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December 2021

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Working paper | 2021-17

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

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September 30, 2021

Abstract

This paper studies whether 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 17-24 percent following the 2010 announcement of U.K. tax rate reductions. Exploiting location-specific nighttime luminosity data as well as local data from the African Demographic and Health Surveys, we also document increased economic activity and higher employment rates of African citizens within close proximity (10 kilometers) of local U.K.-owned subsidiaries. Our findings imply that, beyond the goal of motivating home country investment, developed countries' corporate tax cuts have economic impact in developing nations.

Keywords: Multinational Firms, Tax Rates, Foreign Investment, Economic Development
JEL classifications: D22, D25, F14, F21, F23, F63, J23, O1

*We thank Daphne Armstrong, Alex Edwards (discussant), Zach Fox, Daniel Garrett (discussant), David Kenchington, John Kepler, Douglas Jean Laporte, Stacie LaPlante, Elias Papaioannou, Joe Piotroski, Thomas Rauter, David Samuel, Kevin Standridge, Eddy Tam (discussant), Lydia Wang, Brian Webb, and Ryan Wilson (discussant) for helpful comments. We acknowledge helpful feedback from workshop participants at the Ohio State University, Stanford Graduate School of Business, and the University of Wisconsin-Madison, as well as conference participants at the 2021 BYU Accounting Symposium, the 2021 Oxford CBT Doctoral Conference, the 2021 Annual MannheimTaxation Conference, the 2021 Berlin-Vallendar Conference on Tax Research, and the 2021 EIASM Conference on Current Research in Taxation. We thank Julian Marenz, Inga Schulz, and Zhiyan Chen for excellent research assistance. 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 Rauh, 2019), but generally this work examines investment activity within the home jurisdiction. We study whether tax rate reductions in one country are associated with *foreign* investment. We focus on developing nations in particular to evaluate whether domestic corporate tax rate cuts serve as an indirect form of foreign aid. We show that major corporate tax cuts in the U.K. result in greater multinational firm investment in sub-Saharan Africa and drive increased economic activity and employment in local African markets.

Understanding the role of developed countries' investment in developing nations is important for a variety of reasons. First, while foreign direct investment ("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 to better evaluate 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 generate large spillover effects in the local economy. However, multinational firms have been accused of exploiting local markets in developing countries, such as 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 transfers to developing countries are a critical source of aid, these direct policies are subject to local capture that limits the potential beneficial impact (Andersen et al., 2021). 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 central prediction is that tax rate reductions in developed countries are associated with foreign investment in developing nations. Theory 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). Thus, if tax rate cuts in one country generate additional financial resources for a firm, the firm could increase domestic and/or foreign investment. Consistent with this theory, recent empirical work finds that multinational firms increase foreign investment and employment after domestic tax rate changes (Lester, 2019; Glaeser et al., 2021). However, this evidence primarily examines investment in developed nations that are characterized by strong institutions and that have relatively low (and investment-favorable) statutory tax burdens. Whether such increased investment occurs in developing nations with weaker institutions and relatively higher statutory tax burdens is unclear ex ante. In addition to examining whether investment flows to Africa, we also quantify, using a variety of outcomes and methods, how much tax-related investment occurs.

Our empirical tests focus on a major tax cut in the U.K. as a shock to firms' investment in developing African nations. We use this particular tax change for four reasons. First, the U.K. tax system changed substantially, with policymakers committing to reduce the corporate tax rate from 28% to 20% by 2015 (Bowers, 2010; Liu, 2020). These rate reductions were salient and large enough to have a significant impact on corporate investment. Second, the primary focus of the U.K. tax rate reduction was to encourage domestic investment in the U.K., and therefore, the rate change provides a powerful and exogenous setting in which to examine 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 for investment in developing economies. Finally, our tests exploit variation across 46 different African nations, helping to rule out alternative explanations (such as low-taxed African regimes) and more confidently attribute our results to the U.K. tax rate change.

We construct a panel dataset of global firms from 2005 to 2018 from the Bureau van Dijk Orbis historical database. We focus on identifying majority-owned subsidiaries and track these

subsidiaries across hierarchical layers in nearly all countries of the world.[1] We retain only those parent firms with a subsidiary in at least one of the 46 sub-Saharan African nations between 2005 and 2018. Our sample includes 22,000 distinct parent firms that own over 64,000 African subsidiaries. 22 percent (19 percent) of the subsidiaries are owned by parent firms in the same African country (other African countries); the remaining 59 percent of subsidiaries are owned by parents from over 90 other countries, including western nations such as France, Germany, the U.K., and the U.S. The sample consists of 250,000 subsidiary-years, which are aggregated to the parent level for a sample of 103,670 parent firm-country-year observations (for example, Unilever-Kenya-2008).

Our first tests study changes in U.K. subsidiary presence as a proxy for firm investment in Africa. Specifically, we use a difference-in-differences specification to compare the change in the number of U.K.-owned subsidiaries in Africa around the U.K. tax cut with the change in the number of African subsidiaries of other parent firms. We find that U.K. multinational firms increased the number of subsidiaries in African countries by 17 percent after the tax cut relative to the control group. This effect increases to 24 percent in the sample conditioned on multinational firms having a pre-existing presence in a given African country prior to the U.K. tax rate reduction.[2] Limiting the control group to multinationals from OECD countries or multinationals from countries with former colonial ties to Africa yields consistent and even larger effects. We also find that results are robust to isolating the control group to French multinationals, who are most similar in terms of firm characteristics and historical investment patterns in Africa. 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 appears

[1] 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. Therefore, we are able to track firm-level equity ownership of foreign subsidiaries in 46 African countries throughout the sample period. The Online Appendix documents several steps taken to validate the data and the ownership links; see also De Simone and Olbert (2021) and Olbert (2021).

[2] 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 (a known issue with Orbis). Conditioning the empirical tests on an existing multinational presence prior to the U.K. tax rate reduction helps to mitigate concerns that the effects are driven by improved coverage in the dataset over time. Supplementary tests further validate the Orbis data; see the Online Appendix.

to be met, as foreign-owned subsidiary presence was not statistically different between the U.K. and each of the control groups prior to the reform. The U.K. tax cut-induced investment effect is present in 2010 and 2011 and becomes even stronger in later years as the corporate tax rate further declines.

Additional analyses demonstrate predictably larger effects in several 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 U.K. effective tax rates prior to the law change, 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 percent. 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 extraction sector do not drive our results.

In addition to forming new African subsidiaries, U.K. firms may have responded to the tax rate change with increased capital investment and employment in their existing African subsidiaries. Thus, we next examine whether the U.K. tax change was broadly associated with increased economic activity surrounding any (existing or new) U.K. subsidiary after the U.K. tax rate change. We measure local economic activity in two ways. First, 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). Specifically, we construct 10 kilometer (km) grid-cell radii around each subsidiary location and measure changes in luminosity from the pre- to post-reform period. Estimation requires us to hand-collect and geo-code addresses of the U.K. subsidiaries in Africa, which necessarily reduces the sample. We find a 2.2-4.5 percent increase in luminosity following the U.K. tax rate in grid-cells containing a U.K. subsidiary as compared to both i) relatively near grid-cells that have similar luminosity values in the pre-period but lack a U.K. subsidiary, and ii) other grid-cells containing 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 survey respondent to the closest U.K.-owned subsidiary in the

same country.[3] We then test whether a surveyed individual living close to the U.K. subsidiary (within 10 km) was more likely to be employed after the U.K. tax cut as compared to individuals living in the same general area but outside of the 10 km radius. We find that employment increases by 2.7 to 3.6 percentage points relative to individuals living further away from U.K. subsidiaries. Evaluated at the sample mean, this effect represents a 5 percent increase in total local employment. After further refining the control sample to include only French firms, we continue to find positive effects ranging from 1.8-2.6 percentage points.

We contribute to two streams of literature. First, we build on work studying fiscal policy spillovers (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 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; De Vito et al., 2021). However, 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. 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.[4] The closest study to our paper is Liu (2020), who documents notable investment into low-tax countries following the U.K.'s change from a worldwide to a territorial system of taxing corporate profits. However, because most of the African countries in our sample have comparable or higher statutory tax rates as compared to the U.K., the results cannot be attributed to the same factors studied in Liu (2020). Thus, we offer novel evidence linking increased subsidiary ownership, luminosity, and African employment data with fiscal policies originating in the industrial world.

[3]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).

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

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),[5] 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.[6] This finding is of particular importance given recent concerns that development in these countries has stalled and that leaders may even abandon open trade and investment (The Economist, 2021). Our results imply instead that multinational firm presence is a likely channel through which FDI enters and alters the African economy.

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 likely 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.[7]

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

[6] 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) shows that domestic firms in India benefit from product imports from richer countries.

[7] 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).

However, corporate investment in *foreign* developing countries could also increase after *domestic* tax rate reductions. Corporate investment and tax rate changes are related through a variety of mechanisms. Subject to certain exceptions (for example, in the absence of full expensing, etc.) a tax rate cut is generally expected to increase investment by lowering the cost of capital (Jorgenson, 1963; Hall and Jorgenson, 1967). However, this result generally applies to domestic investment. In the case of foreign investment, three reasons may lead domestic tax rate reductions to increased foreign investment.

First, the tax cuts may provide increased cash flows, thereby aiding financially constrained firms to realize positive net present value projects abroad (Fazzari et al., 1988). As a result, we may observe financially constrained firms increasing investment in Africa following the U.K. tax cut. Second, even if firms were unconstrained, we may observe that increased cash flows attributable to the domestic tax rate reduction provide necessary funding if typical capital providers are unwilling to provide financing for projects in developing nations. For example, while U.K. financial institutions may typically finance a firm's investment project in the home country or in other developed nations, they may be less willing to do so in developing economies because the returns are subject to both more risk and information asymmetry. Furthermore, the returns may be subject to fewer government protections in less developed political systems. Consequently, external financing may be more difficult to obtain and firms that otherwise have easy or low-cost access to capital may need to rely on internal sources for developing country investment.

Third, in the case of integrated multinational firms, returns realized in Africa are at least to some extent taxed at a lower rate after the U.K. tax rate cuts. The reason is that multinational firms typically employ internal capital markets to facilitate foreign operations. For example, the U.K. headquarters entity or other U.K.-based functions engage with an African subsidiary by providing management services, delivering intermediary products, or providing access to the firm's intellectual capital. The African subsidiary will be charged for such internally provided products and services following the arm's length principle. As a result, the firm's U.K. entities realize higher profits, i.e., the firm's tax base in the U.K. increases due to more operations abroad. Thus, lower domestic tax rates partially decrease the cost of capital for investments in foreign countries, which can explain increased investment in Africa (Jorgenson, 1963).

During the sample period, firms were increasingly expanding their global footprint, sug-

gesting a saturated domestic market, favorable foreign growth opportunities, or both. Whether and to what extent 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 Changes

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% (OECD, 2020) and much higher than the low or 0% tax rates afforded by tax haven countries. 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.[8] 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. As a consequence of both the worldwide tax regime and the relatively high corporate tax rate, 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]

While other countries also had tax rate reductions during the sample period, we focus on the U.K. tax rate change for several reasons.[10] First, the rate change was substantial, providing an

[8]To mitigate immediate double taxation of foreign-earned profits, the 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).

[9]U.K.-based 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]The Online Appendix presents results from testing responses to four other substantial tax changes during the

almost 30 percent 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).[11] 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. Third, 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.

Finally, Liu (2020) shows that the switch to a territorial tax regime in 2009 motivated cross-border investment. However, Liu (2020) focuses on investment in low-tax, developed jurisdictions as destination countries. By studying African nations, we not only provide new evidence about investment into developing countries (which were explicitly excluded from earlier work), but we also exploit variation across African national tax rates, many of which are similar or higher than the U.K. rate. This variation in local country rates permits us to disentangle the effects of the change in regime (worldwide vs. territorial) from the change in tax rates (28% vs. 20%), a distinction that is particularly relevant for generalizing results to other countries that have concurrent changes in regimes and tax rates (such as the U.S. in 2017).

Figure 1 depicts multinational firm investment in Africa proxied by the number of multinational firms' subsidiaries in a given country. The color coding reflects the total number of foreign-owned MNE subsidiaries in a country in Panel (A); in Panel (B), the shading captures

sample period in Germany (2008), Canada (2008), Japan (2012), and Spain (2015). The analyses demonstrates that our results generalize to these other settings. We also acknowledge that several other countries had corporate tax rate changes during the sample period, but because many of these changes were relatively smaller in size, we expect that the amount of cross-border investment may be minimal.

