Access to Mobile Phones (and Better Jobs?)

Abstract: The impact of mobile phone infrastructure on job quality remains understudied in countries with developing labor markets. I take advantage of a supply shock in the mobile phone market to evaluate how access to this technology could improve job search in the labor market of a developing country. However, in contrast to other studies that focus primarily on employment levels, I am interested in job quality indicators. This is relevant in a developing country context where the main concern may not be the quantity of employment, but rather its quality. Peru illustrates this contrast: in 2004, 75% of workers were informally employed, while the unemployment rate was only around 5%. I use employment in informal enterprises, informal employment, time-related and income-related underemployment, second-job holding, and the desire for additional work as measures of job quality. I find that overall employment does not increase, although there are some shifts from agricultural to non-agricultural and from non-wage to wage employment, consistent with findings in the existing literature. At the same time, informal employment and employment in informal enterprises increase. These results suggest that changes in employment levels alone provide an incomplete picture of the labor market effects of mobile phone infrastructure in developing countries.

Keywords: Mobile phones, 2G technology, job quality, staggered adoption, cohort-specific treatment effects.

1. Introduction

Do mobile phones help workers access better jobs? Mobile communication can reduce search frictions by making workers easier to reach, allowing firms to contact potential employees more quickly, and helping job seekers maintain wider social and professional networks. These mechanisms are especially relevant in developing-country labor markets, where information frictions, informal hiring, and spatial isolation can limit access to better employment opportunities.

A growing literature studies the effects of mobile phones on labor-market outcomes in developing countries (Aker & Mbiti, 2010; Jensen, 2007; Klonner & Nolen, 2010; Nsabimana & Funjika, 2019). Most of this work focuses on employment, unemployment, and sectoral reallocation, particularly in rural labor markets. Less is known about whether mobile phone infrastructure changes the quality of employment, including informality, underemployment, and the type of jobs workers hold.

Peru provides a useful setting to study this question because the expansion of mobile phone service was shaped by a major supply-side shock. Mobile services were introduced in 1990, but coverage initially remained concentrated in Lima and Callao and targeted firms or higher-income users. Regulatory changes and the entry of America Movil in 2005 changed the structure of the market. Beginning in 2006, mobile operators rapidly expanded base-station infrastructure and coverage across districts outside the capital region.

This paper uses that staggered expansion to estimate the effect of mobile phone infrastructure on labor-market outcomes. I combine district-level information on mobile phone service availability with repeated cross-sectional individual data from ENAHO. Treatment is defined as district-level access to mobile phone service, and effects are estimated by treatment cohort to account for staggered adoption and differences across districts treated in different years.

The analysis focuses on a narrower set of outcomes than earlier drafts. I study employment and non-employment, wage and non-wage employment, agricultural and non-agricultural employment, employment in informal enterprises, informal employment,

time-related and income-related underemployment, second-job holding, and the desire for additional work. This set of outcomes is designed to capture not only whether people work, but also whether mobile phone infrastructure changes the type and quality of work available to them.

The preliminary results show little evidence of changes in aggregate employment, but they suggest changes in the composition and quality of employment. Wage employment increases for the 2006 cohort, while non-wage employment falls for the 2006 and 2007 cohorts. Non-agricultural employment increases most clearly for the 2008 cohort. At the same time, informal employment and employment in informal enterprises increase for some cohorts, suggesting that improved communication may have expanded access to jobs without necessarily improving job quality.

The rest of the paper is organized as follows. Section 2 describes the expansion of mobile phone infrastructure and adoption in Peru. Section 3 presents the theoretical framework. Section 4 describes the data and outcomes. Section 5 presents the empirical strategy and covariate-balance evidence. Section 6 reports preliminary results. Section 7 discusses mechanisms, and Section 8 presents preliminary conclusions.

