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The impact of fibre broadband on online behaviour in a South African township

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Executive Summary

The difference between mobile and fibre broadband is analogous to bottled versus tap water.¹ Each serves its purpose, but it quickly becomes expensive if you need to water a tree with Valpré.

Only 2.7 million of South Africa's roughly 18 million households have a fibre-to-the-home (FTTH) connection. Most households beyond the reach of fibre networks rely on mobile data, which can make data-intensive tasks like online learning, remote work, or running a business prohibitively costly.

Many of these families live in South African townships and until recently, the commercial case for installing fibre in low-income, high-density areas did not add up. But over the past three years, several fibre network operators (FNOs) have reworked their models to deliver a wave of affordable fibre to townships.

Prepaid fibre products designed for low-income households are being rolled out by fibertime™, Vumatel, and others. These products allow users to access uncapped broadband for as little as R5 per day or around R100 per month. Most providers waive installation fees, and some install a Wi-Fi router in every home at no extra cost, making it easier for residents to connect. By using low-cost deployment methods like aerial fibre and capitalising on the density of homes, townships have become a competitive battleground for FNOs.

The result is that tens of thousands of households in previously disconnected areas are getting high-speed, affordable internet connectivity for the first time.

This raises the question: Does affordable high-speed internet make a meaningful economic difference for residents of South Africa's low-income urban townships?

Intuitively, digital inclusion can catalyse economic progress, but there has been little hard evidence of causation. This is because fixed broadband

¹We credit this analogy to Richard Henn, where we heard it first.

coverage typically favours already better-off areas and rollout is not random - a necessary condition to establish causality.

We took advantage of a rare chance to isolate the effect of bringing ubiquitous fibre to a low-income urban community: the staggered rollout of a fibre network in Kayamandi, a township adjacent to Stellenbosch in the Western Cape, where every home with a permanent electricity connection received a free router. Crucially, the whole community was not connected at once. The fibre project was piloted in late 2022 and progressed to cover the rest of Kayamandi over the next three years. This staggered rollout created a natural experiment: at any given moment, some households had fibre while others were still waiting.

To gather data for this project, we conducted three rounds of household surveys targeting the same dwellings to track changes over time. The first was in August 2022, before the network was installed, to collect baseline information on internet use and other socioeconomic outcomes like household income and economic participation. Existing network coverage by FNOs in Kayamandi was minimal at the time. The second survey was in late 2023, when just under half of the community had received home fibre. The third was in early 2025, by when over 10 000 homes, essentially the entire township except for one area without electricity, had been connected.

By comparing respondents in homes that were connected *early* with those connected *later (or not at all)*, and controlling for pre-existing differences between respondents, we attempted to isolate the impact of affordable, fast broadband access. Because households couldn't influence when the network would reach their home and the timing of connections was essentially random from the residents' perspective, differences in outcomes can be attributed to the introduction of fibre rather than to pre-existing trends.

Network rollout was done by fibertime, a FNO and internet service provider that installs fibre networks in townships across South Africa. fibertime's network is unique in that it provides a router to every home within its coverage area, and anyone within range of a router can access fibertime Wi-Fi.

Our analysis reveals notable impacts of bringing fibre to Kayamandi. We show that, after getting home fibre, respondents used less mobile data. We also find a causal relationship between home fibre and adults using the internet for learning, such as research, educational sites and classes. The findings also reveal that home fibre encouraged respondents - specifically those already doing some form of paid work - to use the internet to find better or alternative employment.

Our results suggest that fibre priced at a level aligned with township household budgets enables shifts from internet-use focused predominantly on communication, to more productive activities without increasing total connectivity spending.

This is the first in a series of BER Research Notes that investigate the causal relationship between affordable fibre and socioeconomic outcomes across different regions of South Africa. It provides early evidence to suggest that closing the connectivity gap can be a powerful element in tackling some of South Africa's economic growth challenges.

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Introduction

Access to fast and affordable internet has, in many respects, become essential for socioeconomic inclusion. The ITU (International Telecommunication Union) estimates that three-quarters of South Africans use the internet in some form or another. Most South Africans live in areas where they can access mobile internet and the population of 64 million people has 83.4 million active mobile subscriptions (ITU, 2023). Yet, there are only an estimated 2.7 million fibre-to-the-home subscriptions (Puchert, 2025) among South Africa's roughly 18 million households. Part of the reason is that more than half of these households earn less than R 5 000 per month and live in low-income, high-density urban communities ('townships'). Until recently, these areas did not present commercially attractive prospects for fibre network operators to enter (Vermeulen, 2025).

Laying fibre and building last-mile infrastructure is expensive, and companies have historically focused on suburbs where the commercial imperative made most sense. Operators were reluctant to invest in townships, inhibited by high rollout costs and uncertain returns. Many low-income households have had to rely on accessing the internet using mobile data, typically sold by volume. As a result, heavy internet use for online education, working from home, or online business activities quickly become expensive and is effectively out of reach for poorer households. **If access to fast internet has the potential to affect socioeconomic outcomes, the digital divide in respect of fast internet access could perpetuate existing economic inequalities.**

Closing the gap: A township fibre revolution

Technological innovations and novel business models are transforming South Africa's fibre landscape and bringing high-speed internet into township communities. Several network operators have started redesigning their service models to serve lower-income, high-density areas.

Townships typically have high population densities, allowing operators to lower the cost of connecting a home. The sprawling nature of informal settlements with many small dwellings, which was once a deterrent to fibre rollout, is becoming a driver instead. Densely populated communities mean more homes passed per kilometre of fibre, lowering the marginal cost of connecting a home compared to sparsely populated wealthy suburbs. Installation costs are reduced by using innovative deployment methods (such as mounting fibre on overhead poles or micro-trenching along roads). In some township projects, companies lower the barrier to entry even further by providing free installation of a ready-to-use Wi-Fi router in every dwelling passed.

But perhaps the most groundbreaking change is the introduction of pay-as-you-go fibre offerings. Traditional long-term contracts and credit checks often pose a barrier to entry into township markets ([Mosimanegape, 2025](#)). To address this, some operators have launched daily rates or month-to-month, no-contract fibre plans with prepaid vouchers that mirror the flexibility consumers are used to on mobile. It also aligns fibre service with the cash flow realities of lower-income households, removing some of the hurdles that previously excluded these users.

As a result of these dynamics, unlimited fibre broadband has become much more affordable in townships. Instead of R 600–R 1 000 per month fibre contracts tailored to wealthier households living in leafy suburbs, uncapped fibre is now becoming available in townships for as little as R 100 per month.

At the time of writing, Vumatel and fibertime are the largest FNOs operating in this space, but they are not the only players. Vumatel, through its Vuma Key offering, delivers a basic 10 Mbps uncapped line at R 99 per month for households with a monthly income of less than R 5 000.

fibertime follows a different rollout strategy. It offers 100 Mbps uncapped fibre and installs a (free) router in each (electrified) home it passes. Users pay R 5 per device per day (e.g., mobile phone, computer, television) to access the network. By bringing the price point down to a few rands a day, providers have made high-speed home fibre a realistic option in communities that could not afford it.

Evaluating the impact of home fibre in Kayamandi

FIBRE ROLLOUT AS A NATURAL EXPERIMENT

While fibertime is not the only fibre network operator in Kayamandi, its saturation model of installing a router in every dwelling within its coverage area² creates a unique research opportunity. In most settings, broadband uptake is voluntary and linked to household characteristics, making it difficult to separate cause from effect. fibertime's approach allows us to consider treatment (i.e. getting a home fibre connection) effectively random across dwellings, providing conditions suitable for causal analysis.

fibertime rolls out aerial fibre, with fibre cables connected with a drop cable from a pole to a router in a home. High drop densities per pole reduce the marginal cost of connecting a home, and the high population density improves commercial viability.