[11] 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).

the total number of U.K.-owned subsidiaries. By far the most foreign investment overall, as well as the most U.K. investment in Africa, is in South Africa. Panel (B) shows that the U.K. firm presence is relatively strong and particularly pronounced in former U.K. colonial countries (e.g., Kenya), confirming a sufficient U.K. presence in the sample.

3 Data, Sample, and Descriptive Statistics

3.1 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.[12] 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 following De Simone and Olbert (2021) and Olbert (2021).

The data are at the legal entity level. The ownership links in the data permit observation of whether an entity is "standalone" (meaning that it is not owned by another entity) or if it is owned by another firm. We call a legal entity a subsidiary if it is owned by another entity.[13] Because we are focused on studying the destination countries of business investment, we retain all African subsidiaries between 2005 and 2018 and use the ownership links in the data to identify each subsidiary's parent company and home country of incorporation. We observe 64,549 unique subsidiaries across 46 sub-Saharan countries, with a total of 250,112 subsidiary-years for the period 2005 to 2018. These subsidiaries are owned by 22,830 firms from 149 home countries.

[12] 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.

[13] The term "subsidiary" is typically used for a corporate entity as opposed to other legal entities such as partnerships. The data do not permit us to identify which entities are corporations, 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 construct of interest, FDI in Africa, could occur through any of these entities.

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. We address this issue through use of alternative samples in the empirical tests; see Section 4.3.

Table A.2 in the Online Appendix presents the sample based on parent firms' home countries. We first separately list the parent countries with the largest number of African subsidiaries and then report the count of remaining observations across three groups 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"). Approximately 20,000 subsidiary-years, or 8.0 percent of the total subsidiary-level observations, correspond to U.K. parent companies. The primary sample used in the empirical tests aggregates all subsidiaries of a parent firm to the country-year level, for a total of 103,670 parent firm-country-year observations; see Online Appendix Table A.3. This appendix also shows that 22 percent (20 percent) of the firm-country-year observations relate to parents of African subsidiaries in the same (different) African country, with the remaining observations spread across many other jurisdictions.

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

The Orbis subsidiary data permit measurement of U.K. firm presence in Africa; however, they do not allow us to directly measure outcomes such as total investment and employment spending at the subsidiary level for both existing and new African subsidiaries. In the absence of firm-specific financial data for each African subsidiary, we indirectly measure African investment and employment activity using two additional datasets.

We first proxy for local investment activity using the density of nighttime light emissions within narrowly defined regions (grid-cells) around U.K. firms' subsidiary locations. The geo-coded nature of these data allows us to study spatial economic outcomes in very specific ge-

ographic areas where these 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 subsidiary location, 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 U.K. 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. The data are at the pixel-level; we construct $0.1 * 0.1$ degree grid-cells from the pixel data to measure effects within a 10 km radius around each U.K. firm. Our tests use the annual cloud-free-observation-weighted average over all stable nightlight pixels. As with the Orbis data, we use data starting in 2005. However, we end the data used for these tests in 2013 due to the change in satellites in that year and the lack of concordance with the later 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, thereby capturing direct hiring by existing or new U.K. subsidiaries, as well as any local spillover effects resulting from increased economic activity in the area. We obtain data from the Demographic and Health Surveys (DHS), which are surveys of nationally representative, repeated cross sections of African citizens. The survey obtains information regarding respondents' demographic characteristics, health status, and employment. 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, which is an individual's neighborhood or village.

To construct a measure of employment, we follow Hjort and Poulsen (2019) and use responses to this specific question: "Aside from your own housework, have you done any work in the last seven days?" The data are reported for each individual respondent, which we aggregate to the sampling cluster level. As sampling clusters rarely appear in survey rounds both before and after the U.K. tax reform, we aggregate clusters into $10 * 10$ km grid-cells using DHS-provided GPS coordinates so as to measure employment levels in the local area both pre- and post-change. Imposing the requirement that a grid-cell be observed at least once before and after the U.K. tax reform necessitates the use of some survey data from 1998.[14] We further restrict our sample of countries to those for which GPS coordinates are available so that we can link these data to the U.K. multinational subsidiary addresses. Table A.4 in the Online Appendix presents the survey years in each of the 22 countries with requisite DHS data. Section 5.3 provides an example of these data and a representative figure for an area in Kenya.

3.4 Merging Data on Firm Presence with Data on 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 U.K. firms' subsidiary addresses. First, we perform an internet search of the nearly 3,300 distinct U.K. African subsidiaries (excluding South Africa) to identify company addresses. We identify an address for 1,637 subsidiaries, or approximately 50 percent of the (non-South African) U.K. subsidiaries.[15] This proportion appears reasonable given (i) the developing nature of the countries, (ii) the overall low level of internet presence by subsidiary companies of largely private firms, and (iii) 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 1,479 French subsidiaries

[14] For example, if a 10 km grid-cell in Kenya is surveyed in 2008, 2009, 2013, and 2014, we include all individual observations of this 10 km grid-cell into our analysis. However, if another 10 km grid-cell in Kenya is only surveyed in 2010 and 2014, we do not include observations of this 10 km grid-cell because there are no pre-period observations for that area.

[15] Three individual research assistants performed a manual internet search for each African subsidiary address 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. We first conducted this search for all entities in countries other than South Africa to ensure completeness across the broadest set of jurisdictions; ongoing work is repeating this process for the large number of South African entities.

(approximately 50 percent of the French sample). We then geo-code all addresses to obtain latitude and longitude coordinates.

Second, we retrieve GPS coordinates for all relevant pixels in the DMSP satellite data, as well as the latitude and longitude provided by DHS for each administered survey. Because the DHS 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.[16] Finally, we merge the location of the U.K. companies to both the satellite data and to survey respondents' addresses for our empirical tests.

3.5 Summary Statistics

Table 1 provides descriptive statistics about the sample. Recall that the 250,112 subsidiary-year observations are aggregated to the parent firm-African country-year level (e.g., Unilever-Kenya-2008), for a total of 103,670 firm-country-year observations. The median (average) parent firm has 1.00 (2.41) subsidiaries in an African country. Approximately 7.0 percent of this sample (7,100 observations) are U.K. parent firms. The median (average) parent firm has 13 (138.1) subsidiaries worldwide and operates in five (18.5) 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 20.25 percent, and the average firm has 10.78 tax haven subsidiaries. The parents' home countries report relatively low inflation of 3.67 percent and have over $2.3 trillion in average GDP.

We construct the luminosity sample by aggregating grid-cell data to the annual level for each of the U.K. and French subsidiaries for which address information was obtained (1,637 U.K. subsidiaries and 1,473 French subsidiaries). We obtain nine years of data (2005-2013) for the 3,110 locations with available luminosity data, resulting in a balanced panel of 27,934 subsidiary-year observations. The average 10 km radius grid-cell in which a multinational firm subsidiary is located exhibits a nighttime luminosity value of 43.9. This value, which is reported in the range between 0 (complete darkness) and 63 (maximum coding in the DMSP data), is higher, as expected, when compared to 7.7 around the relatively more remote extraction sites

[16]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.

used in Christensen et al. (2020*b*).

The sample used for the employment analysis includes 610,064 individual respondent-years, of which 157,587 relate to respondents within a 10 km radius of the U.K. subsidiary (untabulated). Approximately 64 percent of DHS survey respondents reported working outside the home (*Employment (0/1)*). The closest U.K. firm was on average 117 km from a DHS survey cluster. The average respondent lived in a household with 6.3 members and was 29 years old. Our empirical tests use varying radii around the survey cluster to compare employment status following an increased U.K. presence.

4 U.K. Tax Changes and Firm Presence in Africa

4.1 Graphical Evidence

Our first analyses examines the effect of the U.K. tax rate reduction on the total number of African subsidiaries owned by U.K. multinationals. Specifically, we analyze the relationship between the number of subsidiaries a 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 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 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 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 (Jeppesen and 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. 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 rate reduction on U.K. multinationals' African presence, we estimate the following difference-in-differences model using OLS:

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

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. We estimate Eq. 1 at the multinational firm-country-level ($n = 103,670$). *U.K. Firm* is an indicator variable equal to one if a firm f 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 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.[17] Including a measure of the tax differential controls for differences in tax rates within a multinational group and the corresponding investment incentives.

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. $\eta_{f(i)}$ denote firm fixed effects and control for time-invariant factors at the firm level, such as the general propensity to invest in an

[17] 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.

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).

4.3 Empirical Results - Firm Presence in Sub-Saharan African

4.3.1 Average Effects of the U.K. Tax Rate Change

Table 2 tabulates the results from estimating model 1. Based on the logarithmic transformation of the dependent variable, we interpret β as the percentage increase in the number of U.K. subsidiaries 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. 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 parent firm must be observed as owning at least one subsidiary within a country prior to 2010 (indicated by the label for "Balanced Presence"). Use of this sample mitigates concerns that the results are driven entirely by improving 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 coverage in the dataset.

The coefficient of 0.179 in Column (1) means that there is an approximately 17.9 percent increase in the number of U.K. multinational African subsidiaries after the announcement of the U.K. tax rate reduction, relative to the increase in the number of African subsidiaries owned by other firms. 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 17.9 percent to 24.0 percent increase in the number of U.K. subsidiaries as compared to parent firms. Given that the average parent firm has 2.41 subsidiaries in an African country (from Table 1), this is equivalent to an increase of 0.43 - 0.58 subsidiaries per African country in which each U.K. firm operates.

Figure 3 plots results of an event study test estimating annual treatment coefficients relative to 2009 as the base year before the reform ($t = -1$). The dots plot the point estimates that correspond to Table 2, Panel (A) Column 6, and the green shading provides the 95% confidence interval. The figure provides support for the validity of the common trends assumption given no statistically significant differences in years t-5 to t-1. The Figure also demonstrates an effect that begins one year following the announced U.K. tax rate reduction and persists throughout the sample period. The increasing effects reflect that the tax rate continued to decline later in the sample period.[18]

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 multi-segment firms 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 (3)), 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 (4)). Across each of these tests, we continue to observe an increased U.K. affiliate presence, with the coefficients implying an increase of 17.1-21.7 percent in the odd columns and a larger 28.1-34.4 percent increase in the more restrictive samples presented

[18]Online Appendix Table A.5 presents results after including separate *Post* indicators for 2010-2011, 2012-2014, and after 2014. We also include an indicator for 2009, the last year preceding the announcement of the tax rate reduction, to evaluate any potential anticipatory effects. We find no anticipation effect in 2009, moderate and statistically significant effects in 2010-2011 and stronger effects in 2012-2014. After the full tax rate reduction is effective 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 reduction explains our findings of increased multinational firm investment in Africa.

in the even columns. These effects imply increases of 0.41-0.83 U.K. subsidiaries on average per U.K. firm-country relative to non-U.K. firms.[19]

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.[20] We observe, as expected, that the results are strongest in those countries; furthermore, the 21.4 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 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 23.5 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 23.4 percent 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. 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 therefore, we want to assess the extent to which this industry drives 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.

[19] Table A.6, Panel (A) in the Online Appendix reports results that are robust to varying the fixed effects structure. In Table A.6 Panel (B), 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.

[20] Countries in our dataset with an U.K. colonial history are: Botswana, Eswatini, Gambia, Ghana, Kenya, Lesotho, Malawi, Nigeria, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Uganda, Zambia, and Zimbabwe. The sample is slightly smaller as compared to Table 2, Panel (A) due to the loss of singleton observations during estimation.

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 rates prior to the U.K. tax rate reduction, which reflects companies' effective tax position after taking into account both the U.K. statutory tax rate as well as certain tax incentives or planning strategies. U.K. parent firms with the highest effective tax rates prior to the tax rate reduction are presumably those that can benefit the most from the U.K. change and thus should have the greatest tax savings and the largest competitive gains for investment purposes. 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 effective tax rates pre-reform; the coefficient of 0.218 in Column (1) means that those firms had a 21.8 percent increase in subsidiary presence after the reform. In contrast, 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 inferences about the effects of the U.K. tax rate reductions on African investment.