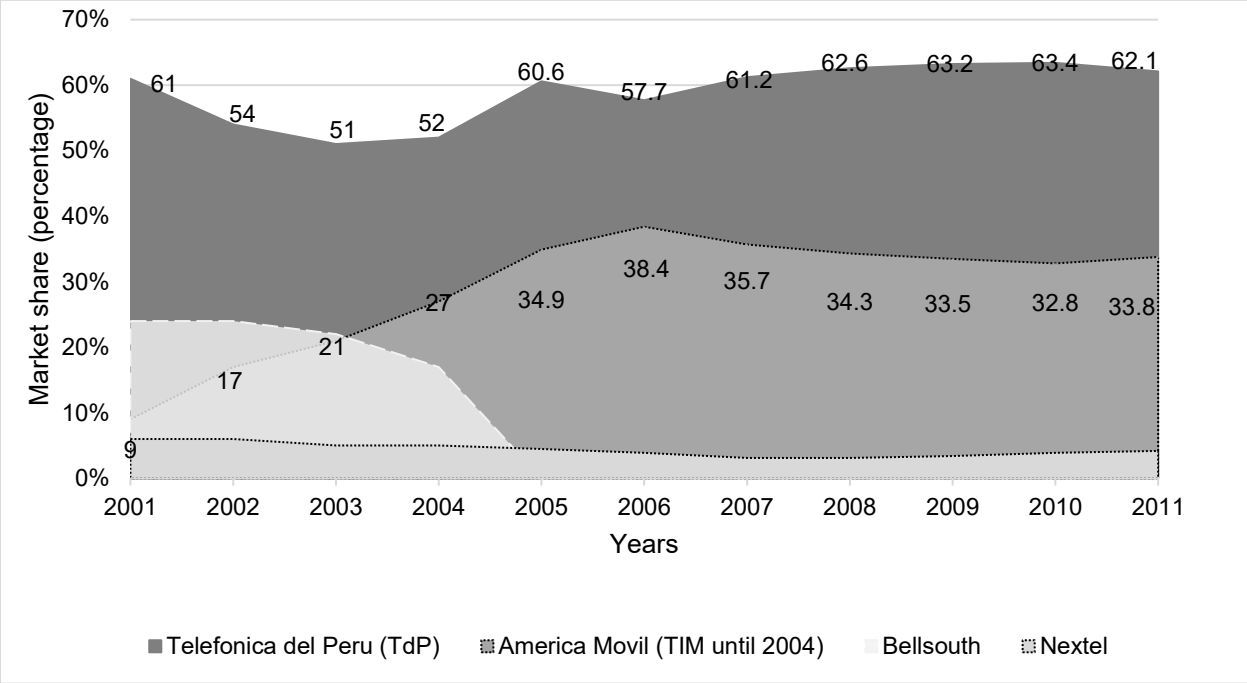
2. Infrastructure Expansion and Mobile Phone Adoption

The first mobile phone service in Peru was introduced in 1990 by the Peruvian company Tele 2000, which mainly operated in the Metropolitan Lima Area and targeted the corporate sector (El comercio, 2021). The two existing public companies, CPT and ENTEL, followed Tele 2000 by introducing mobile infrastructure for middle-class users beginning in June 1991, although coverage remained limited to Lima and Callao (El comercio, 2021). In 1994, the Spanish firm Telefonica acquired the two public telephone companies and merged them to create Telefónica del Perú (TdP). Tele 2000 was later acquired by BellSouth, a private U.S. firm that also obtained a concession to provide mobile services in regions outside Lima and Callao (El comercio, 2021; OSIPTEL, 2014).

Two regulatory changes helped make the market more dynamic: the 1996 shift of responsibility for mobile-to-fixed and fixed-to-mobile calls to the calling party, and the 2005 cap on interconnection charges between mobile operators (OSIPTEL, 2014). After the first change, the Italian company TIM won the auction to operate mobile service

networks in 2000, and Nextel entered the mobile market in 1998, although it mainly served corporate clients (Infobae, 2023). The second change likely encouraged competition by allowing operators to reach efficient scale, which was especially important for new entrants (OSIPTEL, 2014). In 2005, TdP acquired BellSouth (Peruvian government portal, 2006e), and America Movil entered the market by purchasing TIM (Latin Spots, 2005). From 2005 onward, TdP and America Movil formed the duopoly that shaped the market during the period of analysis (Figure 1).

