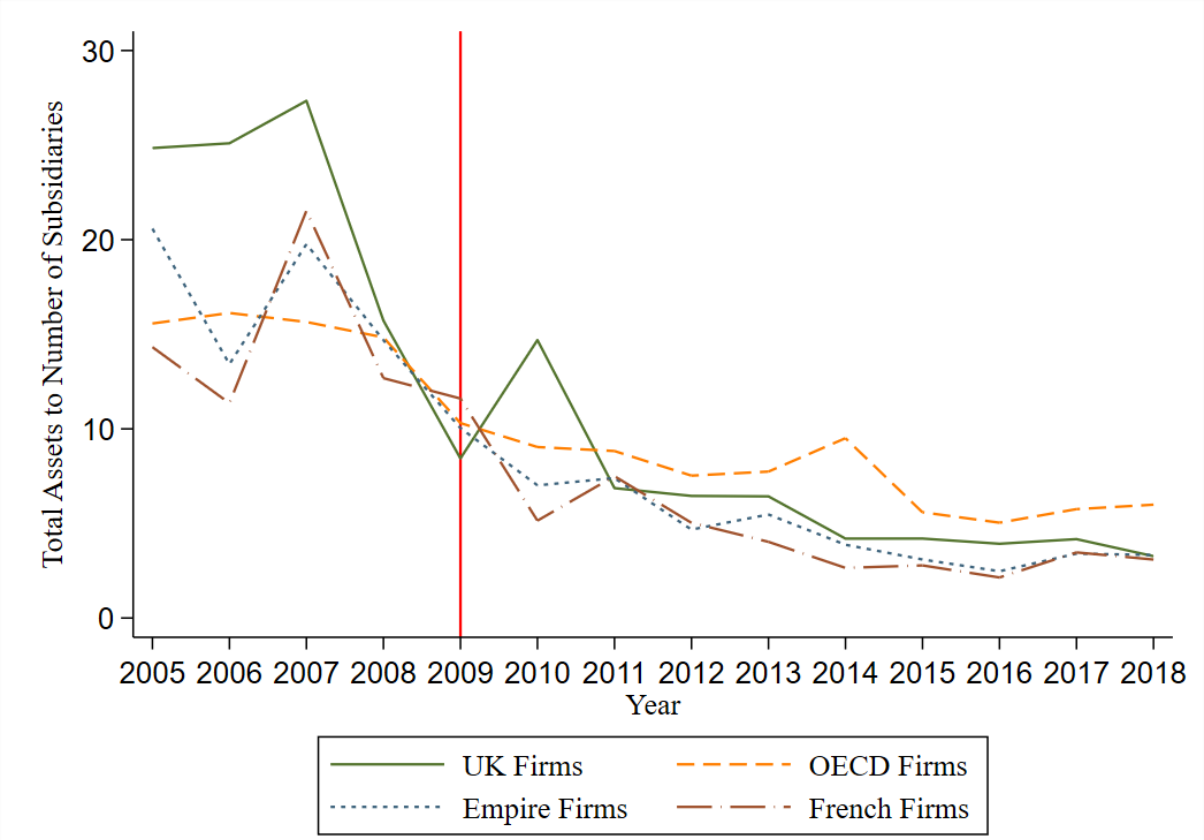
A.2 Data Validation

Table A.4: Multinational Firm Subsidiaries in the Orbis Database and Home Country FDI Outflow

	(1)	(2)	(3)	(4)
	Log. Number Subsidiaries			
Outward FDI Flow	0.165***	0.180***		
	(0.03)	(0.03)		
Outward FDI Stock			0.049***	0.050***
			(0.01)	(0.01)
Obs.	4,014	4,014	4,022	4,022
Adj. R2	0.050	0.087	0.214	0.252
Year FE	No	Yes	No	Yes

Notes: This table reports coefficient estimates of regressions estimating the relation between outward FDI from an OECD country to a sub-Saharan African country and the natural logarithm of the total number of multinational firm subsidiaries in a given sub-Saharan country. *Log. Number Subsidiaries* refers to the total number of subsidiaries in a sub-Saharan country owned by multinational firms from one OECD country. *Outward FDI Flow* refers to the pairwise outward FDI flow from an OECD country to a sub-Saharan country during a calendar year. *Outward FDI Stock* refers to the pairwise outward FDI stock that an OECD country holds in a sub-Saharan country at the end of a calendar year. Data on outward FDI by African country is obtained from OECD.Stat. Firm data are from BvD Orbis. Robust standard errors are clustered at the country-pair and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Figure A.1: Multinational Firm Subsidiaries in the Orbis Database and Firm Size Over Time



Notes: This figure plots the mean ratio of consolidated total assets to the number of subsidiaries in sub-Saharan Africa for multinational firms from 2005 to 2018. The mean ratio of UK multinational firms (green solid line) is compared to the mean ratio of multinational firms with parent entities incorporated in OECD countries (orange dashed line), multinational firms with parent entities incorporated in former colonial empire countries (blue dotted line), and French multinational firms (maroon dash-dotted line) in sub-Saharan African countries. The red vertical line marks the UK tax reform in 2009. Firm data are from BvD Orbis.