5 U.K. Tax Cuts, 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:

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

The dependent variable *Local Economic Activity* captures either the average annual nighttime luminosity or employment status of a surveyed African individual. When measuring nighttime luminosity, we use *Log. Luminosity*, the natural logarithm of average annual nighttime luminosity of grid-cell $g(i)$ with firm i in its center as the dependent 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 an U.K. multinational firm subsidiary based on our manual search for addresses and GPS coordinates of U.K.-owned subsidiaries.[21] 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 we only permit matches that 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 grid-cells in the same country that have French subsidiaries. *Post* is an indicator variable equal to one for years after 2009. Control variables include the natural logarithm of the African country's population and GDP (*Log. Population* and *Log. GDP*) as measures of the country's economic

[21] 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.

activity. All models include grid-cell fixed effects; some models also include country-year fixed effects, $\zeta_{c(i)t}$, which absorb the time-varying country-level control variables and capture other changes in economic activity over time for each country. 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. We predict that β will be positive. However, we may observe little benefit if the subsidiary produces little real substantive economic activity that drives increased luminosity.

When measuring employment with the DHS survey data, the dependent variable is *Employment (0/1)*, which 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. 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 by that subsidiary, or by other companies in the area that benefit from the U.K. multinational presence. *Post* is as defined above. 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*. Consistent with the approach in Hjort and Poulsen (2019), we include 10 km grid-cell fixed effects interacted with the treatment indicator, $\delta_{g(i)} * U.K.FirmPresence_{g(i)}$, which control for any time-invariant differences at the local level that may be correlated with U.K. multinational firm subsidiary presence. 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 25 (or 50) km away from a next French multinational firm subsidiary. We cluster

standard errors at the enumeration area. As above, we predict that β will be positive if the U.K. corporate tax rate reduction motivates direct or spillover employment effects.

5.2 Empirical Results - Economic Activity Measured with Nighttime Luminosity

Figure 4 provides an example of the geo-coded luminosity data that depicts the effects we study formally when estimating Eq. 2. The example presents the luminosity data in an area in Kenya with both U.K. and French multinational presence. Panel (A) compares the location of the U.K. and French subsidiaries in 2008 to the same location in 2012. The red triangle (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 the U.K. and French locations, respectively. While there is some increased luminosity around the French affiliate, the change near the U.K. subsidiary appears much more substantial.

Table 5 reports formal regression results from estimating the effects of U.K. tax cuts on nighttime luminosity. We use two samples to do so. The first sample comparing grid-cells around U.K. subsidiaries to grid-cells further away - but in the same country - that lack a U.K. presence. Specifically, we match the grid-cells containing the 1,637 U.K. subsidiaries (with requisite address information) to other grid cells in the same country that had a similar level of luminosity (within 20 percent) as of the year preceding the tax rate change announcement. Because we require that the matched cells have similar levels of luminosity and be in the same country (but do not have a U.K. subsidiary), we retain 545 matched pairs. We then obtain luminosity data for these matched pairs, resulting in 9,810 subsidiary-year observations (545 x 2 x 9). Column (1) of Panel (A) reports results for this sample. We observe a 4.5 percent increase in luminosity in the local area surrounding U.K. subsidiaries in the years following the U.K. tax reform, controlling for the African country's population and overall level of economic activity. 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 with country-year fixed effects and grid-cell-by-U.K. firm

presence fixed effects, explicitly controlling for any time-invariant differences at the local level that may be correlated with U.K. firm presence. The size and significance of the coefficient is again unchanged.

One concern with using a control sample of grid-cells that lack a U.K. subsidiary is that the tests effectively compare grid-cells in more industrialized areas that may naturally attract foreign presence to grid-cells in less industrialized areas, thereby biasing the results. We address this concern in Panel (B), which presents results for measuring luminosity using a control sample of grid-cells with a centered French subsidiary. Specifically, we include grid-cells containing all 1,637 U.K. subsidiaries, as well as 1,473 grid-cells containing French subsidiaries, resulting in a total sample of 27,934 subsidiary-year observations after merging with the available luminosity data. We continue to observe that areas surrounding U.K. subsidiaries exhibit greater luminosity following U.K. tax cuts when using this sample in Panel (B). Although the size of the coefficients declines, the results continue to demonstrate a notable effect. Specifically, the coefficients imply a 2.2-2.6 percent increase in luminosity for U.K. subsidiaries 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. 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 that correspond to Table 5 Panel A, which use other within-country grid-cells with similar pre-reform luminosity values as control observations; 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 shows how effects vary based on differing radii around each location (1 km – 100 km). As expected, the effect of U.K. firm presence on local economic activity is robust across small radii and dissipates with increasing radii values.

5.3 Empirical Results - Local Employment

We next test whether employment increased in the local area surrounding U.K. subsidiaries after 2009. Figure 7 graphically depicts the DHS data used in this test. Panel (A) plots 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 5 km 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 individuals 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 coefficient estimates can be interpreted as percentage point changes in the probability of being employed. Column (1) estimates that individuals living close to a U.K. multinational subsidiary after the tax rate cut (*U.K. Firm Presence* $*$ *Post*) were 3.2 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 64 percent, this is a substantial change, implying a 5 percent 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.[22]

[22]One concern is that large metropolitan areas are the most likely destination for a U.K. multinational firm

Table 6, Panel (B) reports results using respondents living close to French-owned subsidiary locations as the control group. Use of this control group again ensures we are not mechanically comparing changes in employment in more versus less industrialized areas. Across all specifications, we document a 1.8 to 2.6 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 64 percent baseline employment rate, this implies a change of 2.8-4.1 percent.

Figure 8 presents these effects graphically using five different radii (1 km, 2 km, 5 km, 10 km, and 25 km). For each control group, we continue to observe a positive but decreasing effect as the radii increases and the average respondent's distance to the subsidiary increases. In Panel (A), even at 25 km, Figure 8 still shows a positive employment effect that is statistically different from zero.

6 Supplementary Analyses and Robustness Tests

6.1 Tax Changes in Other Countries

Although we focus on the U.K. tax reform, we also expect that other major tax changes in developed countries may result in increased outbound FDI to less developed countries (conditional on those countries having positive NPV projects). In this section, we examine the effect on subsidiary presence in Africa following four other major corporate tax reforms over the last 20 years: Germany (2008), Canada (2008), Japan (2012), and Spain (2015).[23]

Figure A.1 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. These raw data show a stark increase in the number of African subsidiaries after the tax rate change (green line). In contrast, we find that parent firms from other nations without substantial tax rate reductions have a relatively consistent number of subsidiaries (orange dotted line).

While Figure A.1 provides descriptive evidence that corporate tax cuts in these other juris-

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.

[23] We are unable to test the U.S. tax reform due to only one post-period year of available data (2018).

dictions are associated with 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. Thus, Table A.7 presents results from a staggered difference-in-differences test, where the variable *Tax Reform* is an indicator equal to one for the years following a tax rate change in each of the four countries. We document a positive and statistically significant coefficient that is robust to the inclusion of different controls and fixed effects, confirming that the documented effects from the U.K. setting also occur when examining these other four tax rate changes.

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. While use of the samples with a pre-existing presence in a country helps to mitigate this concern, we also conduct three additional tests to further validate the data. Table A.8 in the Online Appendix first validates the data 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 external data from the OECD. For example, we study whether the number of U.K. subsidiaries in Kenya in 2007 as observed in Orbis 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 confirming that the data we use is consistent with macroeconomic data that measures a similar construct.

Second, we plot the ratio of a firm's consolidated total assets to its number of subsidiaries over the sample period, observing negatively-sloped lines across several different samples in Figure A.2. One possible explanation is that new subsidiaries have fewer assets over time, or that the newer subsidiaries hold different (more intangible) assets that are less likely to be recorded on firm financial statements. A second possible explanation is that the declining line is driven by a growing denominator attributable to improved coverage in the Orbis database, which would be problematic for our empirical tests. While it is not possible to distinguish between these

explanations given the lack of subsidiary-level financial data, 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.[24] This suggests that even if the increased number of subsidiaries is due to disclosure issues, it is not systematically different for U.K. firms as compared to other firms, thereby further mitigating concerns that the Orbis data coverage is driving the observed results.

Third, in untabulated analyses, we further limit the balanced sample used in the empirical tests to only those multinational firms with a presence in the country from t-2 to t+2. We then re-estimate Eq. (1). This restriction results in a substantial reduction in the sample to 6,000 firm-country-year observations, of which approximately 10 percent relate to U.K. firms. Despite this small sample, we find that the coefficient remains the same size and continues to be statistically significant when testing the effects relative to OECD groups, empire countries, and France.

6.3 The Effects of Territorial Tax Regime Change

As discussed previously, the U.K. had other changes to its corporate tax policy during our sample period. Specifically, the U.K. converted to a territorial system in 2009. Two factors suggest that the results we document relate to changes in the U.K. tax rate, not the change to the territorial regime. First, prior work examined FDI in response to the U.K.'s switch to the territorial regime, finding a negative change Matheson et al., 2013.[25] Second, the event study result presented in Figure 3 shows that the increased subsidiary presence occurs later in the sample period, in years that correspond with additional tax rate changes. While this evidence implies that tax rate changes drive the observed results, we conduct two additional analyses to further assess driver of these effects.

First, we verify that our observed results seem unlikely due to conversion to a territorial regime by examining the counterfactual: the Japanese corporate tax reform. Similar to the U.K., Japan had two substantial changes in tax policy during the sample period: a switch to a territorial regime and a tax rate reduction. However, unlike the U.K., where these events occurred close in event time, these were separated by three years in Japan. Specifically, Japan

[24]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 changes.

[25]This result occurs because, prior to the change, firms were penalized for repatriating income earned abroad and therefore would reinvest income in host countries. In a territorial system, there is no penalty for repatriation; thus, FDI decreases, especially in low-tax countries.

converted to a territorial system in 2009, but retained its existing corporate tax rate until 2012. In Panel (B) of Table A.6, we use only Japanese firms in our control sample, finding a positive and statistically significant effect for the U.K. companies. This result permits us to attribute the results to the U.K. corporate income tax rate cuts, not to the transition from the worldwide to a territorial system of taxation. 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.

Second, we examine whether our results vary with the tax rate of the host African country. If the switch to territorial taxation drives the observed results, then we would expect to observe the results in countries with the lowest tax rate (and thus, the greatest difference between the U.K. and the statutory home country African rate). To examine this, we retrieve African statutory tax rates from the Tax Foundation, finding that only the countries of Comoros and Somalia had statutory tax rates lower than the U.K. rate after 2014. Observations from these countries account for less than 3 percent of all observations, thereby mitigating the concern that the switch to the territorial system drives our results. In Table A.10, we estimate our main model after partitioning the sample based on the tax rate differential between the U.K. and the African countries. We find a statistically significant effect in both subsamples, with no significant difference across these groups. Thus, the results do not appear driven by the change in tax regime.

6.4 Robustness Analyses

We conduct two additional robustness tests. First, our main tests focus on the number of subsidiaries a firm has in a country, refining the sample to require a presence in the pre-2009 period. In an additional test, we show that the effect of the U.K. tax reform on foreign subsidiary presence obtains at the extensive margin as well. Specifically, we estimate a linear probability model in which the outcome variable is an indicator equal to one once a subsidiary is established during our sample period (i.e., once it becomes observable in the database). Results are reported in Table A.9 in the Online Appendix. Estimates suggest that a newly formed subsidiary in Africa is approximately 1.79 percentage points more likely to be formed by a U.K. multinational firm after the U.K. tax rate change 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 percent (untabulated), this

result suggests a 26 percent increase in the likelihood that an African subsidiary belongs to a U.K. firm. These effects occur when using a number of other control samples, as seen in Panel (B).

A related question is whether U.K. firms invest in countries other than in the developing nations we focus on in this study. In Table A.11 in the Online Appendix, we present results from testing whether the U.K. tax rate change is associated with investment into other *developed* countries. We find positive effects for U.K. firms' presence in Germany and in Ireland, as well as the broader group of OECD countries. However, the coefficients appear smaller as compared to the African analysis, with effects ranging from 4.2-7.5 percent. This relatively smaller effect may be explained by U.K. firms already being widely invested in these markets. We note that we observe a *negative* effect of the U.K. tax reform on the number of U.K. firms' domestic subsidiaries. One possible explanation for this result is that the U.K. motivated foreign investment into the country, whereas existing U.K. firms responded with either no new domestic subsidiaries but instead increased investment in existing entities.

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 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.