Figure 1. Evolution of the market share (percentage) of mobile services by company

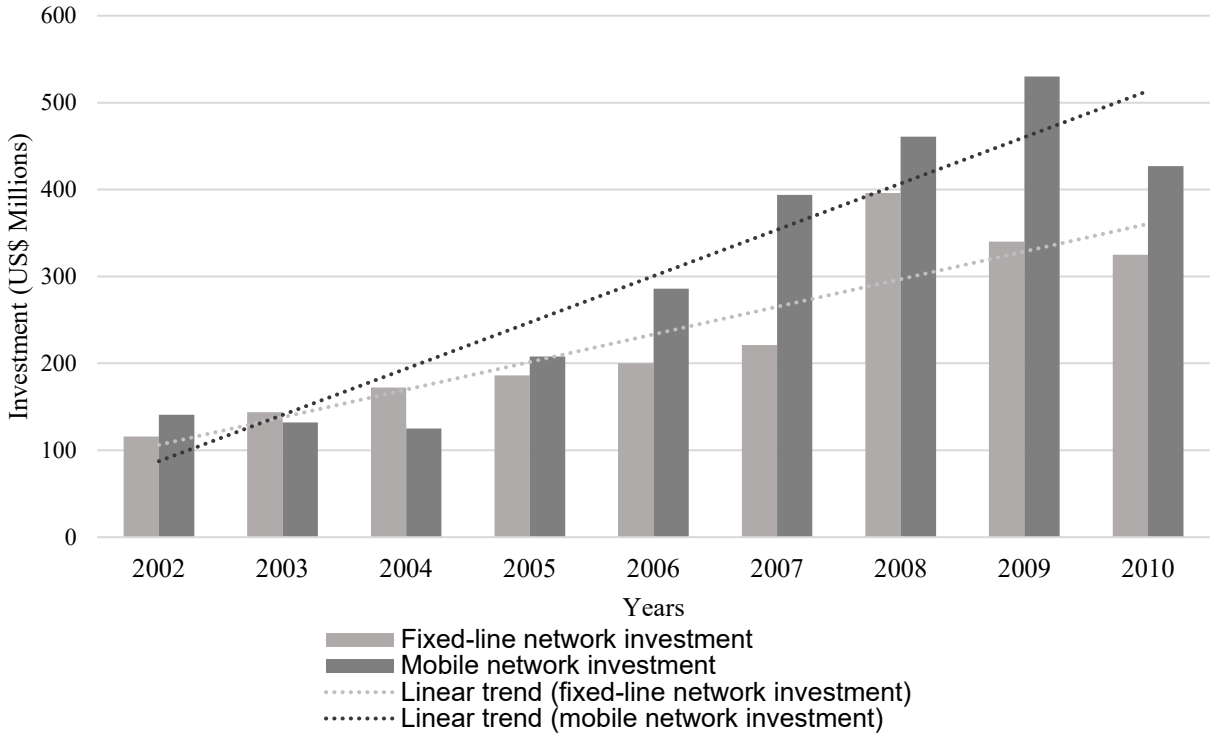


Notes: The information comes from the 2011 Annual Report of the Secretariat of Communications (MTC Secretariat of Communications, 2011).

The entry of America Movil into the Peruvian mobile phone industry represented a supply shock. In 2006, Carlos Slim and the company's CEO, Humberto Chavez, announced a strong investment commitment, starting with an initial investment of US$ 100 million to expand the capacity of mobile networks (Peruvian government portal, 2006b, 2006d). Figure 2 illustrates investment trends across mobile phone services and other telecommunication services (fixed phone and internet) from 2002 to 2010. Until 2005, investment in the two network types was similar, and in some years fixed-line network

type was larger. Between 2004 and 2009, investment in mobile networks rose substantially, peaking in 2005 and surpassing investment in fixed-line networks.