Figure 1: An example of a fibertime box with drops into homes

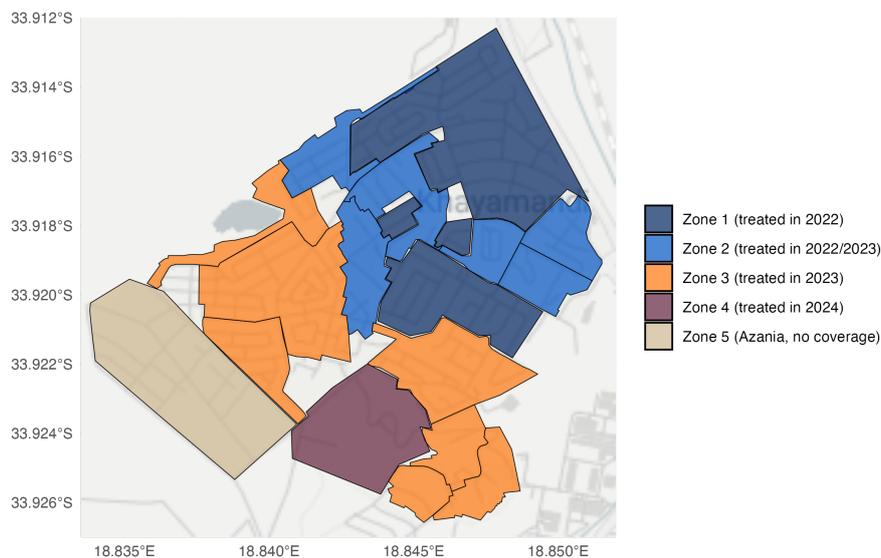


²Subject to having a permanent electricity connection

Unlike a traditional fibre network, fibertime operates a passive optical network (PON) that uses a single fibre optic cable to transmit signals to multiple users. The network has a single-SSID, which means that anyone within range of a fibertime router can use the network, without needing to re-connect to a specific router.³

fibertime piloted its technology and business model in Kayamandi, a low-income, high-density community with an adult population of about ~38 000 (GeoTerraImage (Pty) Ltd, 2022), adjacent to Stellenbosch in the Western Cape. The network was rolled out in phases, with different areas within Kayamandi connected at different points in time (Figure 2).

Figure 2: fibertime network rollout in Kayamandi



Source: fibertime

fibertime began installing fibre and activating homes in Kayamandi to pilot the project in 2022Q4, with the first homes coming online in October that year (Zone 1, Figure 2). During this rollout phase, Wi-Fi routers were installed in ~900 formal brick-and-mortar homes in Kayamandi. In an adjacent area

³A Wi-Fi network operating with a single Service Set Identifier (SSID) essentially means that multiple physical access points, like routers, are configured with the same name and password. It allows a device to remain connected to the network when it moves from within the range of one access point (router) to another.

primarily composed of informal homes ('shacks'), Wi-Fi routers were installed on poles with the intention that the surrounding homes would be able to access the network without requiring a router inside the dwelling (Zone 2, [Figure 2](#)). However, connectivity posed an issue for households surrounding the poles: Metal structures create a Faraday cage effect⁴ that distort Wi-Fi signals.

fibertime adjusted its strategy and began commercial rollout in Kayamandi in 2023Q3. It divided the area into distinct geographic polygons; each polygon broadly corresponding to a neighbourhood block bounded by roads, allowing fibertime to manage deployment in contiguous sections ([Figure 2](#)).

fibertime installed a Wi-Fi router in formal and informal dwellings alike. During this period, every home in Kayamandi with a permanent electricity connection received a router. Approximately 6 600 homes were connected during this phase of network rollout. Two areas in Kayamandi, namely Azania and Enkanini, did not have municipal electricity connections at the time and were not covered by the fibertime network. Stellenbosch Municipality electrified 3 300 households in Enkanini early in 2024 ([Stellenbosch Municipality, 2024](#)), and fibertime followed to install routers in these homes in 2024Q4 (Zone 4, [Figure 2](#)). By June 2025, fibertime had connected roughly 10 300 homes in Kayamandi.⁵ Azania remains without municipal electricity connections and hence does not have routers installed (Zone 5, [Figure 2](#)).

Importantly, residents could not influence when their home would receive a router. This is what allows us to treat the timing of connection as an exogenous factor, and which is a necessary condition to establish causality.

We conducted three waves of household survey data collection in Kayamandi, timed to coincide with the rollout of the fibertime network. The first of these took place in 2022Q3 (24 August - 6 September) before the fibre network was rolled out, and represents our baseline (pre-intervention) survey. We

⁴Conductive material like zinc or corrugated iron (of which many informal dwellings are made) reflects and absorbs radio waves, especially if openings like windows and doors are small

⁵South Africa began experiencing severe load-shedding at the end of 2022, which encouraged fibertime also to install UPS power banks with each router so that the network remains on when the electricity connection is off.

stratified the sample based on dwelling type, to ensure a representative number of formal (brick and mortar), informal and backyard dwellings. Kayamandi had roughly 15 532 dwellings in 2022 ([GeoTerralimage \(Pty\) Ltd, 2022](#)); we sampled and interviewed respondents from 1 001 households across all wards of Kayamandi, equivalent to 6.4% of households.

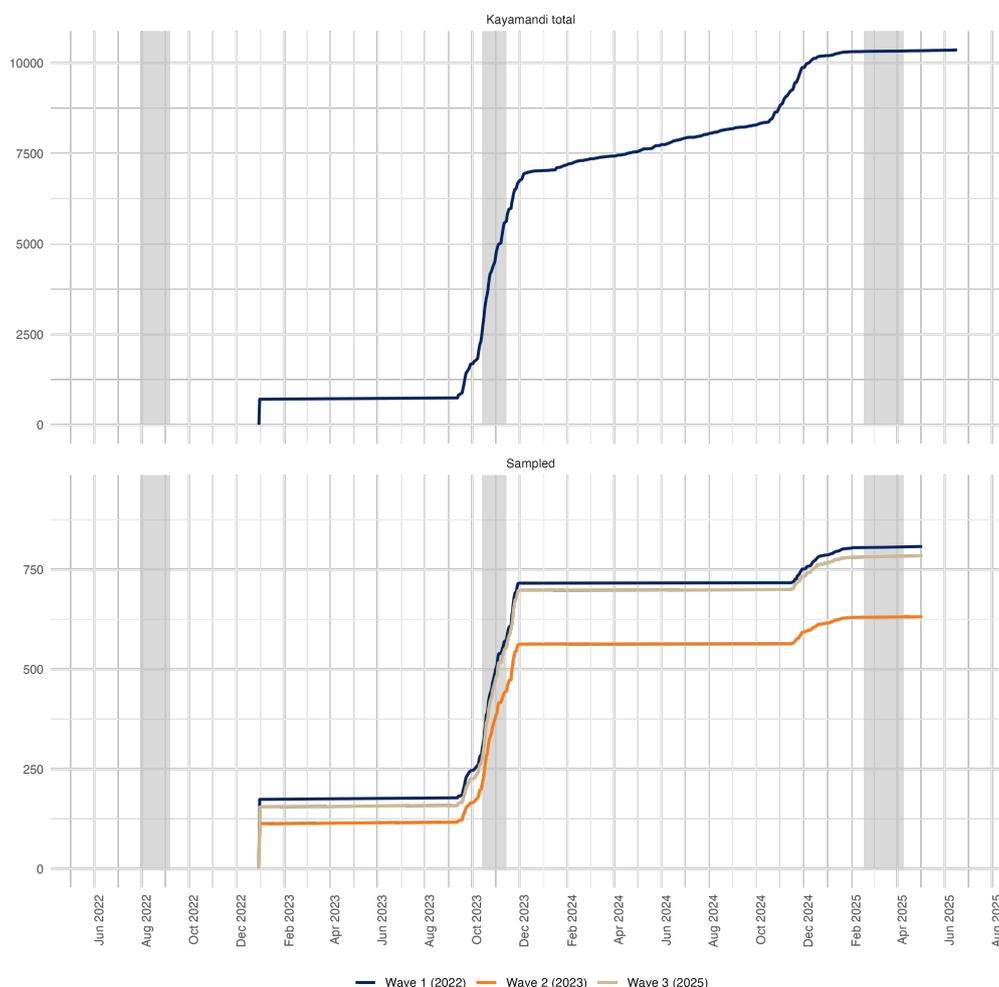
Enumerators were given GPS coordinates of the sampled households to ensure unbiased fieldwork. An adult household member responsible for making internet-purchasing decisions was randomly selected and interviewed face-to-face. Interviews lasted approximately 30 minutes, and responses were captured on Computer-Assisted Personal Interviewing (CAPI) devices with a scripted survey link. The questionnaire included questions about internet use, as well as socioeconomic characteristics such as employment status, household income, etc. The purpose of the baseline survey was to obtain a picture of conditions before ubiquitous fibre internet arrived. In each of the subsequent waves (described below), respondents answered the same core questions as at baseline, allowing us to track changes in outcomes like internet use, job status, incomes, etc. In 2022, only twelve of the homes sampled in our baseline survey reported that they *mostly use fibre* to access the internet in Kayamandi.