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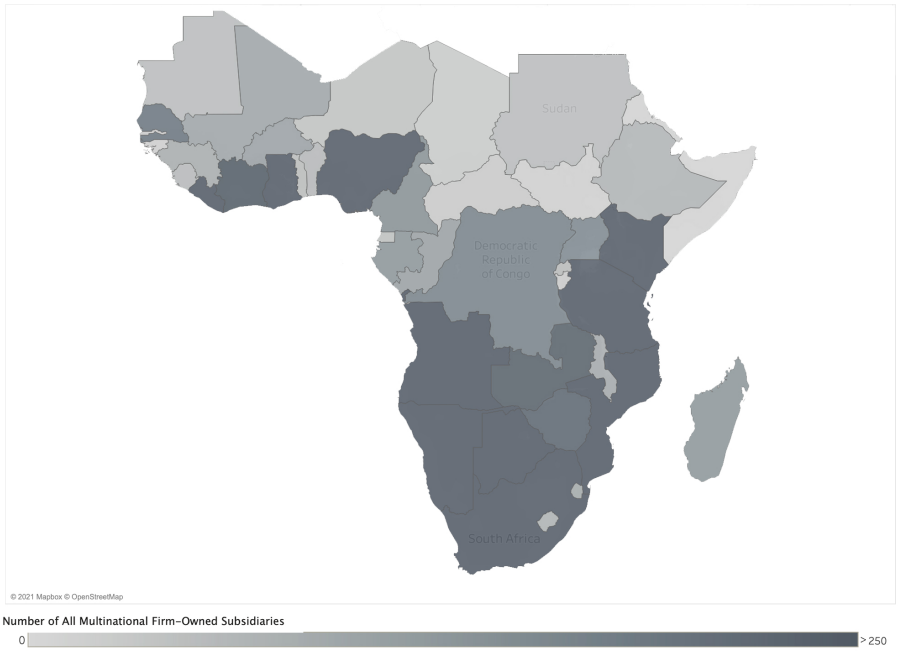
Figure 1: Foreign-owned Multinational Firm Subsidiaries in Sub-Saharan Africa

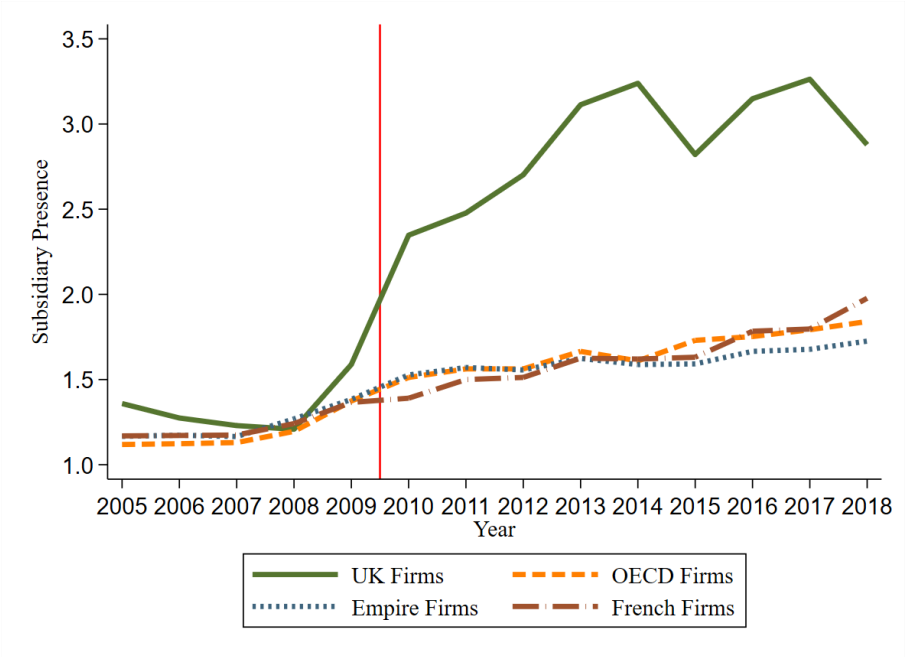
(A) All Multinational Firm Subsidiaries



(B) U.K.-owned Subsidiaries

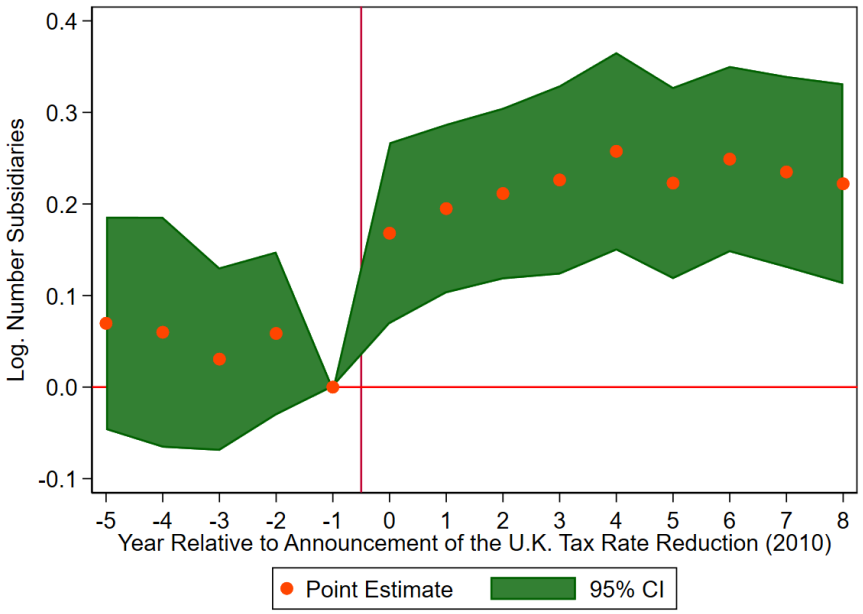
Notes: This figure shows the average number of all foreign-owned multinational firm subsidiaries (Panel (A)) and the number of U.K. multinational firm subsidiaries (Panel (B)) in sub-Saharan African countries across sample years. The color-coding is capped at 250 subsidiaries in a given year to improve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

Figure 2: U.K. Tax Cut and Multinational Firm Presence in Sub-Saharan Africa



Notes: This figure plots the mean number of subsidiaries owned by U.K. 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 U.K. tax cut announcement.

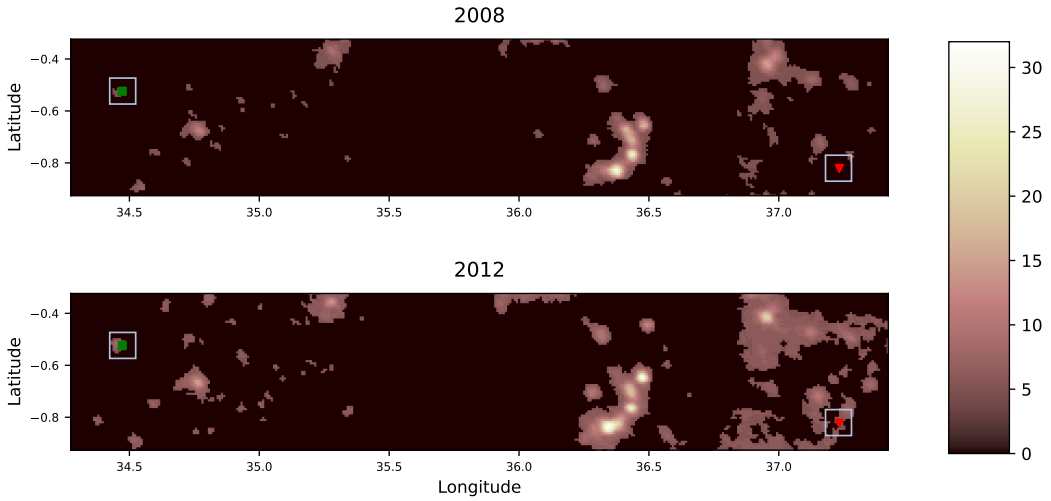
Figure 3: Event Study Results for U.K. Presence in Sub-Saharan Africa



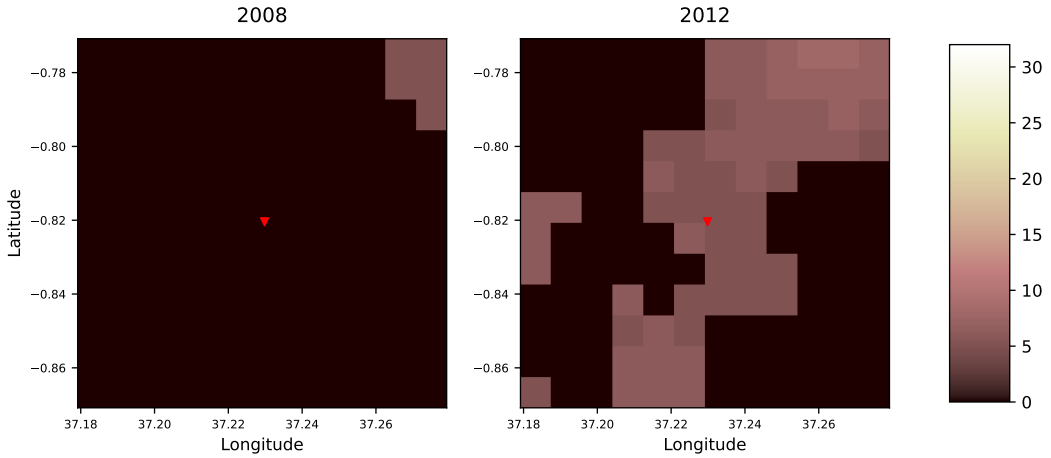
Notes: This figure displays the coefficient estimates and 95% confidence intervals for the event study regressions estimating the difference in the natural logarithm of the number of subsidiaries for U.K. firms as compared to non-U.K. multinational firms over time relative to the year preceding the U.K. tax cut announcement. The specifications are based on the model presented in Column (3) of Table 2 and include country-by-year and firm fixed effects. Standard errors are clustered at the firm level.

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

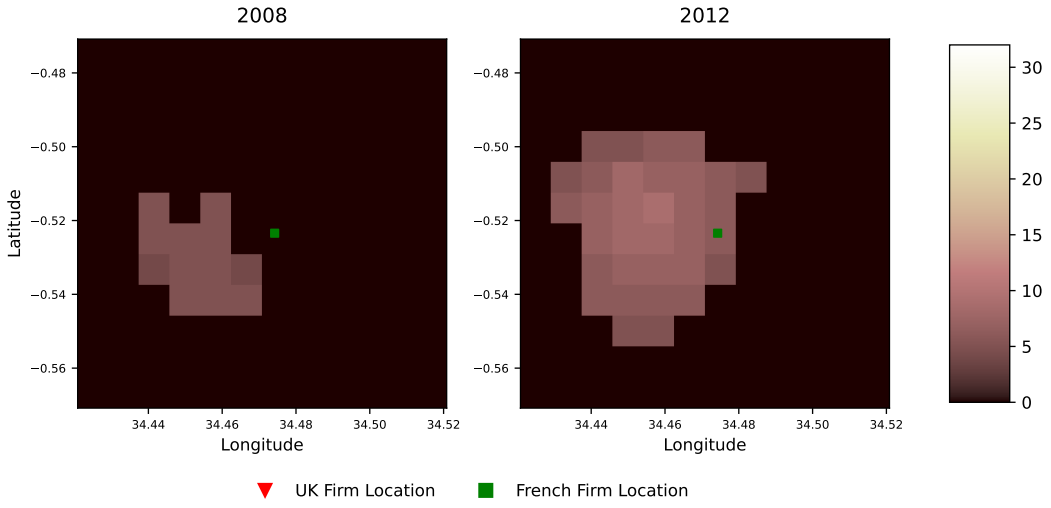
(A) Area in Kenya with U.K. and French Multinational Firm Presence



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



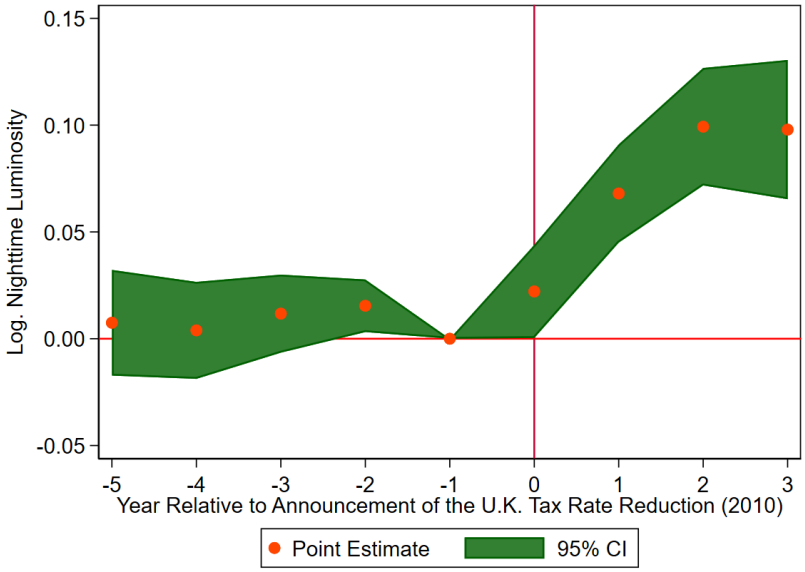
(C) Pixel-level Luminosity within 10km Grid-cell of French Firm Location