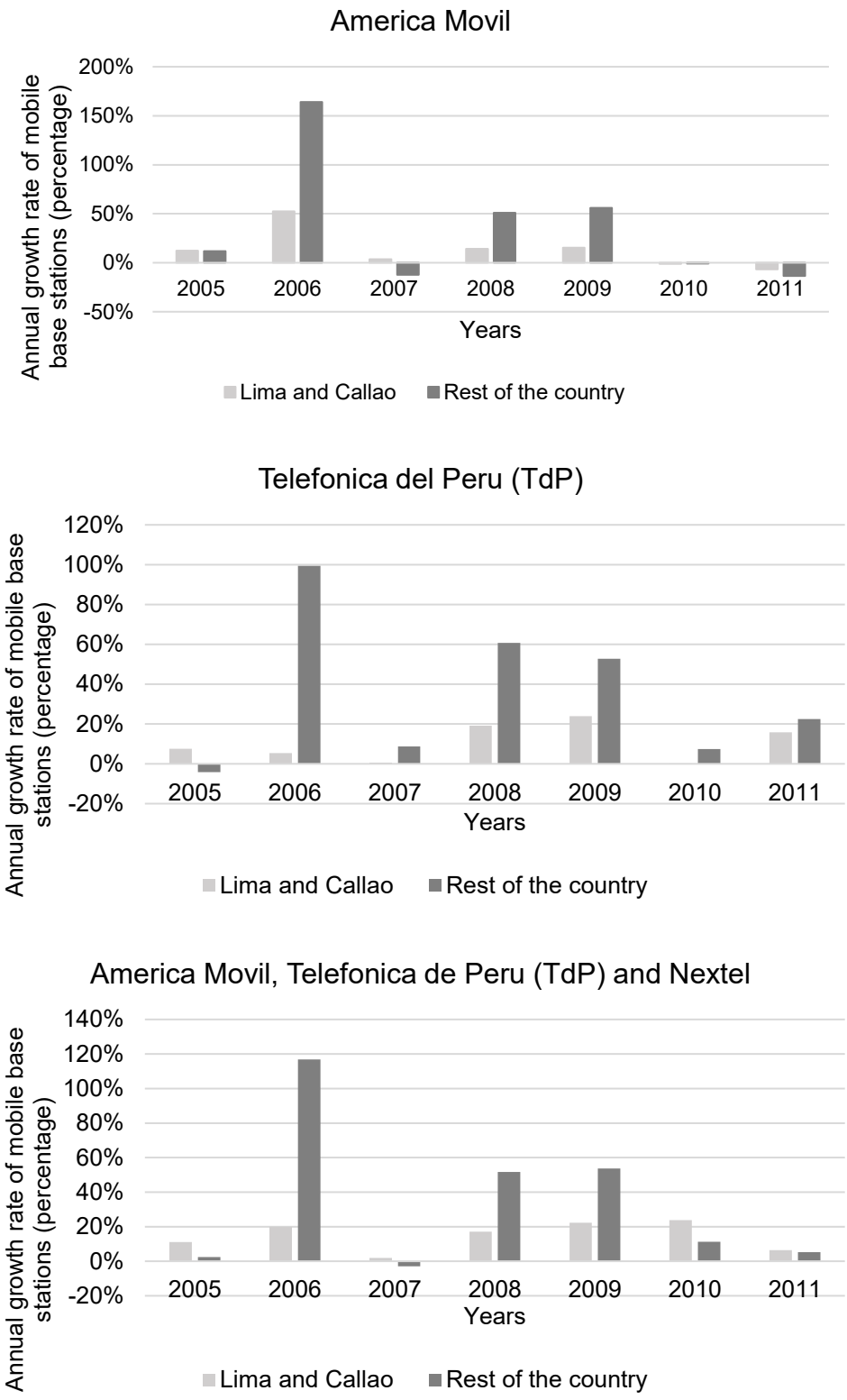
Figure 2. Telecommunication Investment (US$ Millions) by Network Type (2001-2010)



Source: Telecom service providers (OSIPTEL, 2012). From 2002 to 2008, referred to fixed-line networks as fixed-line telephone services, and mobile networks were referred to as mobile phone services, reporting similar numbers for this period (OSIPTEL, 2008).

These investments were part of America Movil's strategy in the Peruvian mobile phone market. The company considered Peru the most promising mobile market in the region because penetration was low relative to other Latin American countries (Peruvian government portal, 2006a). Figure 3 shows that America Movil expanded mobile phone base-station infrastructure across regions. Overall, mobile operators focused their investments on expanding infrastructure, particularly outside Lima and Callao. As a result, in June 2006, America Movil became the operator with the widest regional coverage in the country (Peruvian government portal, 2006c). TdP also invested in mobile phone base stations across regions during the same period.

Figure 3. Annual growth of the mobile base stations by company and region (2005-2011)



Own elaboration, based on the 2004-2011 reports of the MTC Secretariat of Communications. Notes: Lima includes the metropolitan area and the region of Lima.