Two follow-up surveys took place after rollout started. The first of these (the second wave) was conducted in 2023Q4 (14 October - 14 November), by which time roughly 46% of homes in our sample had been treated. Enumerators began by phoning the respondents sampled during the 2022 baseline survey. Face-to-face top-up interviews at originally sampled dwellings were conducted with respondents who could not be reached telephonically. Forty per cent of respondents surveyed in 2023 were reached telephonically, and the remainder were interviewed in person. The second follow-up survey (third wave) was conducted in 2025Q1 (21 February - 9 April). This survey was conducted in person. Enumerators returned to the dwellings originally sampled in 2022 and a top-up sample of homes to account for attrition.⁶ By this time, an estimated 85% of homes in our sample had a fibertime router installed.

⁶Our main specification excludes the top-up sample of homes, to avoid unnecessarily introducing sampling bias.

Each survey wave in our sample reflects a similar distribution of activation dates to that of the overall population (Figure 3).

Figure 3: Total cumulative activations over the study period



Notes: Shaded areas indicate survey periods.

Enumerators conducting the survey in 2023 and 2025 visited the same homes and tried to interview the same individuals as in 2022 at baseline. If the baseline respondent wasn't available, another adult in the household was surveyed. We were unable to follow the same individuals from 2022 to 2025. In 2023, we managed to find roughly 60% of the original 1 001

respondents interviewed at baseline.⁷ We had even more difficulty finding these same individuals at the same dwellings in 2025, and were able to make a (fuzzy) match of only 127 persons across all three waves. These are too few observations to create a robust panel of the same individuals. Instead, our design creates a repeated cross-section of individuals interviewed at the same 715 dwellings in 2022, 2023 and 2025. By returning to the same structures, we ensured consistency in treatment location even if the specific respondent differed.

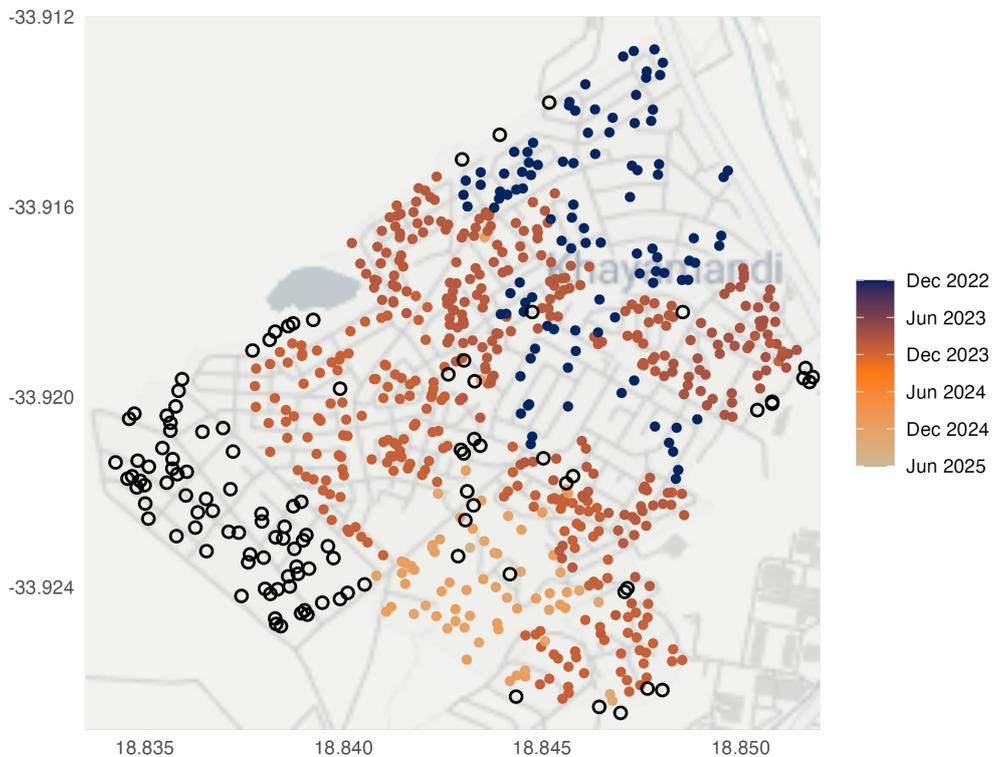
ASSIGNING TREATMENT

We relied on fibertime's rollout data to determine when and which dwellings were *treated* (i.e., received a router). fibertime supplied the latitude and longitude of each fibre drop (installation point) and the date the connection became active. We matched each drop to the nearest dwelling (within a 20-metre radius) in our sample and assigned the fibre activation date associated with that drop. If the assigned activation day preceded the date a dwelling was surveyed, that dwelling is marked as treated. This spatial matching enabled us to infer the timeline of fibre connectivity for individual households based on proximity to fibertime's network, without having to rely on recall data collected in our survey.

One limitation of our study is that we do not have individual coordinates or activation dates for formal homes connected during fibertime's pilot rollout in 2022. We therefore conservatively assume that any sampled dwelling situated in the first polygon (Zone 1 - [Figure 2](#)) was connected by December 2022 (in actuality, they may have been connected earlier). In other words, all dwellings in the initial area are treated as having fibre by the end of 2022. We similarly assume that homes in the informal area covered by the initial Wi-Fi poles in 2022 were untreated, when they may have already been using the network at this stage. Both of these assumptions mean that our findings are conservative.

⁷This is based on fuzzy matching gender and age characteristics of an individual within a dwelling, and allowing for one level increase in the age bracket

Figure 4: Treatment status by dwellings in our sample



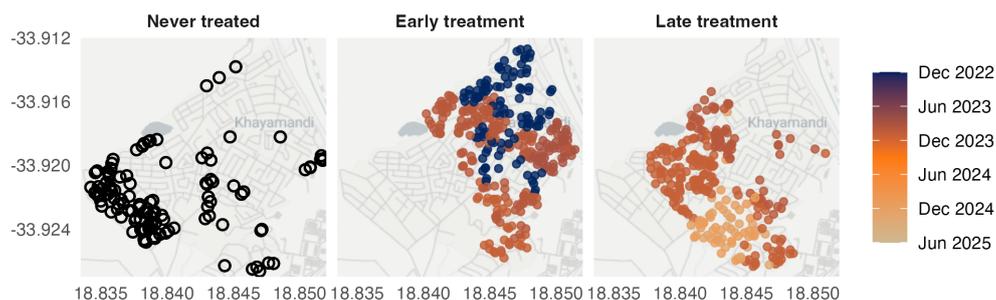
Notes: Sampled dwellings represented by black circles are untreated.

We split the dwellings in our sample into three cohorts, depending on whether they had a router installed at the time of being interviewed (Figure 2). Dwellings treated prior to being interviewed in 2023 are assigned to the *early-treatment cohort*. Dwellings treated after being interviewed in 2023 but prior to being interviewed in 2025 are assigned to the *late-treatment cohort*. Dwellings that did not yet receive fibre by the time of being interviewed in 2025 are assigned to the *never-treated cohort*. Treatment effects in each time period are identified by comparing respondents in treated homes with those not-yet-treated, including those who are never-treated within our study horizon.

These cohorts do not fully account for the heterogeneity of treatment. Some homes in each of the treated cohorts are likely to have had fibre for longer than others, as shown by the shaded circles in Figure 5. It is likely that the

effect of having an active fibre connection is non-linear and may strengthen or weaken over time. The results presented in this paper show the average effect.

Figure 5: Treatment cohorts



Another important factor is that, although treatment is defined at the dwelling level, network access in Kayamandi extends beyond individual homes. As mentioned earlier, the single-SSID nature of fibertime’s network allows any internet-enabled device within the range of a router to connect. This means that respondents who were technically *untreated* (i.e., living in dwellings without home fibre) could still access the Wi-Fi fibre network. This feature has important implications for our estimation strategy and interpretation of our findings. It creates spillover treatment effects that blur the distinction between treated and untreated households, and could result in us underestimating the true effect of fibre connectivity. This means that the observed differences between the two groups are likely to be smaller than if the untreated cohort did not have access.

Identification strategy: Staggered difference-in-differences

To estimate the causal impact of fibre access, we use a staggered difference-in-differences (DiD) design that takes advantage of fibertime's phased network rollout across Kayamandi. The staggered rollout created natural variation in treatment timing: some dwellings were connected earlier, while others remained unconnected for longer. This allows us to compare changes in outcomes over time between persons living in homes that have gained access to fibre and those that have not yet been connected.

Before the rollout, all groups were without fibre, and we assume that, in the absence of the intervention, their outcome trajectories would have followed similar trends on average (even if there were level differences). Once some areas were connected, we observe whether the outcomes for people living in treated dwellings begin to diverge from those living in homes not yet connected.