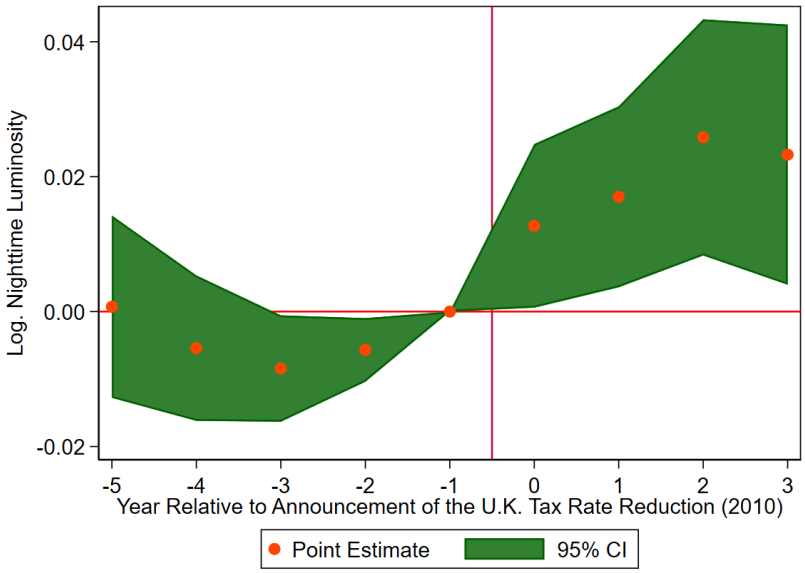
Notes: This figure shows nighttime luminosity around the locations of a U.K. multinational firm subsidiary (red triangles) and French multinational firm subsidiary (green squares) in Kenya. Panel (A) presents the geographic distribution of pixel-level luminosity in 2008 and 2012. Panel (B) presents the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

Figure 5: Event Study Results for the Effect of U.K. Presence in Sub-Saharan Africa on Local Economic Activity

(A) U.K. Presence within 10 km Radius Grid-cells vs. Placebo Regions

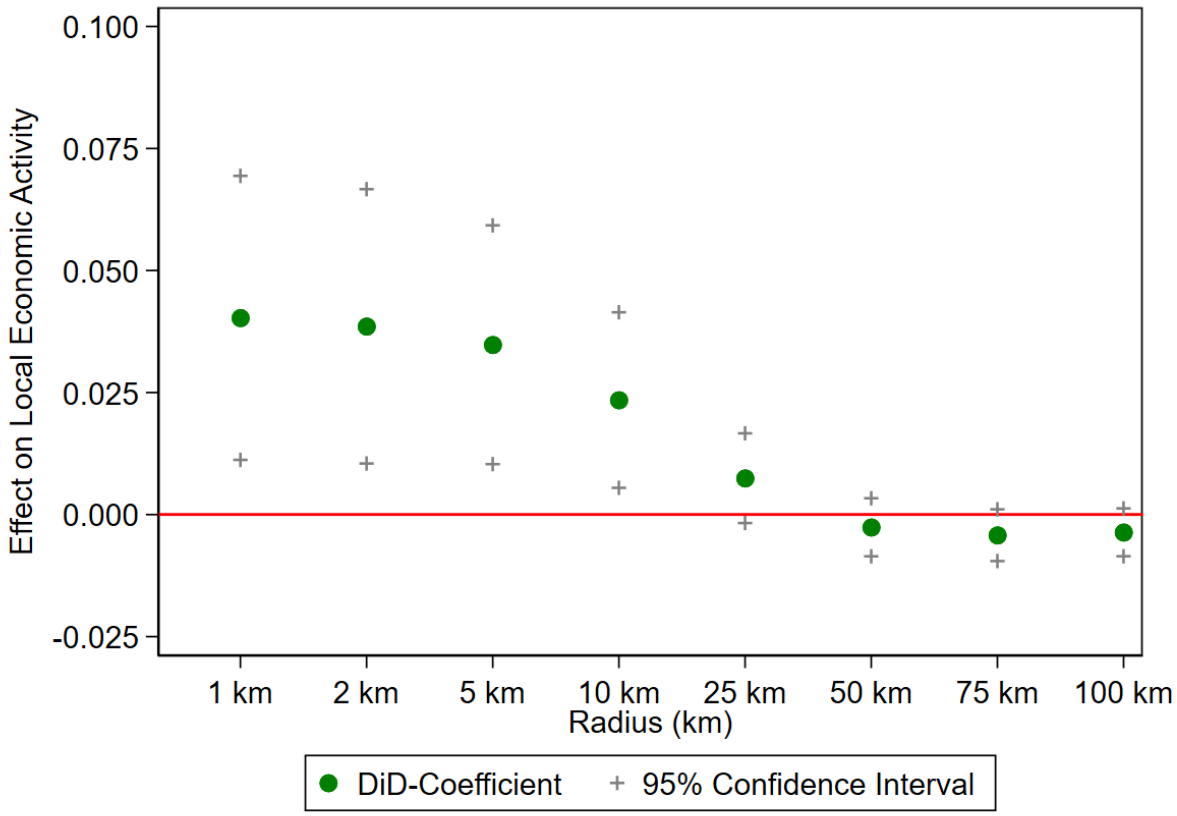


(B) U.K. Presence within 10 km Radius Grid-cells vs. French Presence within 10 km Radius Grid-cells



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 10 km radius grid-cells with centered U.K. multinational firm presence as compared to those without U.K. multinational firm presence over time. Effects are plotted relative to 2009, which is the year preceding the announcement of the U.K. tax rate reduction. In Panel (A), we match 10 km radius grid-cells with centered U.K. multinational firm presence to control grid-cells within the same country that are at least 10 km away from the next U.K.-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 10 km radius grid-cells centered around French multinational firm presence. The specifications include country-by-year and grid-cell fixed effects, and standard errors are clustered at the grid-cell level.

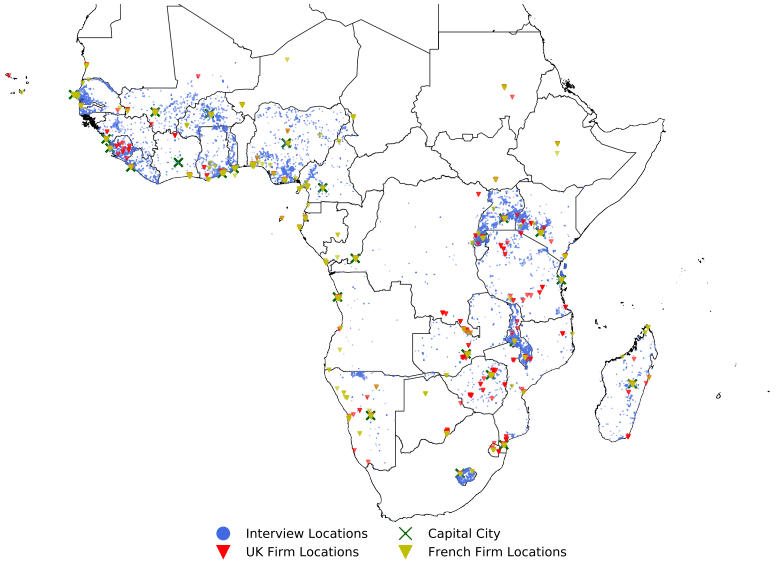
Figure 6: Treatment Effects of Multinational Firm Presence on Local Economic Activity by Luminosity Grid-cell Size



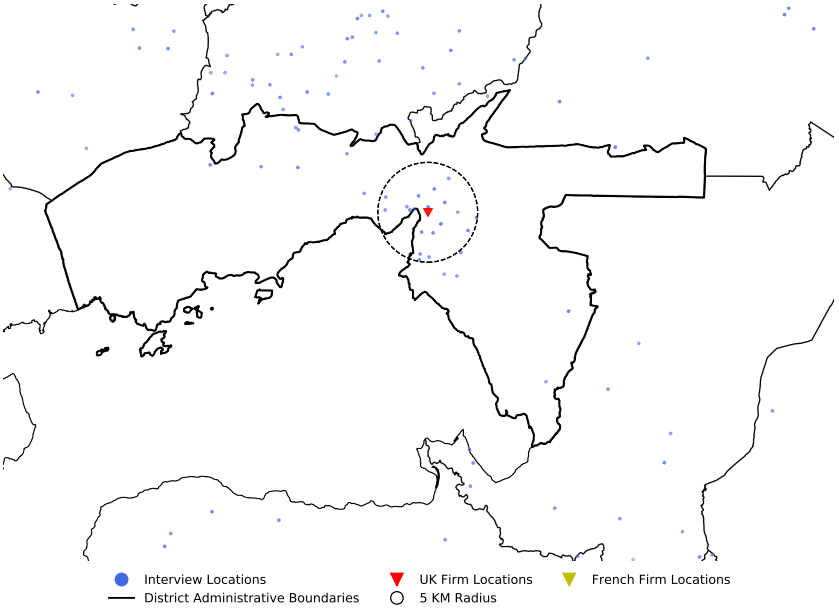
Notes: This figure plots coefficient estimates of *U.K. Firm * Post* from Eq. 2 and 95% confidence intervals that correspond to results presented Table 5, Column (2). The dependent variable *Log. Luminosity* reflects varying grid-cell radii of 1 km, 2 km, 5 km, 10 km, 25 km, 50 km, 75 km, and 100 km. Treated observations refer to grid-cells with centered U.K. multinational firm presence, while control observations are grid-cells with centered French multinational firm presence. The specifications include country-by-year and grid-cell fixed effects. Standard errors are clustered at the grid-cell level.

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

(A) Locations throughout Sub-Saharan Africa



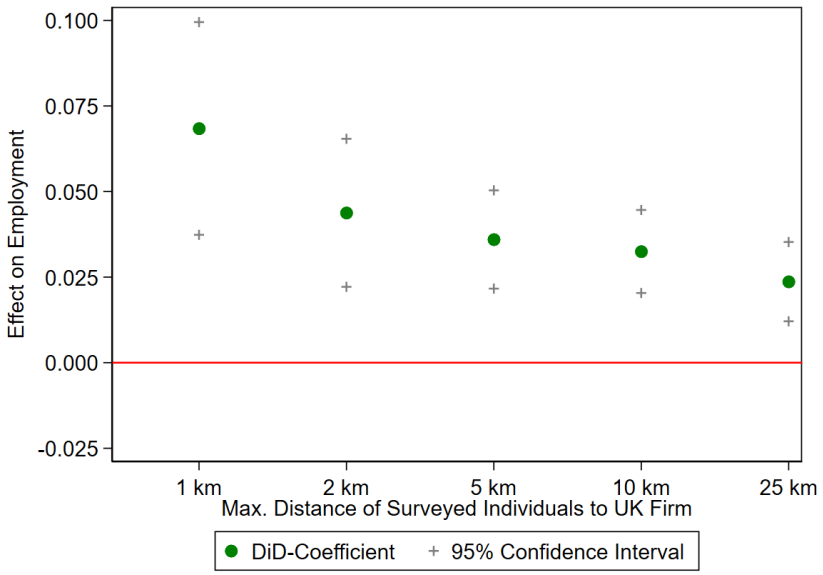
(B) Example of DHS Survey Clusters and U.K. and French Subsidiaries in the Kisumu Area (Kenya)