The expansion of the mobile network infrastructure led to a substantial reduction in the prices of both mobile services and equipment within a few years. In the early 1990s, mobile phones were primarily considered business tools because they were large and expensive, making them affordable only to corporate executives (El comercio, 2021). The supply shock in 2006 triggered a sustained decline in the prices of mobile phones and services, making them increasingly affordable for the general population. Moreover, the reduction in poverty during this period also helped expand the potential consumer base for mobile services.

Table 1. Mobile phone equipment (US$ and Percentage of the Legal Minimum Wage), Rate per minute (US$) and coverage (number of districts), by year

	1990	2005	2006
Equipment (included line)	$3500	$49.40	$30.90
Rate per minute	$0.5	$0.41	$0.33
Legal minimum monthly wage	$40 (in 1991)	$141	$151
% of equipment (denominator: cost of equipment)	8750%	35%	21%
Coverage	49[1/]	410	970

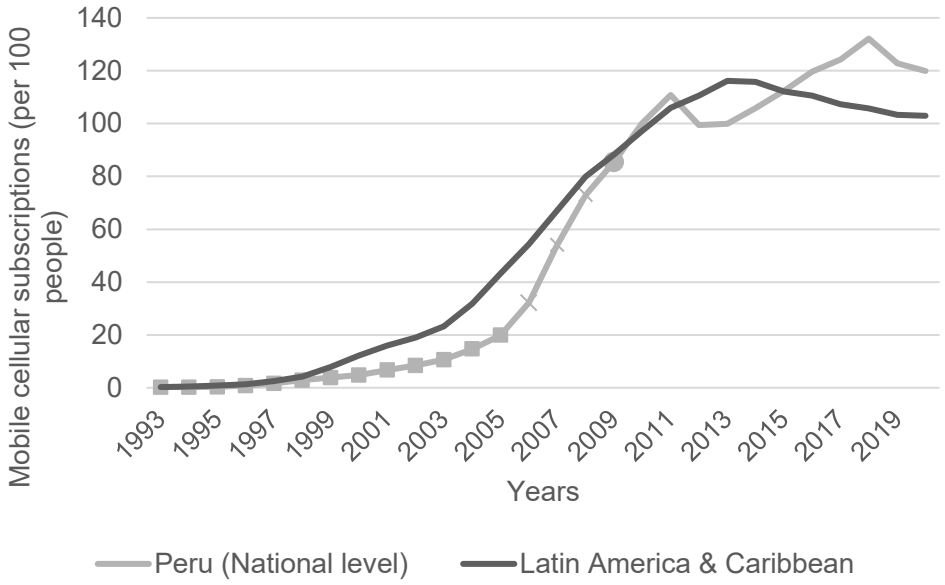
Notes: In 1990, there was also a monthly service fee between $15 and $200. By 2005 and 2006, both prepaid and postpaid mobile services were available.

[1/] 49 is the maximum number of districts that are contained by Lima and Callao, as the source (El comercio, 2021) only states that the service was available in some districts of the Lima and Callao metropolitan area.

This reduction of prices for mobile phone services increased their use relative to other countries and telecommunication services. Figure *4* shows that Peru lagged behind the Latin American average until 2009, with a change in trend beginning in 2006. In the same