The DiD estimator captures how the change in an outcome (such as the probability that a respondent is using the internet for specific activities) from baseline to post-rollout differs between treated and control groups. By comparing trends over time, we control for broader shocks and time-varying factors, such as local economic changes, seasonality, post-COVID economic recovery, etc., that affect all residents equally.

The design also allows us to trace outcome dynamics relative to when a home was connected. This helps verify the identifying assumption of parallel trends that, in the absence of fibre, persons living in treated and later-connected (i.e., not-yet-treated) households would have experienced similar trends in online behaviour. If post-treatment trajectories diverge only after connection, this strengthens the causal interpretation of the estimated effects. Event-study plots validate the absence of pre-treatment divergence.

MODEL SPECIFICATION

Our research design constitutes a repeated cross-section of individuals in the same dwelling units over time. Treatment is assigned at the dwelling level, and we compare the outcomes of individuals living in dwellings that receive fibre (staggered) with those of individuals in homes that have not yet been treated. This implies that treatment effects are interpreted as the effect of home fibre on *the average person* living in a treated dwelling.

Each specification of our model includes controls to improve the precision of our causal estimates. We include pre-treatment controls that may affect internet use behaviour, such as key demographic (age and gender) and household characteristics (household size and dwelling type), internet use at baseline, and research design variables (survey mode and whether the interview took place during the workweek). To test whether employment changes internet use behaviour, we also estimate the model on a subsample limited to individuals who reported doing any form of paid work.

We retain only pre-treatment controls that vary across respondents.⁸ Survey mode is excluded in the main DiD estimation because interviews in 2022 and 2025 were done entirely in-person, but we address survey-mode bias by testing if our results hold when we only include in-person workweek interviews.

Our sample is reweighted to align with Kayamandi's population (age x gender). The weights are calibrated to the baseline composition (2022) to avoid post-treatment bias (see Annexure).

We use the Callaway–Sant'Anna framework ([Callaway and Sant'Anna, 2021](#)) to estimate the average treatment effect on the treated (ATT) by cohort and over time, reporting dynamic effects from one wave before to one wave after treatment. Standard errors are clustered at the rollout-zone level (19 clusters) to account for within-area correlation in outcomes.

⁸This means that for any cohort, there must be at least two distinct non-missing values.

LIMITATIONS AND CAVEATS

Our study faces the common concern that unobserved factors ('confounders') may influence the results. The staggered fibre rollout began with formal dwellings and spread across Kayamandi, so it is possible that other time-varying factors coincided with when different parts of Kayamandi were connected. For instance, external developments in the local economy, like nearby construction projects, public works programmes, or localised criminal activity, might have affected some households and not others over the same period. Although the DiD and staggered design mitigates many such endogeneity concerns, any violation of the 'parallel trends assumption' (if persons living in early-connected homes were on a different trajectory or if unseen shocks hit some groups and not others) would bias the estimated fibre effects.

Furthermore, respondents self-reported key characteristics and behaviours, such as internet use and data spending. Such survey measures are prone to recall errors and response biases: people may misestimate their spending on connectivity or inaccurately report their internet use behaviour. These measurement issues can blur the true effect of fibre.

The nature of the fibre network rollout in Kayamandi also introduces variations that warrant caution. The intervention wasn't a uniform, simultaneous switch-on for everyone; it was a staggered rollout, with households connecting at different times, with differing service quality during the pilot phase. This heterogeneity means the treatment isn't identical across everyone who has been classified as treated. Some respondents have had access for longer before being surveyed (potentially allowing more time to influence behaviour), while others were connected closer to the time of the interview. If the effect of treatment is non-linear, individual experiences may differ.

In addition, as described earlier, fibertime's single-SSID network causes that we likely underestimate rather than overestimate treatment effects since respondents without home fibre can also connect.

Finally, one must be careful to generalise these findings beyond Kayamandi.

This township has unique features, as it is a dense, peri-urban community adjacent to one of the wealthiest towns in South Africa. Kayamandi's proximity to Stellenbosch and its existing community dynamics may not be representative of all low-income areas. Thus, while the study provides valuable insights into the potential socioeconomic benefits of digital infrastructure in a South African township, its conclusions may not be universally applicable to every other community. The evidence should be extrapolated with caution.

The reported gains are context-dependent and should be interpreted as suggestive of impact rather than definitive proof. We are conducting more research in other settings to deepen our understanding of the impact of fibre connectivity in low-income communities.

ROBUSTNESS CHECKS

For robustness, we re-estimated our model on two subsamples. Each subsample maintained the same post-stratification weighting scheme, so differences did not reflect the composition of respondents. One subsample was limited to in-person interviews conducted during the workweek, thereby reducing any bias introduced by survey mode or availability. The second subsample included only individuals who reported doing some form of paid work, to test whether their online behaviour differed from that of those not working.

We also conducted a falsification check to ensure our estimated treatment effects were not driven by broader area-specific trends. To do this, we ran a placebo test that assigned fake treatment by 2023 to sampled dwellings in Azania that mostly used mobile data, and treated all other dwellings in the sample as controls (i.e., untreated). Statistically significant outcomes under the placebo treatment of Azania, in the same direction as our treatment effect, would have raised questions about a finding.

Our findings follow.

Internet access, spending and data use patterns

Internet access in Kayamandi was historically limited to mobile data. When we conducted our baseline survey in 2022, only one per cent of respondents (internet users) in our sample reported that they *mostly use fibre* in Kayamandi, with the rest of our sample relying on mobile data.

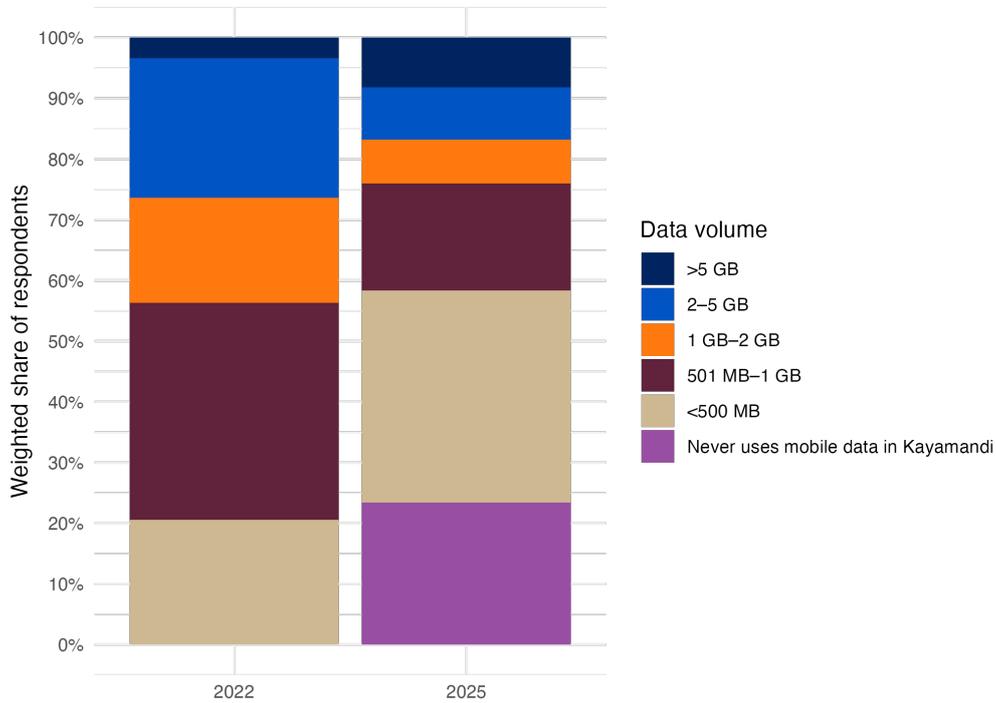
By 2025, when asked ‘Which of the following (mobile data loaded on your SIM card or a Wi-Fi / fibre connection) do you use most often to access the internet in Kayamandi?’ 58% of respondents answered *fibre*. However, internet users did not abandon using mobile data altogether. Asked ‘How often do you use fibre / Wi-Fi to access the internet in the area of Kayamandi?’ and ‘How often do you use mobile data to access the internet in the area of Kayamandi?’ 45% answered ‘All the time’ to both.

In response to the question ‘Who is your service provider for your fibre / Wi-Fi connection in Kayamandi?’, 98% of fibre-users in 2025 said that it was *fibertime*.

DID HOME FIBRE CHANGE HOW MUCH MOBILE DATA PEOPLE BUY?