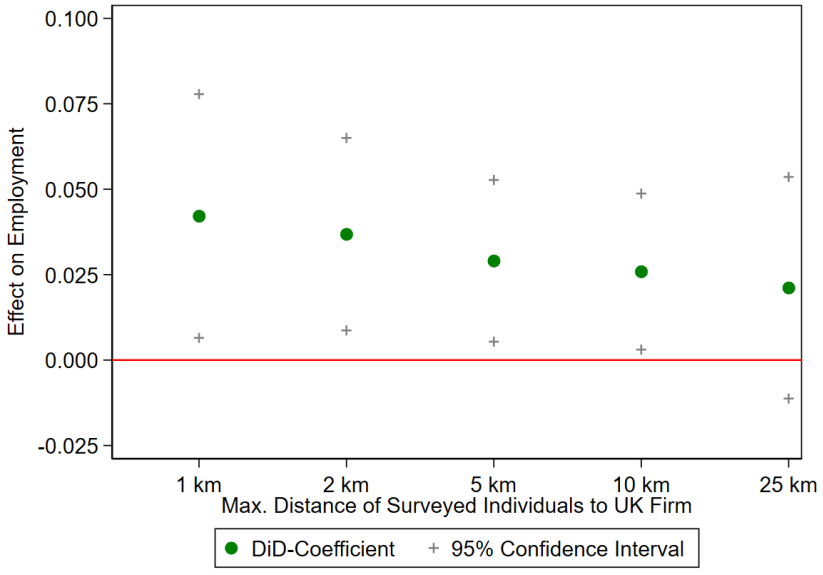
Notes: This figure shows the locations of DHS interviews (blue dots) and U.K. or French multinational firm subsidiaries (red or green triangles), respectively. Panel (A) presents the geographic distributions across all countries in sub-Saharan African. Panel (B) presents the geographic distributions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

(A) U.K. Firm Presence vs. Non-U.K. Firm Presence



(B) U.K. Firm Presence vs. French Firm Presence



Notes: This figure plots coefficient estimates of *U.K. Firm * Post* from Eq. (2) and 95% confidence intervals that correspond to results presented in Table 6, Column (6). We estimate the effect on the outcome variable *Employment* for varying distances of 1 km, 2 km, 5 km, 10 km, and 25 km between the surveyed individual and the closest U.K.-owned subsidiary. In Panel (A), control observations are surveyed individuals at least 10 km or 25 km away from the next U.K.-owned subsidiary. In Panel (B), control observations are surveyed individuals living within a 25 km distance to a French-owned subsidiary but at least 10 km or 25 km away from the closest U.K.-owned subsidiary. The specifications include country-by-year and grid-cell $*$ U.K. firm presence fixed effects. Standard errors are clustered at the grid-cell level.

Table 1: Summary Statistics

Variable	Obs	Mean	P10	P25	Median	P75	P90	SD
Subsidiary Presence Variables (Firm-Country-Year)								
Log. Number Subsidiaries (in African-country)	103,670	0.41	0.00	0.00	0.00	0.69	1.39	0.70
Number Subsidiaries (in African-country)	103,670	2.41	1.00	1.00	1.00	2.00	4.00	7.33
UK Firm	103,670	0.07	0.00	0.00	0.00	0.00	0.00	0.25
Number Subsidiaries (worldwide)	103,670	138.13	2.00	2.00	13.00	94.00	398.00	472.20
Number Subsidiary Countries (worldwide)	103,670	18.45	1.00	2.00	5.00	25.00	59.00	27.04
Tax Differential within Firm (%)	103,670	20.25	0.00	0.00	15.50	35.00	55.00	19.03
Number Tax Haven Subsidiaries	103,670	10.78	0.00	0.00	0.00	5.00	25.00	56.68
UK Colonies	103,670	0.64	0.00	0.00	1.00	1.00	1.00	0.48
Consolidated Firm Variables (Firm-Country-Year)								
ETR	13,769	0.26	0.12	0.19	0.25	0.30	0.39	0.12
3y ETR	10,170	0.26	0.14	0.20	0.24	0.31	0.40	0.11
Home Country Controls (Firm-Country-Year)								
Population (in millions)	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 (USD in trillions)	102,733	2.32	0.03	0.30	0.40	2.60	3.74	4.59
Nighttime Luminosity Analysis (Grid Cell-Year)								
Nighttime Luminosity (10km)	27,934	44.03	0.00	37.15	49.55	56.81	63.00	17.01
African Country Controls (Grid Cell-Year)								
GDP (USD in billions)	27,934	53.90	0.14	10.19	17.82	31.96	508.69	104.43
Population (in millions)	27,934	34.59	0.16	12.00	19.61	38.71	171.77	44.01
Local Employment (DHS) Analysis (Individual-Year)								
Employment (0/1)	610,064	0.64	0.00	0.00	1.00	1.00	1.00	0.48
U.K. Firm Presence (km)	610,064	117.05	2.43	9.11	60.05	156.09	329.69	149.76
Regional Employment	610,064	0.64	0.47	0.55	0.65	0.73	0.81	0.13
Male	610,064	0.28	0.00	0.00	0.00	1.00	1.00	0.45
Household Members	610,064	6.33	3.00	4.00	6.00	8.00	11.00	3.79
Age	610,064	28.99	17.00	20.00	27.00	36.00	44.00	10.26
Urban Region	610,064	0.54	0.00	0.00	1.00	1.00	1.00	0.50
Marital Status	602,870	0.96	0.00	0.00	1.00	1.00	2.00	1.09

Notes: This table presents descriptive statistics for the samples used in the empirical tests. We report the unit of observation for each group of variables in parentheses. For the luminosity analysis, grid-cells are defined as 0.1*0.1 decimal degrees, which is approximately 10*10 km. We construct equally-sized grid-cells for the nighttime luminosity analysis as well as the 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*					
U.K. Firm	-0.117***	-0.117***				
	(0.03)	(0.03)				
*U.K. Firm * Post*	0.179***	0.226***	0.200***	0.208***	0.196***	0.240***
	(0.03)	(0.07)	(0.04)	(0.08)	(0.05)	(0.07)
Obs.	103,670	20,681	96,126	20,230	77,328	18,649
Adj. R2	0.013	0.098	0.546	0.690	0.660	0.795
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 FE	No	No	Yes	Yes	Yes	Yes
Country-Pair FE	No	No	No	No	Yes	Yes
Year FE	Yes	Yes	.	.	.	.
Industry-Year FE	No	No	No	No	Yes	Yes
Country-Year FE	No	No	Yes	Yes	Yes	Yes

Panel (B)	*Log. Number Subsidiaries*					
Control Group:	OECD Firms		Empire Firms		U.K. vs. FR Firms	
*U.K. Firm * Post*	0.217***	0.344***	0.198***	0.301***	0.171***	0.281***
	(0.04)	(0.07)	(0.04)	(0.07)	(0.05)	(0.08)
Obs.	49,980	12,644	27,059	7,826	14,633	5,335
Adj. R2	0.434	0.554	0.429	0.551	0.404	0.532
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 specifications from Eq. (1), which tests the effect of the U.K. tax cut on the natural logarithm of the number of a firm's subsidiaries in a given sub-Saharan country (*Log. Number Subsidiaries*) for the sample period 2005 to 2018. *U.K. Firm* is a binary variable equal to one if a multinational firm's parent entity is incorporated in the U.K. *Post* is a binary indicator equal to one for years after 2009. Panel (A) presents results using all firms in our sample, including African parent companies in the same country as the African subsidiary (African domestic groups), African parent companies in a different country from the African subsidiary (African multinationals), and all other multinational parent firms. Panel (B) presents results restricting the sample of control firms to multinational parent firms from OECD countries (Col. (1)-(2)), from former colonial empires (Belgium, France, Germany, Italy, Portugal, Spain in Col. (3)-(4)), and French multinational firms (Col. (5)-(6)). 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) to mitigate concerns about improving data coverage over time. 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		U.K. vs. FR Firms	
	U.K. Colonies	Non-U.K. colonies	U.K. Colonies	Non-U.K. colonies
*U.K. 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
*U.K. 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 specifications from Eq. (1), which tests the effect of the U.K. tax cut on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*) for the sample period 2005 to 2018. *U.K. Firm* is a binary variable equal to one if a multinational firm's parent entity is incorporated in U.K. *Post* is a binary indicator equal to one for years after 2009. In Panel (A), the sample is partitioned at the sub-Saharan country level based on whether the subsidiary is located in a fomer U.K. sub-Saharan colony or not. Columns (1) and (2) present results using all parent firms in our sample. Columns (3) and (4) present results restricting the sample to French and U.K. multinational parent firms. Panel (B) presents estimates for partitioning the sample into different industry categories based on NACE Rev. 2 sections, where *Manufacturing* refers to section "C", *Construction* to section "F", and *Mining & Quarrying* to sections "B". 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 Firm Characteristics

	(1)	(2)	(3)	(4)
	Log. Number Subsidiaries			
	Pre-period Effective Tax Rate		Pre-three-year Effective Tax Rate	
	High	Low	High	Low
*U.K. 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 specifications from Eq. (1), which tests the effect of the U.K. tax cut on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*) for the sample period 2005 to 2018. *U.K. Firm* is a binary variable equal to one if a multinational firm's parent entity is incorporated in U.K. *Post* is a binary indicator equal to one for years after 2009. In columns (1) and (2), the sample is partitioned at the multinational firm level based on the median consolidated effective tax rates (ETRs) in 2009. In columns (3) and (4), the sample is partitioned based on the median of multinational firms' three-year (2007-2009) average consolidated effective tax rate. 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)*		
	U.K. Firm Presence within 10km		
*U.K. 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 FE * U.K. Firm Presence	No	No	Yes
Year FE	Yes	.	.
Country-Year FE	No	Yes	Yes
Panel (B)	*Log. Nighttime Luminosity (10km)*		
	U.K. Firm Presence vs. French Firm Presence		
*U.K. 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	23,220	27,927
Adj. R2	0.978	0.981	0.982
Grid-cell FE	Yes	Yes	.
Grid-cell FE * U.K. Firm Presence	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 specifications from Eq. (2), which tests the effect of the U.K. tax rate reduction on local economic activity measured with nighttime luminosity in sub-Saharan Africa. The unit of observation is a luminosity grid-cell with a 10 km radius in a given country-year. *U.K. Firm Presence* is equal to one if a grid-cell contains a U.K. subsidiary. *Post* is a binary indicator equal to one for years after 2009. In Panel (A), we match 10 km radius grid-cells centered around U.K. multinational firm presence to control grid-cells within the same country that are at least 10 km away from the next U.K.-owned subsidiary and that exhibit an average luminosity value within a $\pm 20\%$ range of the treated observation in the pre-period (2009). In Panel (B), control observations are 10 km radius grid-cells centered around a French multinational subsidiary. Luminosity data are obtained from the United States Air Force Defense Meteorological Satellite Program (DMSP), and 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. The dependent variable *Log. Luminosity* is the natural logarithm of the annualized mean luminosity value. 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)*			
	U.K. Firm Presence vs. Non-U.K. Presence			
	Control Group $>$ 10km		Control Group $>$ 50km	
*U.K. Firm Presence * Post*	0.032***	0.027***	0.036***	0.030***
	(0.006)	(0.006)	(0.007)	(0.006)
Regional Employment (Pre-period)	0.193***	0.167***	0.195***	0.180***
	(0.046)	(0.047)	(0.053)	(0.054)
Male		0.134***		0.140***
		(0.004)		(0.005)
Household Members		-0.006***		-0.006***
		(0.000)		(0.000)
Marital Status		0.039***		0.039***
		(0.001)		(0.001)
Age		0.014***		0.014***
		(0.000)		(0.000)
Urban Region		-0.018***		-0.009*
		(0.005)		(0.006)
Obs.	610,064	602,870	485,878	480,592
Adj. R2	0.079	0.211	0.078	0.212
Grid-cell FE * U.K. Firm Presence	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Panel (B)	*Employment (0/1)*			
	U.K. Firm Presence vs. French Firm Presence			
	French Firm $\leq$ 25km		French Firm $\leq$ 50km	
*U.K. Firm Presence * Post*	0.026**	0.023**	0.021**	0.018**
	(0.012)	(0.011)	(0.009)	(0.009)
Regional Employment (Pre-period)	0.253***	0.194**	0.232***	0.165**
	(0.072)	(0.078)	(0.064)	(0.069)
Male		0.130***		0.126***
		(0.009)		(0.008)
Household Members		-0.006***		-0.007***
		(0.001)		(0.001)
Marital Status		0.035***		0.035***
		(0.001)		(0.001)
Age		0.016***		0.015***
		(0.000)		(0.000)
Urban Region		-0.028***		-0.032***
		(0.010)		(0.008)
Obs.	198,776	197,021	245,152	243,147
Adj. R2	0.033	0.194	0.045	0.199
Grid-cell FE * U.K. Firm Presence	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Notes: see next page.