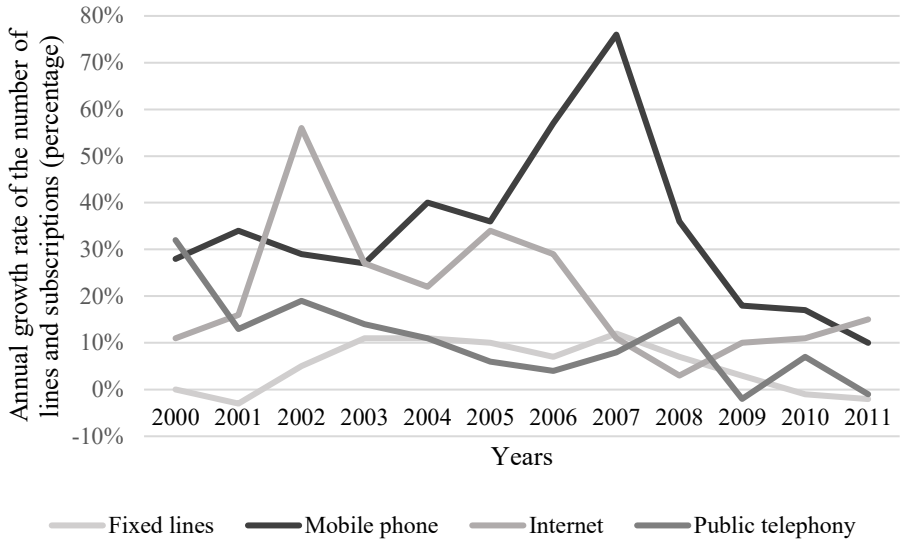
year, mobile phones were the only telecommunications service to experience a sharp increase in their annual growth rate (Figure *5*). Neither public telephony nor fixed-line telephones exhibited a similar increasing trend, with the latter displaying a very stable trend throughout the entire period. Internet subscriptions peaked in 2002, with smaller peaks in 2005 and 2006.

Figure 4. Mobile cellular subscriptions (per 100 people) in Peru compared to Latin America and Caribbean region (1993-2020)



Own elaboration (MTC Secretariat of Communications, 2004; World Bank, 2025)

Figure 5. Annual increase (percentage) of the number of lines and subscriptions by type of telecommunication services, 2000-2011



Mobile phone services and equipment became more accessible to workers beginning in 2006. The entry of America Movil in late 2005, facilitated by regulatory changes in 1996 and 2005, led to an infrastructure expansion that broadened mobile coverage. This expansion made mobile phones more accessible and accelerated adoption beyond corporate executives in Lima and Callao. The next section discusses how this innovation in telecommunications could affect workers' job search, employment type, sectoral allocation, and working conditions.

3. Theoretical Framework

Complete information is a fundamental assumption underlying the First Fundamental Theorem of Welfare Economics and the Law of One Price (Jensen, 2007). In the presence of information asymmetries, allocations can become inefficient, and price differences across markets can create arbitrage opportunities (Aker et al., 2011). In theory, these frictions can generate waste and price dispersion.

The resulting “waste” from information friction in the labor market is reflected in worker misallocations. This waste is manifested in people who want to work but cannot (unemployment), individuals who desire to work more than they currently do (underemployment), or poor matches between jobs and workers (skill mismatches).

Mobile phone technology reduces search costs for better job opportunities, leading to better worker allocation and lower labor earnings dispersion (Aker & Mbiti, 2010).

4. Data

Treatment is defined at the district level, while outcomes are measured at the individual level. Districts constitute Peru's third and typically lowest administrative level. I exploit variation in the timing of mobile phone service availability across districts to estimate intention-to-treat effects on labor-market outcomes and working conditions for individuals living in these areas.

Treatment Variable

The mobile phone infrastructure variable is a time-varying binary indicator for the availability of mobile phone service at the district level between 2004 and 2011. The main source is the MTC Secretariat of Communications (now defunct), which published quarterly reports on public telecommunications services during this period. These reports include national- and district-level statistics for internet, mobile phone, and landline services, covering the most relevant communication technologies in the country.

Using this information, the 2007 INEI district shapefile, and district codes from the 2007 Peruvian Population Census, I construct a treatment variable that classifies a district as treated once mobile phone service becomes available (Appendix 1). Table 2 reports the number of treated districts by year during 2004-2011 and shows a sharp increase between 2005 and 2006, when the infrastructure expansion began.

Table 2. Mobile phones infrastructure expansion over 2004-2011

	Number of districts	Share of districts (total:1833 districts)
1990-2004	399	22%
2005	11	0%
2006	560	31%
2007	259	14%
2008	194	11%
2009	61	3%

2010	102	6%
2011	23	1%
Never treated	225	12%

Outcomes

For the outcomes, I use the nationally representative household survey ENAHO, which is widely used in applied research on Peru (Dell, 2010; Aragón & Rud, 2013; Bellemare et al., 2018; Cisneros-Acevedo, 2022). Conducted continuously since 1997 by the National Institute of Statistics (INEI), ENAHO follows a probabilistic, multi-stage sampling design with rural and urban strata and provides national and regional inference at the 95% confidence level, using the 2007 Population Census as a reference. I rely primarily on the labor module and restrict the sample to individuals aged 14 to 64, corresponding to the working-age population in Peru. I pool repeated cross-sections from ENAHO for 2002-2015 to construct an individual-level dataset of non-panel individuals, which provides four years before and after each treatment cohort.