The rollout of a near-ubiquitous fibre network in Kayamandi led to a sharp decline in mobile data use. Figure 6 shows the distribution of monthly mobile data purchases in 2022 and 2025. In 2022, only 20% of respondents reported purchasing less than 500 MB of mobile data per month. By 2025, this had increased to more than half of respondents.

Figure 6: Mobile data purchases: 2022 vs 2025

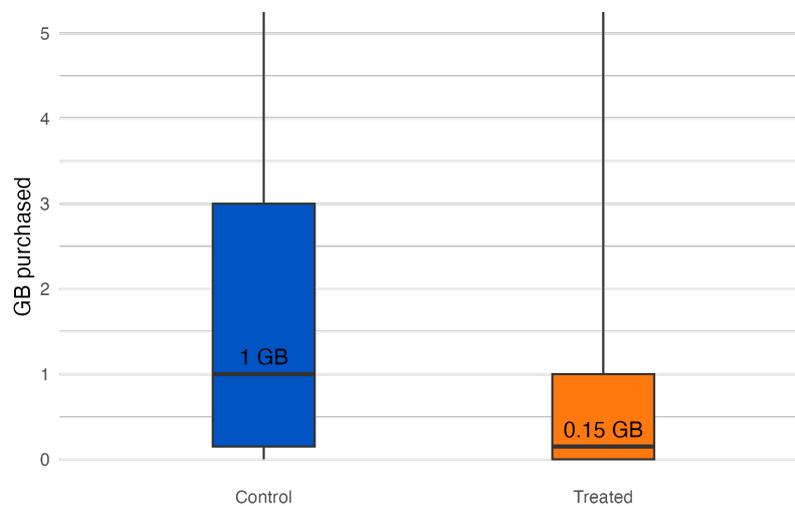


Notes: Post-stratification weights align the sample to Kayamandi’s baseline population and dwelling composition.

Box plots provide a more nuanced view of the distribution of mobile data use across our sample. The boxes represent the 25th to 75th percentiles of respondents, with the thick black line illustrating the median (50th percentile).

Figure 7 compares mobile data use in 2025 among respondents with home fibre (*treated*) and those without (*never-treated control group*). For respondents with home fibre (the orange bar), median monthly mobile data use fell to 100-200 MB, with three quarters of respondents saying that they use 1 GB or less. In contrast, persons without home fibre (the blue bar) continued to use more mobile data, with many still buying up to 3 GB per month, and median mobile data purchases of 1 GB per month. **Put differently, 75% of persons living in homes without fibre relied on up to 3 GB of mobile data per month. Among those with home fibre, 75% used 1 GB or less.**

Figure 7: Monthly mobile data purchases in 2025, by treatment group



Notes: Survey-weighted box plots show the 5th, 25th, 50th, 75th and 95th percentiles of monthly mobile data use in Kayamandi. Outliers are excluded. The middle line represents the weighted median spend. Post-stratification weights align the sample to Kayamandi's baseline population and dwelling composition.

After fibre became widely available, respondents in connected households relied far less on mobile data, while those without home fibre continued purchasing larger mobile bundles. This pattern indicates that, at a price point of R5 per device per day (fibertime's prevailing pricing at the time of our study), households substituted mobile data with fibre.

HOW DID CONNECTIVITY SPENDING CHANGE AFTER FIBRE ROLLOUT?

This substitution from mobile to fibre is also evident when comparing spending patterns. Figure 8 shows the distribution of total monthly internet spending on mobile data and fibre access in 2025 among respondents with and without home fibre.

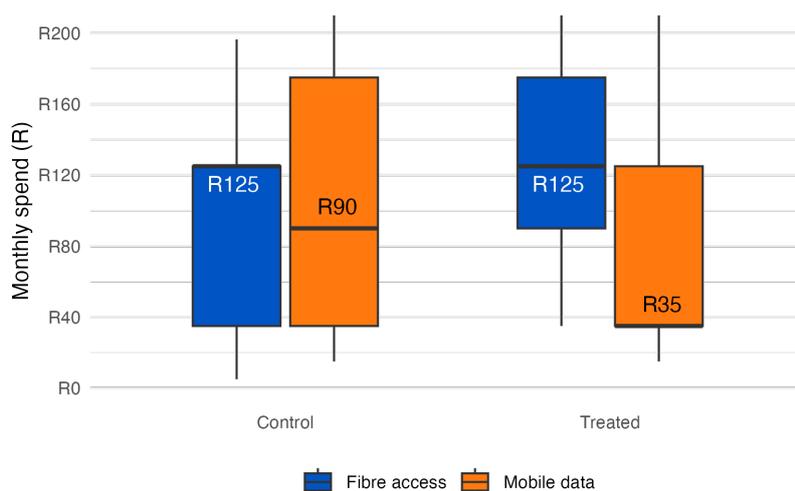
Regardless of whether a person had home fibre, respondents in both groups, at the median, spent R100 to R150 per month on fibre access. (*Values were collected in bins, with R125 as the midpoint.*) It highlights the single-SSID

nature of fibertime’s network, which allows anyone within range of a fibertime router to connect.

However, among respondents *without* home fibre, few spent more than R100-R150 on fibre access per month while among those *with* home fibre, half spent more - probably because they are more likely to connect multiple devices.

The contrast in spending on mobile data is even starker: respondents in untreated dwellings at the median spent R81-R100 (midpoint value R90) per month on mobile data, and those in treated homes only R21-R50 (midpoint value R35). These values mirror the mobile data volumes shown in [Figure 7](#).

Figure 8: Distribution of monthly internet spending by treatment cohort, 2025



Notes: Survey responses to questions about internet spending revealed that many respondents were not yet familiar with how to distinguish mobile data from fibre access. Observations were cleaned as follows: (i) mobile data marked as “uncapped” but purchased daily were treated as invalid and set to missing, as these are likely misclassified fibre purchases; (ii) cases where mobile volume was “uncapped” and mobile and fibre spending and frequency were identical, were also treated as misclassified fibre purchases and set to missing for the mobile variables; and (iii) fibre spending entries reporting “daily” fibre use but less than R20 monthly spend on fibre were treated as inconsistent and set to missing on the assumption that these values relate to daily rather than monthly spending. Outliers are excluded, and values are weighted as above.

Spending on connectivity decreased between 2022 and 2025 in nominal terms, and even more so after accounting for inflation. This may reflect the introduction of fibre, although shifts in mobile pricing over the same period also play a role.

In 2022, respondents spent an average of R157 per month on internet access, mainly on mobile data. This was equivalent to about 4.8% of household income. By 2025, average monthly spending on connectivity (mobile data plus fibre access) had fallen to R143, or 4.2% of household income.⁹ This aligns closely with the 4.5% weight assigned to information and communication services in South Africa's CPI basket. However, because spending data were collected only from interviewed adults, total household expenditure on connectivity is likely understated. In multi-user households, the share of income devoted to internet access will be higher. When expressed as a percentage of per-capita household income, spending on connectivity increased slightly, from 11.7% in 2022 to 13.8% in 2025.

The evidence suggests that fibre rollout in Kayamandi changed what people buy and may even have lowered total connectivity spend (at the price of R5 per device per day), with fibre substituting for mobile data. From a policy perspective, it suggests that, at the right price, fibre access can increase data use without increasing overall spending.

DID HOME FIBRE CHANGE WHERE PEOPLE USE THE INTERNET?

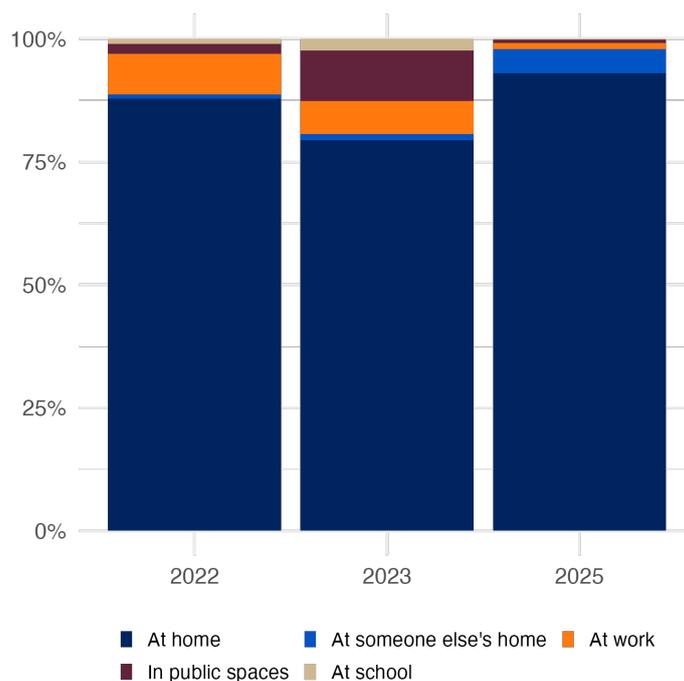
Fibre rollout also affected where people use the internet. [Figure 9](#) shows that slightly more people *mostly use the internet* at home in 2025 compared to 2022.