A.3 Supplementary Analyses

Table A.5: Domestic Tax Cuts and Foreign Subsidiaries in Sub-Saharan Africa

	(1)	(2)	(3)	(4)	(5)	(6)
Panel (A)	*Log. Number Subsidiaries*					
UK Firm	-0.117***	-0.117***				
	(0.03)	(0.03)				
*UK Firm * Post*	0.179***	0.226***	0.172***	0.173**	0.134***	0.133**
	(0.03)	(0.07)	(0.05)	(0.07)	(0.05)	(0.06)
Obs.	103,670	20,681	96,148	20,276	78,867	18,887
Adj. R2	0.013	0.098	0.542	0.678	0.397	0.606
Balanced Presence	No	Yes	No	Yes	No	Yes
Firm FE	No	No	Yes	Yes	Yes	Yes
Country FE	No	No	Yes	Yes	No	No
Year FE	Yes	Yes	Yes	Yes	.	.
Industry-Year FE	No	No	No	No	Yes	Yes

Panel (B)	*Log. Number Subsidiaries*					
	Foreign		UK vs. US		UK vs. JP	
*UK Firm * Post*	0.270***	0.242***	0.401***	0.229**	0.624***	0.411***
	(0.07)	(0.06)	(0.09)	(0.09)	(0.11)	(0.12)
Obs.	63,861	13,559	13,199	3,413	7,503	1,905
Adj. R2	0.745	0.695	0.722	0.685	0.724	0.695
Balanced Presence	No	Yes	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports coefficient estimates of difference-in-differences regressions estimating the effect of the UK tax reform in 2009 on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*). *UK Firm* is a binary variable equal to one if a multinational firm's parent entity is incorporated in UK. *Post* is a binary indicator equal to one for years after 2009. Panel (A) presents results using all firms in our sample. Panel (B) presents results restricting the sample of control firms to multinational firms, US multinational firms and Japanese multinational firms. The models in odd-numbered columns include all firm-by-African country-year observations. The models in even-numbered columns only include firm-by-African country-year observations for firms that already had a subsidiary presence in a given African country in the pre-period (balanced presence). The sample period is from 2005 to 2018. Firm data are from BvD Orbis. Standard errors are clustered at the firm level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.6: Domestic Tax Cuts and the Likelihood of Foreign Subsidiary Presence in Sub-Saharan Africa

	(1)	(2)	(3)	(4)	(5)	(6)
Panel (A)	*New Subsidiary*					
*UK Firm * Post*	0.012***	0.010***	0.011***	0.010***	0.016***	0.012***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Obs.	756,431	756,431	610,125	756,373	729,880	594,291
Adj. R2	0.060	0.103	0.073	0.102	0.116	0.114
Firm Controls	No	No	No	No	Yes	Yes
Firm Country Controls	No	No	No	No	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Pair FE	No	No	No	Yes	No	Yes
Year FE	Yes	.	.	.	.	.
Industry-Year FE	No	No	Yes	No	No	Yes
Country-Year FE	No	Yes	No	Yes	Yes	Yes

Panel (B)	*New Subsidiary*					
	Foreign	OECD	Empires	UK vs. FR	UK vs. US	UK vs. JP
*UK Firm * Post*	0.011***	0.013***	0.022***	0.045***	0.016***	0.028***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Obs.	402,453	285,133	159,052	96,737	96,448	68,697
Adj. R2	0.091	0.088	0.067	0.083	0.085	0.102
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes

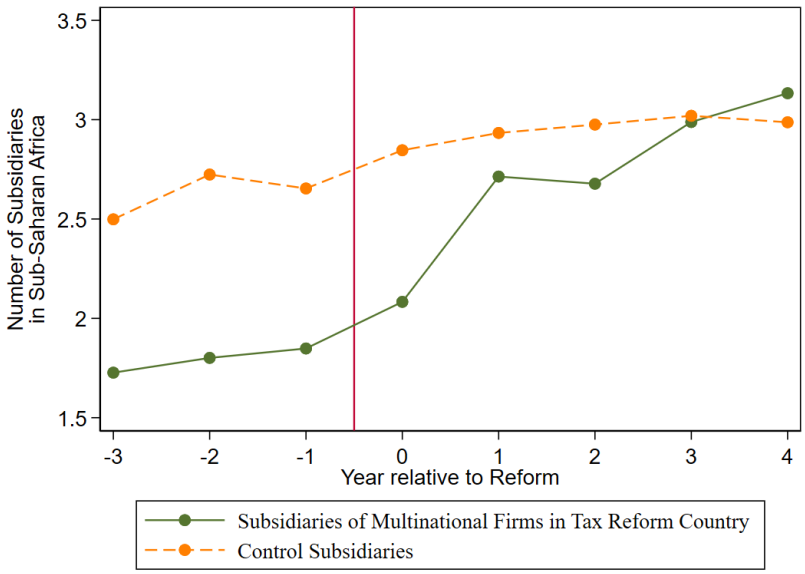
Notes: This table presents coefficient estimates of the linear probability model estimating the probability that a newly founded subsidiary in sub-Saharan African countries is UK-owned after the UK tax reform in 2009. *New Subsidiary* is a binary variable equal to one in the year the sub-Saharan African subsidiary was founded. *UK Firm* is a binary variable equal to one if a multinational firm is headquartered in UK. *Post* is a binary indicator equal to one for years after 2009. Panel A presents results using all firms in our sample. Panel B presents results restricting the sample of control subsidiaries to those of foreign headquartered multinational firms, firms headquartered in OECD countries, firms headquartered in former colonial empires (Belgium, France, Germany, Italy, Portugal, Spain), French multinational firms, US multinational firms, or Japanese multinational firms. The sample period is from 2005 to 2018. The list of control variables is displayed in Table 1. Standard errors are clustered at the firm level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.7: Tax Reform and UK Firm Presence Around the Globe

	(1)	(2)	(3)	(4)	(5)
	Log. Number Subsidiaries				
	France	*Germany*	*Ireland*	*OECD w/o UK*	*UK*
UK Firm * Post	0.047	0.071***	0.042*	0.075***	-0.100***
	(0.03)	(0.02)	(0.02)	(0.01)	(0.01)
Obs.	704,700	1,170,370	129,342	18,214,475	1,465,856
Adj. R2	0.846	0.858	0.805	0.570	0.863
Firm FE	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes

Notes: This table reports coefficient estimates of difference-in-differences regressions estimating the effect of the UK tax reform in 2009 on the natural logarithm of the number of subsidiaries of a firm in a given country (*Log. Number Subsidiaries*). *UK Firm* is a binary variable equal to one if a multinational firm's parent entity is incorporated in UK. *Post* is a binary indicator equal to one for years after 2009. The sample consists of multinational firms incorporated in an OECD country. Column (1) presents results for the effect on the number of subsidiaries in France. Columns (2) to (5) show results for using Germany, Ireland, all OECD countries excluding UK, and UK as countries of interest, respectively. The sample period is from 2005 to 2018. Firm data are from BvD Orbis. Standard errors are clustered at the firm level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Figure A.2: Tax Reforms in OECD Countries and Multinational Firm Presence in Sub-Saharan Africa



Notes: This figure plots the development of the mean number of subsidiaries of multinational firms in sub-Saharan Africa in years relative to calendar years of major corporate income tax reforms in the multinational parent entities' countries of incorporation. Treated subsidiary observations (green solid line) belong to multinational firms with parent entities that are incorporated in an OECD country with a large corporate income tax reductions. The included tax reforms are Germany (2008), Canada (2008), Japan (2012) and Spain (2015). Control observations (orange dotted line) refer to the mean number of subsidiaries in sub-Saharan Africa in the same calendar year belonging to firms incorporated in an OECD country that do not experience a tax reform in the respective event years.

Table A.8: Tax Reforms in OECD Countries and Multinational Firm Presence in Sub-Saharan Africa

	(1)	(2)	(3)
	Log. Number Subsidiaries (Africa)		
Tax Reform	0.25***	0.14***	0.12*
	(0.06)	(0.05)	(0.07)
Obs.	4,717	4,378	3,916
Adj. R2	0.025	0.842	0.847
Balanced Presence	No	No	No
Firm Controls	No	Yes	Yes
Firm Country Controls	No	Yes	Yes
Firm FE	No	Yes	Yes
Industry-Year FE	No	No	Yes
Year FE	Yes	Yes	.

Notes: This table presents coefficient estimates of the difference-in-differences regressions estimating the effect of tax reforms in OECD countries on the natural logarithm of the total number of subsidiaries of a firm in sub-Saharan Africa (*Log. Number Subsidiaries (Africa)*). The included tax reforms and countries are Germany (2008), Canada (2008), Japan (2012) and Spain (2015). *Tax Reform* is an indicator variable equal to one for years after the tax reform in the respective country became effective. Standard errors are clustered at the firm level and presented in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.