My individual-level outcomes comprise key labor market variables and working conditions. For the individual-level outcomes, I construct dummy variables for each category of employment status (employed and non-employed), employment type (wage and non-wage employment), and economic sector (agriculture and non-agriculture sectors). For working conditions, I use measures of informal status (for non-wage and wage workers), employment in an informal enterprise, time-related underemployment (ILO definition), and income-related underemployment (national definition). I also include variables indicating whether the individual has a second job and whether they desire and are available for additional work.

Covariates

Using the ENAHO modules on individual and household characteristics, I include age groups, gender, completion of tertiary education, and rural residence as covariates.

5. Empirical Strategy

The empirical strategy estimates the effect of district-level mobile phone infrastructure on the working-age population, defined as individuals aged 14 to 64.

I define treatment timing under a no-anticipation assumption. America Movil purchased TIM in August 2005, and the major infrastructure expansion began in 2006, leaving limited time for districts or workers to respond before treatment occurred. The pre-trend evidence helps assess the plausibility of this assumption and the broader parallel-trends requirement.

Because treatment adoption is staggered, the empirical design must address parallel-trends assumptions across cohorts and time. I use the Callaway and Sant'Anna (2021) estimator to estimate cohort-specific effects and use pre-treatment estimates to evaluate whether treated cohorts and comparison groups followed similar trends before mobile phone service arrived.

Table 3. Covariate balance statistics by cohort (2004-2011)

Covariates in levels (G-1)	**Adopt**	**Not-yet-treated**	**Never**
Cohort=1990-2004			
Tertiary education	19	17	3
Female %	51	51	46
Age 30-49	40	39	39
Rural	7	8	99
Poverty	26	55	81
Cohort=2005			
Tertiary education	9	8	4
Female %	47	48	47
Age 30-49	39	35	37
Rural	60	75	98
Poverty	47	71	68
Cohort=2006			
Tertiary education	10	7	4
Female %	48	48	49
Age 30-49	39	38	39
Rural	51	60	98
Poverty	45	67	67
Cohort=2007			
Tertiary education	5	4	5

Female	47	48	45
Age 30-49	39	38	40
Rural	76	84	98
Poverty	53	74	68
Cohort=2008			
Tertiary education	4	4	4
Female	46	47	46
Age 30-49	39	36	38
Rural	84	77	99
Poverty	55	72	58
Cohort 2009			
Tertiary education	5	4	2
Female	47	48	46
Age 30-49	40	37	42
Rural	99	79	100
Poverty	56	76	53
Cohort 2010			
Tertiary education	4	3	3
Female	47	46	46
Age 30-49	41	39	39
Rural	90	92	100
Poverty	55	70	55
Cohort 2011			
Tertiary education	5	4	3
Female	49	47	46
Age 30-49	41	43	40
Rural	69	83	100
Poverty	48	66	52

The covariate-balance statistics show that the 2004 and 2005 cohorts differ substantially from both not-yet-treated and never-treated districts. The 2006 and 2007 cohorts are more similar to the not-yet-treated group than to the never-treated group, while later cohorts appear closer to the 2008 cohort. Based on this pattern, I estimate cohort-specific effects using the Callaway and Sant'Anna (2021) estimator, control for pre-2005 rurality, and then evaluate pre-treatment trends.