As mentioned earlier, fibertime installed Wi-Fi poles as part of its pilot phase in 2022. Network quality was poor inside informal dwellings, but a quarter of respondents in 2023 reported that they mostly use the network in public

⁹Estimated across the full sample and weighted to match Kayamandi's baseline population and dwelling composition.

places, likely by connecting to these poles. By 2025, by when these poles had been decommissioned and more homes had received routers, there was a marked increase in the share of respondents who said they *mostly use the internet* in their own homes or someone else's.

Figure 9: Where do respondents mostly use the internet?



Notes: Post-stratification weights were applied to align the sample with Kayamandi's baseline person and dwelling composition.

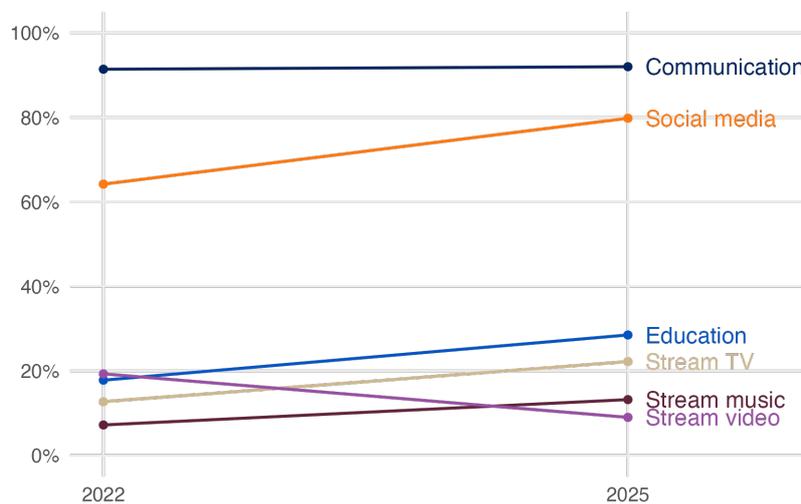
As discussed earlier, the single-SSID nature of the network creates spillovers affecting our control group (those without home fibre). When asked whether they *mostly use fibre* or *mostly use mobile data* to access the internet, 43% (in 2023) and 32% (in 2025) of respondents living in homes without home fibre reported that they *mostly use fibre*. The higher share in 2023 suggests that Wi-Fi poles may have provided a greater source of access to untreated users than when routers were installed inside homes. This strong presence of spillover attenuates our results.

Expansion of online activities

GENERAL INTERNET USAGE TRENDS

Internet use in Kayamandi diversified between 2022 and 2025. [Figure 10](#) and [Figure 11](#) compare the share of respondents using the internet for different activities over time (also see Annexure [Table 1](#)).

Figure 10: Share of respondents using the internet for communication, entertainment and education



Notes: Estimates are weighted to align with Kayamandi's baseline population and dwelling composition so that results reflect the average adult's internet use in the township.

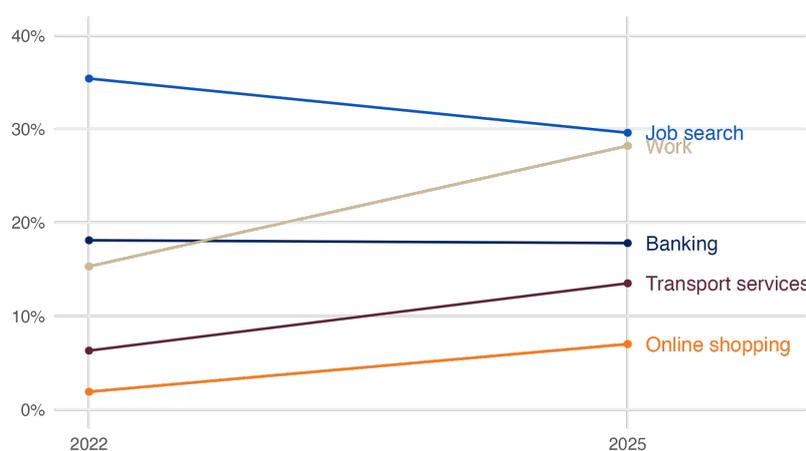
More than 90% of respondents already used the internet for communication in 2022, but the share using it for social media increased from 64% to 80% in 2025. A larger proportion also reported using the internet for school-related purposes such as research, educational websites and online classes.¹⁰

Watching television online (including platforms such as Netflix, DStv Now and Showmax) and streaming music became more common over the study period, while streaming videos on platforms like YouTube halved.

¹⁰Recall that our survey was limited to adult respondents, 18 years or older.

Other notable trends relate to productivity-enhancing activities (Figure 11). The share of respondents using the internet for work, such as emailing or attending online meetings, almost doubled. There was also a marked increase in those using it for transport services (e.g., Uber or Bolt), although the data does not allow us to distinguish between customers and drivers.¹¹

Figure 11: Share of respondents using the internet for productivity



Notes: Estimates are weighted to align with Kayamandi's baseline population and dwelling composition so that results reflect the average adult's internet use in the township.

Just under one in five respondents used the internet for online banking, a share that has remained stable. In contrast, although still relatively low, the share of respondents who shop online roughly tripled over the period. The share of respondents using the internet for job search declined. This may reflect that more people now rely on social media platforms such as LinkedIn or Facebook to find work, or that fewer Kayamandi residents were actively seeking employment, either because they have found work or are no longer searching.

Nonetheless, these trends indicate a broadening of digital participation over the study period, and a shift from using the internet primarily for communication to using it for a wider range of purposes. We next consider

¹¹Some participants reported buying just enough mobile data to request an Uber home after shopping in town, suggesting that this is not purely driven by people being Uber drivers, as one might expect.

whether some of these changes can be linked to the introduction of fast, affordable fibre.

DID GETTING HOME FIBRE INFLUENCE ONLINE BEHAVIOUR?

While many online activities became more common between 2022 and 2025, our empirical approach allows us to identify which increases can be causally attributed to home fibre. This is done by estimating the average treatment effect on the treated (ATT), i.e. the change in online behaviour among respondents who received home fibre. The advantage of using fibertime's network is that getting a router is exogenous and less affected by individual characteristics that could drive uptake.

The event-study plots in [Figure 13](#) illustrate the magnitude of the effects and also indicate which changes occurred immediately and which took time to materialise.

Among all activity measures, the rise in using the internet for education¹² stands out as the most consistent and meaningful finding. It shows that respondents with home fibre were substantially more likely than those without to use the internet for learning.

This effect becomes statistically significant one survey period after treatment and is strongest in the cohort that was treated first (Annexure [Table 2](#) shows the event-study and group-level coefficients, and also provides robustness checks across subsamples that confirm the pattern). Specifically, after controlling for individual characteristics, respondents in the early-treated cohort were 9.6 percentage points (roughly 50%) more likely to use the internet for school purposes after receiving fibre, relative to their baseline rate of 20%. The delay suggests a learning curve, with residents taking time to adjust their online behaviour. Recall that respondents were limited to persons

¹²In our questionnaire this was defined as *using the internet for school purposes (e.g., research, educational sites, classes, etc.)*

aged 18 years and older, suggesting that this likely includes a component of further education rather than high school activity.