Notes: This table reports coefficient estimates of difference-in-differences specifications from Eq. (2), which tests the effect of the U.K. tax rate reduction on local employment in sub-Saharan Africa from 1998-2019. The unit of analysis is the surveyed individual. *U.K. Firm Presence* is equal to one if a U.K. firm's subsidiary is located within a 10 km radius of a survey respondent's 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 regions that had survey rounds both before and after the U.K. tax rate reduction. The dependent variable *Employment (0/1)* is an indicator equal to one if an individual indicates that he/she is employed following Hjort and Poulsen (2019). In Panel (A), the control group consists of individuals living more than 10 or 50 km away from the nearest U.K.-owned subsidiary. In Panel (B), the control group consists of individuals living within a 25 km or 50 km radius of a French-owned subsidiary and not living within a 10 km radius of a U.K.-owned subsidiary. 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.

Online Appendix

A.1 Data

A.2 Supplementary Analyses

A.1 Data

Table A.1: Subsidiaries by African 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	389	599	672	785	820	757	4,893
Benin	4	4	7	7	31	48	55	62	74	78	96	113	134	129	842
Botswana	6	7	8	9	43	156	271	294	444	515	818	866	915	878	5,230
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	60	61	351
Cameroon	14	20	23	28	96	133	153	166	199	210	222	244	294	286	2,088
Cape Verde	3	13	18	16	24	56	70	89	102	177	192	195	207	205	1,367
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	96	116	135	189	220	280	251	1,508
Cote d'Ivoire	22	38	42	50	149	191	230	253	320	358	471	525	643	666	3,958
Democratic Republic of Congo	4	10	17	15	47	92	126	161	216	243	306	348	464	467	2,516
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	114	140	209	219	258	261	1,451
Ethiopia	0	2	3	4	5	15	25	52	83	96	144	176	253	279	1,137
Gabon	6	13	22	23	73	92	123	128	188	208	235	271	312	287	1,981
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	651	1,897	1,959	1,997	8,452
Guinea	1	3	7	11	27	44	65	89	107	112	150	173	205	199	1,193
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	479	587	791	1,005	1,137	1,390	1,515	7,883
Lesotho	3	3	3	3	5	36	48	57	69	72	111	380	381	577	1,748
Liberia	2	2	2	5	20	156	225	541	719	765	832	1,036	1,046	2,858	8,209
Madagascar	7	14	19	20	64	86	110	129	192	181	234	259	286	300	1,901
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	109	153	154	179	195	238	244	1,449
Mauritania	0	3	3	5	16	42	52	60	67	82	109	127	143	134	843
Mozambique	4	25	39	44	48	140	211	287	357	596	827	991	1,123	1,132	5,824
Namibia	6	6	8	9	23	208	330	390	511	644	999	1,155	1,222	1,220	6,731
Niger	3	6	5	5	18	22	32	41	61	59	69	74	90	86	571
Nigeria	49	149	107	130	234	477	655	775	1,014	1,262	1,533	1,808	1,986	1,955	12,134
Rwanda	2	3	3	4	10	25	32	38	46	82	119	142	175	193	874
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	226	290	297	338	377	444	437	2,934
Sierra Leone	2	3	3	4	8	25	33	46	73	78	105	127	152	150	809
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	9,678	11,095	11,228	18,895	20,693	21,951	21,705	136,111
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	416	490	652	729	843	902	4,782
Togo	3	4	4	5	19	32	43	59	76	81	89	103	123	119	760
Uganda	10	22	15	17	27	102	136	184	220	247	303	343	392	398	2,416
Zambia	15	25	34	39	43	122	178	235	331	373	550	610	688	692	3,935
Zimbabwe	25	28	30	35	51	196	239	331	457	526	883	978	1,050	1,080	5,909
Total	1,067	1,458	1,649	1,860	4,944	9,889	13,296	16,532	20,282	22,210	33,162	38,414	41,744	43,605	250,112

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

Table A.2: Subsidiaries by African Country and Parent Home Country

Country	Belgium	France	Germany	Italy	Portugal	Spain	U.K.	U.S.	African Domestic Groups	African Multinationals	Rest of World	Total
Angola	41	254	86	135	2,064	172	214	186	297	780	664	4,893
Benin	14	264	50	13	0	12	25	15	60	154	235	842
Botswana	35	126	132	18	4	18	458	304	327	2,895	913	5,230
Burkina Faso	33	334	42	11	0	4	129	36	62	133	750	1,534
Burundi	27	47	7	5	0	0	8	9	21	113	114	351
Cameroon	32	779	43	74	4	42	146	105	110	229	524	2,088
Cape Verde	12	16	5	100	673	160	24	14	129	120	114	1,367
Central African Republic	3	94	22	9	0	7	24	6	8	41	71	285
Chad	8	157	8	0	0	3	11	11	14	80	93	385
Comoros	0	41	0	0	0	0	3	7	11	49	10	121
Congo	50	425	20	78	9	26	85	74	66	163	512	1,508
Cote d'Ivoire	112	1,284	85	200	13	89	275	147	346	456	951	3,958
Democratic Republic of Congo	337	239	52	105	6	12	240	77	219	320	909	2,516
Equatorial Guinea	13	124	4	7	18	172	30	83	26	29	71	577
Eritrea	10	11	0	13	0	0	14	0	20	3	33	104
Eswatini	11	30	34	25	9	0	151	64	171	844	112	1,451
Ethiopia	24	16	23	77	0	6	105	38	194	195	459	1,137
Gabon	13	834	33	47	14	46	112	81	96	207	498	1,981
Gambia	16	27	16	6	7	9	31	15	50	125	82	384
Ghana	114	322	102	101	17	101	366	357	3,886	1,126	1,960	8,452
Guinea	24	245	9	18	12	24	167	74	63	171	386	1,193
Guinea-Bissau	1	15	2	3	50	21	0	9	20	54	41	216
Kenya	62	279	260	120	30	81	1,034	599	1,416	2,103	1,899	7,883
Lesotho	5	45	32	4	0	0	116	50	800	599	97	1,748
Liberia	60	45	162	54	0	16	294	298	172	2,322	4,786	8,209
Madagascar	54	608	64	54	3	29	108	71	111	364	435	1,901
Malawi	5	61	39	19	43	0	233	134	250	598	348	1,730
Mali	12	299	28	28	8	11	93	41	78	209	642	1,449
Mauritania	31	126	23	10	0	61	30	19	156	113	274	843
Mozambique	27	182	93	229	1,776	123	538	139	347	1,086	1,284	5,824
Namibia	88	126	144	72	35	147	619	215	600	3,580	1,105	6,731
Niger	2	212	12	11	0	4	38	38	22	71	161	571
Nigeria	220	702	257	321	36	62	1,120	1,102	2,721	3,101	2,492	12,134
Rwanda	61	45	23	0	1	1	54	36	114	300	239	874
Sao Tome and Principe	2	9	0	0	98	12	1	1	8	97	62	290
Senegal	96	982	75	240	26	177	119	173	154	287	605	2,934
Sierra Leone	11	48	19	15	8	14	129	39	53	160	313	809
Somalia	0	23	1	0	0	0	3	0	11	17	25	80
South Africa	837	2,937	3,593	1,461	292	954	10,132	7,561	37,672	54,466	16,206	136,111
South Sudan	3	10	0	1	0	0	17	5	7	42	24	109
Sudan	3	41	7	10	0	0	72	9	637	351	377	1,507
Tanzania	44	138	127	97	9	18	650	263	518	1,028	1,890	4,782
Togo	22	234	55	14	1	7	44	22	31	153	177	760
Uganda	32	117	54	38	20	17	281	214	244	715	684	2,416
Zambia	39	111	72	49	0	6	535	225	473	1,342	1,083	3,935
Zimbabwe	9	90	111	87	8	15	1,110	289	1,168	2,514	508	5,909
Total	2,655	13,154	6,026	3,979	5,294	2,679	19,988	13,255	53,959	83,905	45,218	250,112

Notes: This table presents the number of subsidiary-year observations by African country and by the home country of the parent firm.

Table A.3: Parent Firm Presence by African Country and Parent Home Country

Country	Belgium	France	Germany	Italy	Portugal	Spain	U.K.	U.S.	African Domestic Groups	African Multinationals	Rest of World	Total
Angola	32	193	50	80	1,382	143	131	168	226	429	484	3,318
Benin	12	171	28	12	0	11	16	15	49	134	173	621
Botswana	29	77	66	16	4	5	194	166	182	939	567	2,245
Burkina Faso	21	264	28	10	0	4	74	34	55	114	398	1,002
Burundi	26	36	7	5	0	0	6	9	16	93	89	287
Cameroon	30	538	26	56	4	42	112	88	95	183	324	1,498
Cape Verde	10	16	5	66	537	137	19	8	81	104	76	1,059
Central African Republic	2	77	17	9	0	7	16	6	8	39	58	239
Chad	8	102	8	0	0	3	8	11	14	73	78	305
Comoros	0	38	0	0	0	0	3	7	9	33	9	99
Congo	46	289	19	69	9	26	63	68	52	138	373	1,152
Cote d'Ivoire	83	784	45	144	13	66	163	109	230	308	569	2,514
Democratic Republic of Congo	188	138	37	80	5	12	138	64	128	238	500	1,528
Equatorial Guinea	9	100	4	7	18	148	24	48	20	27	62	467
Eritrea	10	9	0	5	0	0	14	0	11	3	29	81
Eswatini	11	27	28	11	6	0	82	48	91	525	88	917
Ethiopia	23	13	20	70	0	6	83	38	103	103	293	752
Gabon	13	464	25	47	9	29	91	77	74	109	324	1,262
Gambia	14	25	13	3	5	9	31	12	20	118	78	328
Ghana	92	215	83	89	16	80	257	297	1,586	667	1,353	4,735
Guinea	23	178	9	16	12	23	81	70	48	137	305	902
Guinea-Bissau	1	14	2	3	40	21	0	9	9	51	39	189
Kenya	52	174	174	107	21	52	429	467	621	942	1,395	4,434
Lesotho	3	19	26	4	0	0	89	31	349	465	74	1,060
Liberia	27	30	62	29	0	14	142	171	158	1,734	1,389	3,756
Madagascar	41	513	47	32	3	25	74	54	84	205	288	1,366
Malawi	3	39	31	14	6	0	140	104	101	302	234	974
Mali	12	226	25	20	8	11	59	37	53	162	388	1,001
Mauritania	31	106	18	9	0	49	25	19	52	102	226	637
Mozambique	24	131	71	160	1,316	92	279	121	225	692	839	3,950
Namibia	64	67	91	45	21	82	197	103	309	1,077	674	2,730
Niger	2	134	12	11	0	4	38	38	22	64	139	464
Nigeria	134	362	182	201	31	61	492	723	1,404	1,103	1,677	6,370
Rwanda	45	34	23	0	1	1	47	27	56	243	188	665
Sao Tome and Principe	2	9	0	0	86	12	1	1	5	81	41	238
Senegal	61	668	34	229	25	157	80	154	123	186	455	2,172
Sierra Leone	11	36	16	14	8	14	98	37	35	144	208	621
Somalia	0	23	1	0	0	0	3	0	5	17	19	68
South Africa	466	1,240	1,458	727	138	424	2,211	3,341	14,445	5,560	7,128	37,138
South Sudan	3	6	0	1	0	0	14	5	6	39	24	98
Sudan	3	35	7	10	0	0	44	9	218	142	337	805
Tanzania	31	88	95	61	9	14	308	200	271	650	1,164	2,891
Togo	22	166	32	14	1	7	26	19	29	95	138	549
Uganda	18	79	48	31	20	12	184	176	158	547	537	1,810
Zambia	28	74	52	23	0	6	287	163	246	869	686	2,434
Zimbabwe	8	60	56	26	8	9	229	145	445	598	355	1,939
Total	1,774	8,087	3,081	2,566	3,762	1,818	7,102	7,497	22,527	20,584	24,872	103,670

Notes: This table presents the number of parent firm-country-year observations by the African country in which the parent has subsidiaries, as well as by the parent's home country.

Table A.4: DHS Survey Waves

Country	Years of Survey Rounds										
Burkina Faso	1998	1999	2003	2010							
Benin	2001	2011	2012	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						
Guinea	1999	2005	2012	2018							
Kenya	2003	2008	2009	2014							
Liberia	2007	2013									
Lesotho	2004	2005	2009	2010	2014						
Mali	2001	2006	2012	2013	2018						
Malawi	2000	2004	2005	2010	2015	2016					
Mozambique	2009	2011	2015								
Namibia	2000	2006	2007	2013							
Nigeria	2003	2008	2013	2018							
Sierra Leone	2008	2013	2019								
Senegal	2005	2010	2011	2012	2013	2014	2019				
Togo	1998	2013	2014								
Tanzania	1999	2003	2004	2007	2008	2009	2010	2011	2012	2015	2016
Uganda	2001	2006	2011	2016							
Zambia	2007	2013	2014	2018	2019						
Zimbabwe	1999	2005	2006	2010	2011	2015					

Notes: This table presents the years of DHS surveys waves used in the empirical analysis.The sample is restricted to DHS survey rounds (i) with available geographic data to match individual respondents' locations to the multinational firm subsidiary locations and (ii) in regions (10 km grid-cells) surveyed at least once before and after the U.K. tax rate reduction.

A.2 Supplementary Analyses

Table A.5: U.K. Tax Rate Reduction and Foriegn Firm Presence in Sub-Saharan Africa

	(1)	(2)	(3)	(4)
	Log. Number Subsidiaries			
	Full Sample		OECD Firms	
*U.K. Firm * 2009*	-0.000	-0.014	-0.015	0.024
	(0.05)	(0.06)	(0.05)	(0.07)
*U.K. Firm * 2010-2011*	0.194***	0.148*	0.139**	0.206**
	(0.06)	(0.09)	(0.05)	(0.08)
*U.K. Firm * 2012-2014*	0.279***	0.255***	0.198***	0.317***
	(0.06)	(0.10)	(0.05)	(0.09)
*U.K. Firm * Post 2014*	0.296***	0.309***	0.209***	0.387***
	(0.06)	(0.10)	(0.04)	(0.09)
Obs.	93,510	19,966	49,980	12,644
Adj. R2	0.567	0.759	0.448	0.585
Balanced Presence	No	Yes	No	Yes
Firm Controls	Yes	Yes	Yes	Yes
Firm Country Controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes

Notes: This table reports coefficient estimates of a difference-in-difference specification from Eq. (1), which tests the effect of the U.K. tax rate reduction on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*) for the sample period 2005 to 2018. *U.K. Firm* is a binary variable equal to one if the parent firm is incorporated in U.K. Separate *Post* indicators are included for the periods 2009, 2010-2011, 2012-2014, and after 2014, with effects measured relative to years prior to 2009. Columns (1) and (2) present results using all firms in our sample. Columns (3) and (4) present results restricting the sample of control firms to OECD parent 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 period preceding the U.K. tax rate reduction (balanced presence). 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.

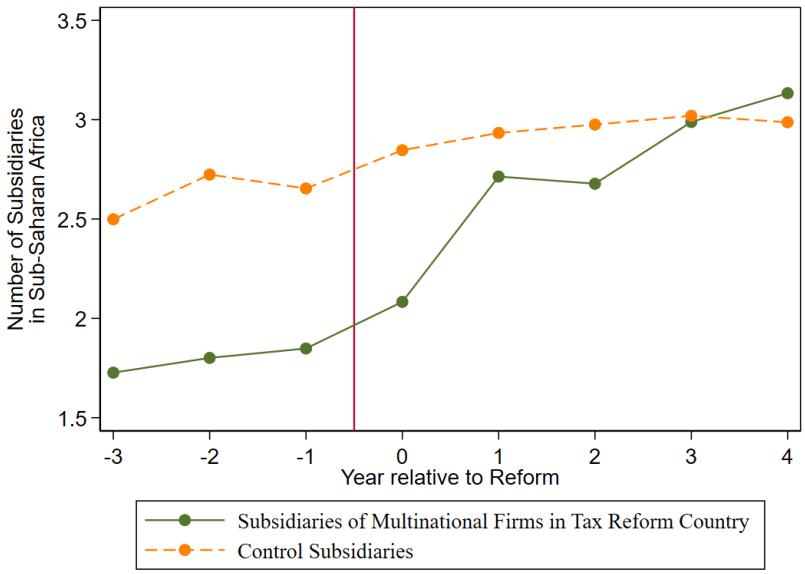
Table A.6: U.K. Tax Rate Reduction and Foreign Subsidiaries in Sub-Saharan Africa

	(1)	(2)	(3)	(4)	(5)	(6)
Panel (A)	*Log. Number Subsidiaries*					
*U.K. Firm * Post*	0.172***	0.173**	0.119**	0.198***	0.116***	0.122**
	(0.05)	(0.07)	(0.05)	(0.07)	(0.04)	(0.06)
Obs.	96,148	20,276	95,955	20,206	78,867	18,887
Adj. R2	0.542	0.678	0.628	0.720	0.537	0.687
Balanced Presence	No	Yes	No	Yes	No	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	.	.	Yes	Yes
Country-Pair FE	No	No	Yes	Yes	No	No
Year FE	Yes	Yes	.	.	.	.
Industry-Year FE	No	No	No	No	Yes	Yes
Country-Year FE	No	No	Yes	Yes	No	No

Panel (B)	*Log. Number Subsidiaries*					
	Foreign		UK vs. US		UK vs. JP	
*U.K. Firm * Post*	0.185***	0.249***	0.240***	0.205**	0.264***	0.400***
	(0.04)	(0.06)	(0.05)	(0.08)	(0.09)	(0.11)
Obs.	67,518	13,701	13,865	3,439	7,918	1,924
Adj. R2	0.428	0.449	0.423	0.394	0.396	0.334
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 a difference-in-difference specification from Eq. (1), which tests the effect of the U.K. tax rate reduction on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*) for the sample period 2005 to 2018. *U.K. Firm* is a binary variable equal to one if a the parent firm is incorporated in U.K. *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 had an existing subsidiary presence in a given African country in the pre-period (balanced presence). 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.1: 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's country of incorporation. Treated subsidiary observations (green solid line) belong to multinational firms with parent entities that are incorporated in one of four OECD countries with a large corporate income tax reduction, including 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 other OECD countries that do not experience a tax reform in the respective event years.

Table A.7: 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	.

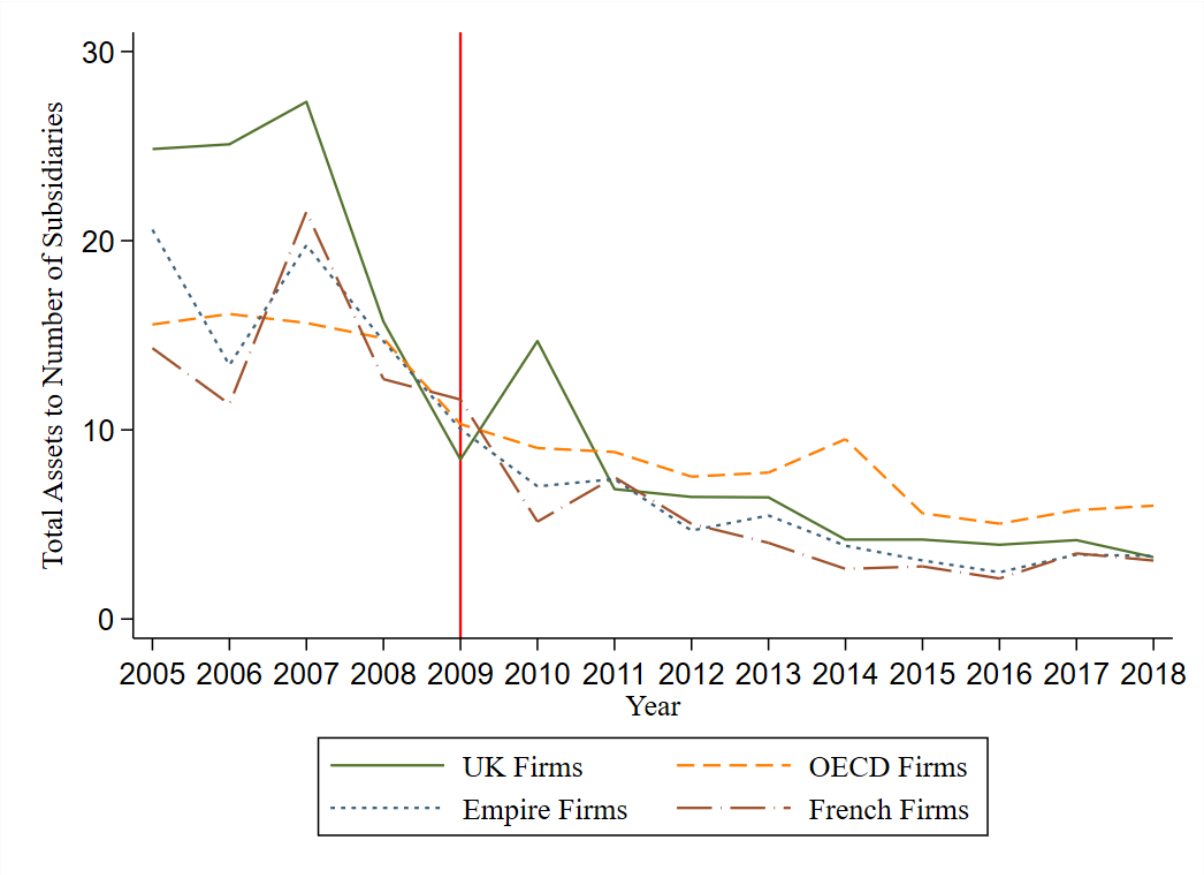
Notes: This table presents coefficient estimates of staggered difference-in-differences regressions estimating the effect of tax reforms in OECD countries on the natural logarithm of the total number of subsidiaries of a firm in sub-Saharan Africa (*Log. Number Subsidiaries (Africa)*). The tax changes include 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. 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.8: Orbis Data Coverage of Multinational Firm Subsidiaries 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 using data from OECD.Stat and the natural logarithm of the total number of multinational firm subsidiaries in a given sub-Saharan country from Orbis. *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. 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.2: Orbis Data Coverage of Multinational Firms 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 U.K. 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 U.K. tax cut announcement. Firm data are from BvD Orbis.

Table A.9: U.K. Tax Rate Reduction and the Likelihood of Foreign Subsidiary Presence in Sub-Saharan Africa

	(1)	(2)	(3)	(4)	(5)	(6)
Panel (A)	*New Subsidiary (0/1)*					
*U.K. 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 (0/1)*					
Control Group:	Foreign	OECD	Empires	UK vs. FR	UK vs. US	UK vs. JP
*U.K. 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 U.K.-owned following the announcement of the U.K. tax rate reduction. *New Subsidiary* is a binary variable equal to one in the year the sub-Saharan African subsidiary was founded. *U.K. Firm* is a binary variable equal to one if a multinational firm is headquartered in U.K. *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 (Column (1)), firms headquartered in OECD countries (Column (2)), firms headquartered in former colonial empires (Belgium, France, Germany, Italy, Portugal, Spain in Column (3)), French multinational firms (Column (4)), US multinational firms (Column (5)), or Japanese multinational firms (Column (6)). 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.10: Variation in the Effect of the U.K. Tax Rate Reduction on Foreign Subsidiary Presence based on African Statutory Tax Rates

	(1)		(2)
	Log. Number Subsidiaries		
	Lower Tax Rate		Higher Tax Rate
*U.K. Firm * Post*	0.230*		0.194***
	(0.12)		(0.05)
Difference		0.036	
		(0.13)	
Obs.	2,696		91,325
Adj. R2	0.515		0.549
Firm FE	Yes		Yes
Country-Year FE	Yes		Yes

Notes: This table reports coefficient estimates of difference-in-differences regressions estimating the effect of the U.K. tax rate reduction on the natural logarithm of the number of subsidiaries of a firm in a given sub-Saharan country (*Log. Number Subsidiaries*) for the sample period 2005 to 2018. *U.K. Firm* is a binary variable equal to one if the multinational parent is incorporated in U.K. *Post* is a binary indicator equal to one for years after 2009. The sample is partitioned at the African country level based on whether the subsidiary is located in a country with a lower corporate tax rate than the U.K. 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.11: U.K. Tax Rate Reduction and U.K. Investment into Other Developed Nations

	(1)	(2)	(3)	(4)	(5)
	Log. Number Subsidiaries				
	France	*Germany*	*Ireland*	*OECD w/o UK*	*UK*
*U.K. 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 U.K. tax cut on the natural logarithm of the number of subsidiaries of a firm in a given country (*Log. Number Subsidiaries*) for the sample period 2005 to 2018. *U.K. Firm* is a binary variable equal to one if the multinational parent entity is incorporated in U.K. *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 of the U.K. tax rate reduction on investment in France, measured based on the number of subsidiaries in France. Columns (2) through (5) present results studying investment into Germany, Ireland, all OECD countries excluding U.K., and the U.K., respectively. 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.