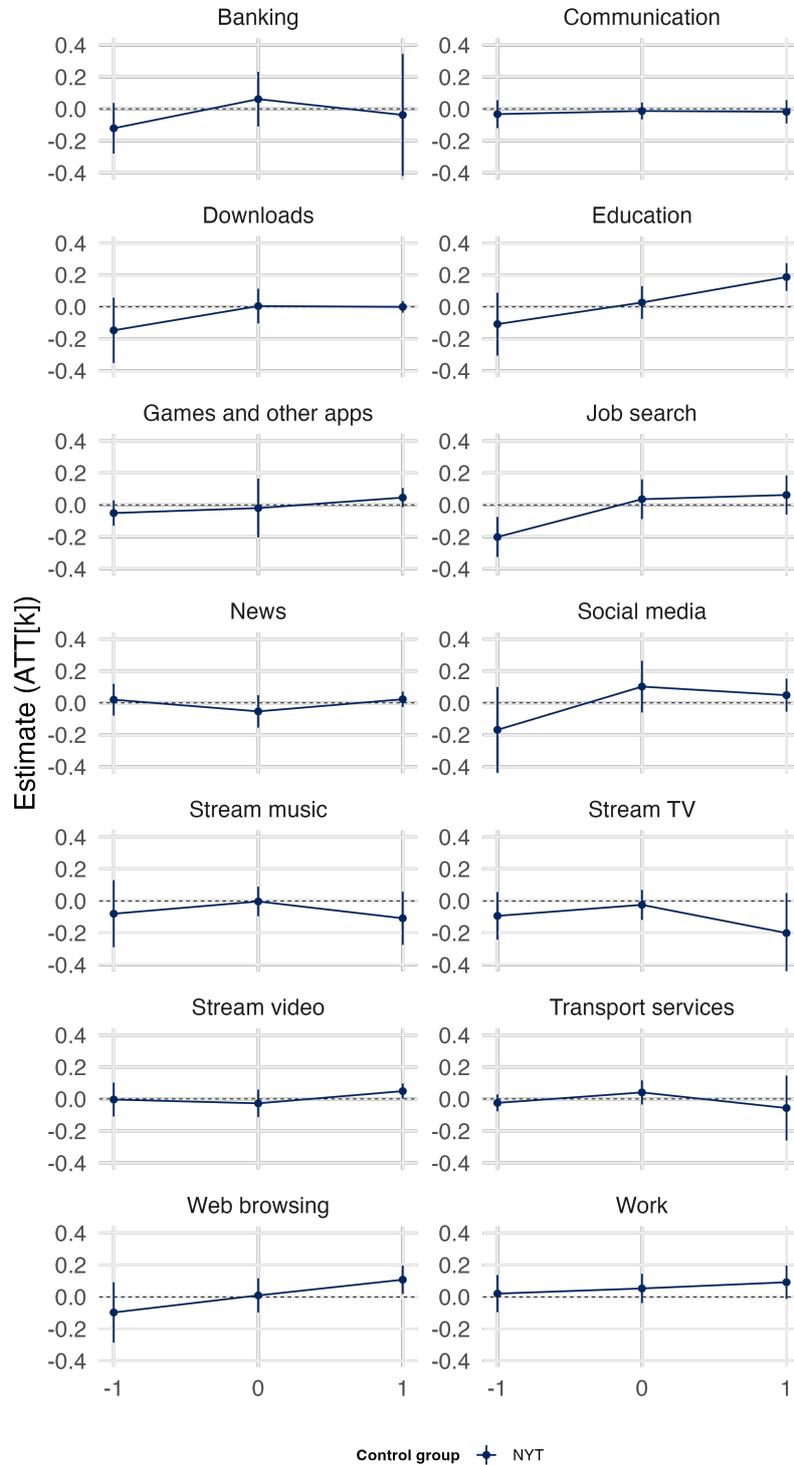
The increase among respondents with home fibre in using the internet for learning also led us to test whether individuals in fibre-connected homes were more likely to be enrolled in formal study programmes. However, home fibre itself did not (yet) appear to encourage enrolment. Methodologically, this highlights a broader challenge: behavioural changes may occur quickly, but socioeconomic impacts take longer to emerge and are affected by a wider array of factors.

From a skills-development and policy perspective, the greater likelihood that respondents with home fibre use the internet for learning is a valuable finding.

Interpreting the event-study plots

- $t = 0$ marks the first survey period in which a respondent had home fibre (treated); $t = -1$ is the wave before treatment (baseline); $t = +1$ is the wave after treatment. This helps us see not only whether fibre matters, but how effects evolve.
- Marker height shows the direction and size of the effect: the percentage point change in the likelihood that a respondent uses the internet for a specific activity (e.g., education, job search), compared with how they would have behaved without fibre. A positive value means fibre made the activity more likely; a negative value means it became less likely.
- Vertical lines show 95% confidence intervals. Longer lines indicate greater uncertainty. Effects are statistically significant and unlikely to be random when the interval does not cross zero.
- If effects appear at $t = 0$, fibre changed behaviour quickly. If effects only appear at $t = +1$, this suggests households take time to adjust their online behaviour after receiving fibre.
- When significance appears at $t = 0$ or $t = +1$, we check for pre-trends that could indicate treated and control groups were already diverging before fibre rollout, making it harder to isolate the causal effect. If the effect at $t = -1$ is close to zero, it means treated and untreated households behaved similarly before fibre arrived. This supports the assumption that post-treatment differences reflect the effect of fibre rather than unrelated trends.

Figure 12: Effect of home fibre on online activity (balanced dwelling sample)



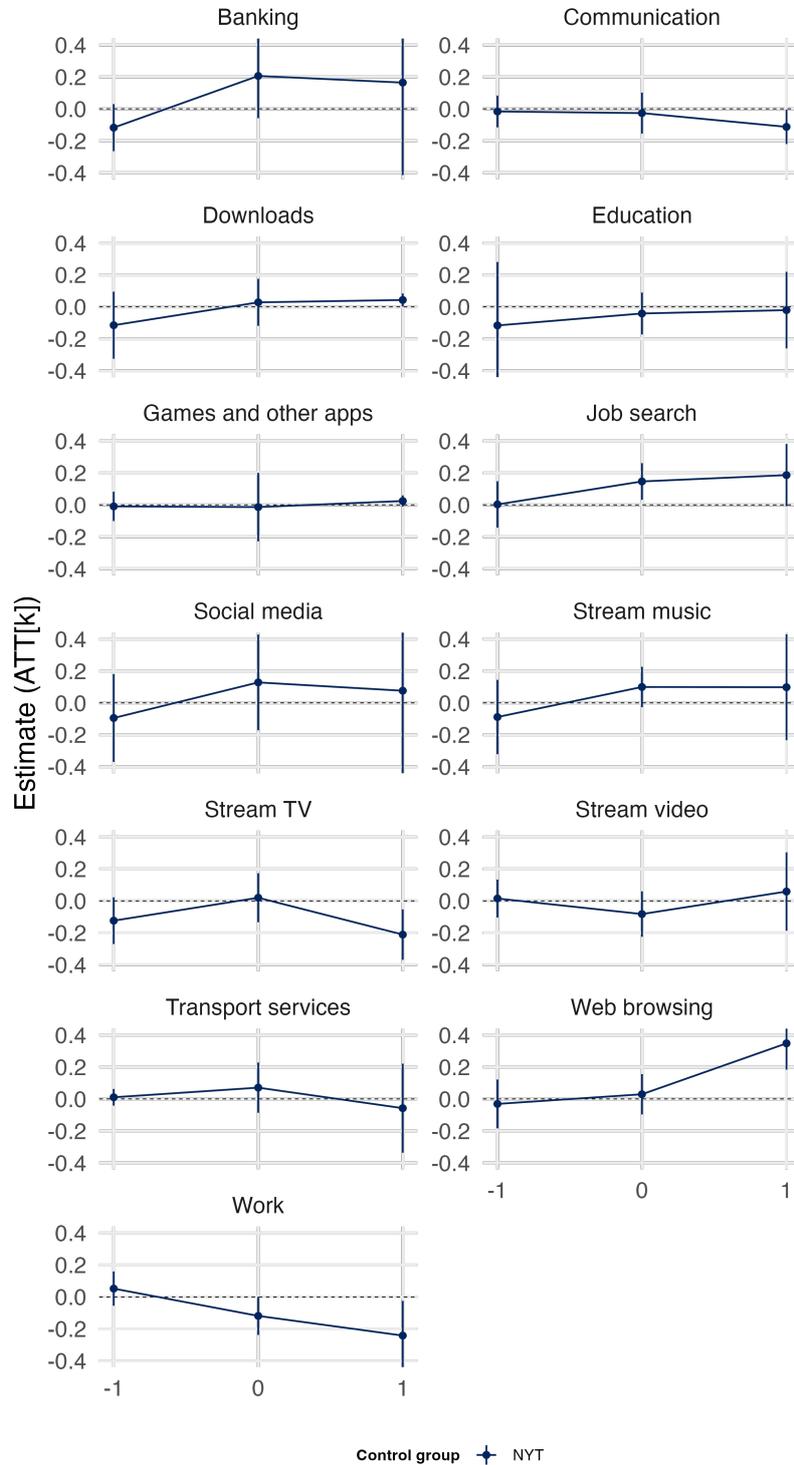
Notes: Estimates compare respondents with home fibre to those not-yet-treated (NYT). Estimates are weighted to align with Kayamandi's 2022 population composition and restricted to dwellings observed in all three survey waves ($n = 2145$).

We also consider whether employed persons¹³ use the internet in a different way to those who are not working. The results do not show the same association between home fibre and internet use for education among employed respondents, which is expected given their employment status. Their lower likelihood of using the internet for work within Kayamandi suggests that many are employed outside the area.

However, the observed increase in using the internet for job search among persons who are already doing some form of paid work (already evident at $t = 0$) is noteworthy. Even though the overall share of respondents using the internet for job search fell between 2022 and 2025, our difference-in-differences estimates show that employed respondents with home fibre were more likely than comparable not-yet-treated respondents to search for jobs online. Annexure [Table 3](#) provides detailed results of the relationship. It confirms that the effect of home fibre on job search already occurs at the time of treatment (in contrast to the delayed effect we observed in the case of using the internet for education), and strengthens into the next period. The negative coefficients in our Azania placebo treatment confirm that this finding is not driven by a broader area trend.

¹³Our definition of employment in this context includes anyone in full-time or part-time employment in the formal or informal sector, or self-employed

Figure 13: Effect of home fibre on online activity, (employed persons)



Notes: Estimates compare respondents with home fibre to those not-yet-treated (NYT). Estimates are weighted to align with Kayamandi's 2022 population composition and restricted to employed persons ($n = 1\,290$).

Conclusion

The rollout of affordable fibre broadband in Kayamandi has reshaped how residents connect, communicate and participate in the digital economy.

Over the course of three years, a community that had previously relied almost entirely on mobile data transitioned to using fibre. Households with home fibre spent less on mobile data without increasing their total connectivity costs, demonstrating that, at the right price, fibre can expand digital access without placing additional pressure on household budgets.

Our findings show that fibre access not only changed what people buy but also how they use the internet. Specifically, respondents with home fibre had a higher likelihood of using the internet for learning. It also appears to have lowered the implicit cost of job search among persons who were already employed, suggesting that home fibre allowed them to use the internet to find better or alternative opportunities.

From a policy perspective, our research in Kayamandi underscores that, when priced at a level accessible to low-income households, fibre can deliver welfare gains without increasing household spending. When the cost barrier of data-intensive internet activity is lowered, people move beyond using the internet for communication.

The findings highlight the potential of fibre to play a transformative role in advancing digital inclusion and local development in South Africa's townships.

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Annexure

Weighting scheme

The survey design involved stratified random sampling by dwelling type, with intentional oversampling of formal and backyard dwellings. We applied post-stratification weights at two levels to restore representativeness, based on the sampling frame produced by [GeoTerralimage \(Pty\) Ltd \(2022\)](#).

1. Dwelling weights are estimated to align the realised sample with Kayamandi's 2022 dwelling composition of ~58% informal dwellings, 23% formal (brick-and-mortar) dwellings, and 19% backyard dwellings.
2. Person weights are estimated to align respondents to the township's adult population by age group (18-35 years / older than 35 years) and gender (male / female). In 2022, roughly 54% of adults living in Kayamandi were between 18-35 years, and 53% of the adult population of the township were male.

Because our main outcomes relate to individual-level characteristics, we use person-weights in estimation. It implies that results are reported for individuals rather than dwellings. We therefore do not upweight the total dwelling counts per cohort which would overstate person-level representation, but instead control for dwelling type in our estimation.

All weights are calibrated to baseline composition to avoid post-treatment bias. Weights are then normalised so that the total equals our sample size at each wave.

Detailed results

Table 1: Share of respondents using the internet for select activities, 2022 and 2025

Activity	2022	2023	2025
Banking	18.1%	19.0%	17.8%
Communication	91.4%	88.9%	92.0%
Downloads	16.4%	8.4%	3.5%
Education	17.8%	8.6%	28.5%
Job search	35.4%	17.0%	29.6%
News	12.3%	11.2%	6.6%
Online shopping	1.9%	4.2%	7.0%
Social media	64.2%	44.2%	79.8%
Stream music	7.2%	5.6%	13.2%
Stream TV	12.7%	13.2%	22.2%
Stream video	19.3%	12.2%	9.0%
Transport services	6.3%	5.5%	13.5%
Web browsing	28.9%	20.4%	13.6%
Work	15.3%	13.5%	28.2%

Notes: These estimates use composite person-dwelling weights to align the sample with Kayamandi's population and dwelling composition at baseline.

Table 2: ATT on likelihood of using the internet for education, by time and cohort

Outcome	Sample	Control	Type	Time/Cohort	Estimate	SE	p-value	N
Education	Balanced panel of dwelling units	NYT	Cohort effects	2	0.096***	(0.033)	0.0039	2 145
Education	Balanced panel of dwelling units	NYT	Cohort effects	3	0.053	(0.119)	0.6579	2 145
Education	Balanced panel of dwelling units	NYT	Event study	-1	-0.108	(0.099)	0.2746	2 145
Education	Balanced panel of dwelling units	NYT	Event study	0	0.027	(0.052)	0.6032	2 145
Education	Balanced panel of dwelling units	NYT	Event study	1	0.187***	(0.046)	0.0001	2 145
Education	In-person, during workweek	NYT	Cohort effects	2	0.146**	(0.068)	0.0310	1 277
Education	In-person, during workweek	NYT	Cohort effects	3	0.119	(0.102)	0.2429	1 277
Education	In-person, during workweek	NYT	Event study	-1	0.028	(0.105)	0.7923	1 277
Education	In-person, during workweek	NYT	Event study	0	0.056	(0.064)	0.3819	1 277
Education	In-person, during workweek	NYT	Event study	1	0.290**	(0.129)	0.0250	1 277
Education	Employed persons	NYT	Cohort effects	2	-0.017	(0.053)	0.7440	1 290
Education	Employed persons	NYT	Cohort effects	3	-0.069	(0.131)	0.5977	1 290
Education	Employed persons	NYT	Event study	-1	-0.117	(0.203)	0.5655	1 290
Education	Employed persons	NYT	Event study	0	-0.042	(0.067)	0.5343	1 290
Education	Employed persons	NYT	Event study	1	-0.021	(0.122)	0.8669	1 290
Education	Azania placebo	NYT	Cohort effects	2	-0.139***	(0.031)	0.0000	2 400
Education	Azania placebo	NYT	Event study	0	-0.015	(0.019)	0.4335	2 400
Education	Azania placebo	NYT	Event study	1	-0.263***	(0.048)	0.0000	2 400

Notes: Estimates use person-weights to align the sample with Kayamandi's baseline population, allowing the coefficients to be interpreted as effects for the average adult in the township.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: ATT on likelihood of using the internet for job search, by time and cohort

Outcome	Sample	Control	Type	Time/Cohort	Estimate	SE	p-value	N
Job search	Balanced panel of dwelling units	NYT	Cohort effects	2	0.038	(0.046)	0.4122	2 145
Job search	Balanced panel of dwelling units	NYT	Cohort effects	3	0.062	(0.116)	0.5961	2 145
Job search	Balanced panel of dwelling units	NYT	Event study	-1	-0.201***	(0.063)	0.0014	2 145
Job search	Balanced panel of dwelling units	NYT	Event study	0	0.035	(0.056)	0.5307	2 145
Job search	Balanced panel of dwelling units	NYT	Event study	1	0.062	(0.059)	0.2938	2 145
Job search	In-person, during workweek	NYT	Cohort effects	2	-0.004	(0.056)	0.9473	1 277
Job search	In-person, during workweek	NYT	Cohort effects	3	-0.076	(0.097)	0.4310	1 277
Job search	In-person, during workweek	NYT	Event study	-1	-0.003	(0.064)	0.9592	1 277
Job search	In-person, during workweek	NYT	Event study	0	-0.030	(0.062)	0.6337	1 277
Job search	In-person, during workweek	NYT	Event study	1	-0.017	(0.067)	0.7972	1 277
Job search	Employed persons	NYT	Cohort effects	2	0.081	(0.064)	0.2066	1 290
Job search	Employed persons	NYT	Cohort effects	3	0.318***	(0.100)	0.0015	1 290
Job search	Employed persons	NYT	Event study	-1	0.003	(0.074)	0.9718	1 290
Job search	Employed persons	NYT	Event study	0	0.147**	(0.058)	0.0122	1 290
Job search	Employed persons	NYT	Event study	1	0.186*	(0.099)	0.0608	1 290
Job search	Azania placebo	NYT	Cohort effects	2	-0.080***	(0.020)	0.0000	2 400
Job search	Azania placebo	NYT	Event study	0	-0.074***	(0.020)	0.0003	2 400
Job search	Azania placebo	NYT	Event study	1	-0.086***	(0.026)	0.0010	2 400

Notes: Estimates use person-weights to align the sample with Kayamandi's baseline population, allowing the coefficients to be interpreted as effects for the average adult in the township.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$