Table 4. Summary of Pre-treatment Estimates by Treatment Cohort

Outcome	Cohort 2006	Cohort 2007	Cohort 2008	Cohort 2009	Cohort 2010	Cohort 2011
Agricultural employment	0.727	0.744	0.364	0.445	0.072*	0.375
Contributing family worker	0.702	0.854	0.447	0.026**	0.033**	0.277
Domestic worker	0.827	0.717	0.748	0.574	0.141	0.635
Employment	0.395	0.660	0.717	0.317	0.357	0.626
Income-related underemployment	0.644	0.925	0.645	0.834	0.476	0.648
Total income higher than poverty line (considering household size)	0.889	0.840	0.679	0.591	0.474	0.536
Total income higher than poverty line	0.498	0.673	0.264	0.614	0.005***	0.395
Total income higher than minimum legal wage	0.872	0.784	0.714	0.593	0.519	0.400
Informal employment	0.774	0.808	0.786	0.099*	0.437	0.586
Employment in an informal enterprise	0.643	0.830	0.664	0.093*	0.016**	0.342
Having a second job	0.903	0.544	0.677	0.024**	0.388	0.459
Non-agricultural employment	0.712	0.743	0.344	0.474	0.093*	0.354
Non-wage employment	0.628	0.817	0.592	0.111	0.345	0.648
Time-related underemployment	0.652	0.868	0.883	0.843	0.422	0.183
Unemployment	0.891	0.874	0.194	0.310	0.228	0.147
Wage employment	0.896	0.914	0.262	0.506	0.437	0.261
Desire for additional work	0.844	0.866	0.777	0.742	0.359	0.480

Notes: Entries report the minimum p-value among the individual pre-treatment ATT estimates for each outcome and treatment cohort. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. The omitted pre-treatment period ($J = -1$) is the reference period. These statistics summarize individual pre-treatment estimates and should not be interpreted as joint pre-trend tests.

6. Preliminary Results

The estimates show no clear effects on overall employment or non-employment, but they do show changes in employment type, sectoral allocation, and working conditions. Wage employment increases for the 2006 cohort, while non-wage employment decreases for the 2006 and 2007 cohorts. There is also a shift from agricultural to non-agricultural employment, particularly for the 2008 cohort. These changes, however, do not translate into an increase in the overall employment rate.

The results also show an increase in informal employment, defined as the absence of social security coverage among wage workers, and an increase in employment in informal enterprises for the 2006 and 2008 cohorts. Time-related underemployment decreases, but there is no corresponding reduction in income-related underemployment.

On the positive side, the likelihood of having a second job declines, as does the desire to work additional hours. These changes may be related to changes in income among part-time workers.

Table 5. Summary of Pre-treatment Estimates by Treatment Cohort

Effects on employment

	J=1	**J=2**	**J=3**	**J=4**
Cohort 2006	-0.026	-0.014	-0.044	0.051
	(0.047)	(0.040)	(0.052)	(0.366)
Cohort 2007	-0.027	-0.028	0.079	0.046
	(0.064)	(0.056)	(0.104)	(0.063)
Cohort 2008	-0.031	0.033	0.010	-0.001
	(0.034)	(0.062)	(0.066)	(0.065)
Cohort 2009	0.004	0.011	0.045	-0.016
	(0.115)	(0.096)	(0.162)	(0.065)

	J=1	J=2	J=3	J=4
Cohort 2010	-0.032	-0.046	-0.034	-0.013
	(0.045)	(0.037)	(0.057)	(0.060)
Cohort 2011	-0.099	-0.056	-0.024	0.020
	(0.273)	(0.240)	(0.203)	(0.138)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Unemployment

	J=1	J=2	J=3	J=4
Cohort 2006	0.011	-0.009	-0.014	-0.036
	(0.018)	(0.026)	(0.014)	(0.032)
Cohort 2007	0.005	-0.009	-0.039	-0.034**
	(0.023)	(0.017)	(0.025)	(0.016)
Cohort 2008	0.009	-0.021	0.002	-0.017
	(0.010)	(0.027)	(0.014)	(0.017)
Cohort 2009	-0.033	-0.032	-0.074	-0.032
	(0.040)	(0.047)	(0.150)	(0.042)
Cohort 2010	-0.002	-0.002	0.005	0.024
	(0.014)	(0.014)	(0.009)	(0.017)
Cohort 2011	0.051	0.046	0.051	0.018
	(0.097)	(0.030)	(0.040)	(0.051)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Wage Employment

	J=1	J=2	J=3	J=4
Cohort 2006	0.035	-0.009	0.132**	0.234**

	J=1	J=2	J=3	J=4
	(0.059)	(0.052)	(0.056)	(0.103)
Cohort 2007	0.051	0.064	0.094	-0.032
	(0.056)	(0.066)	(0.079)	(0.054)
Cohort 2008	0.042	0.120**	0.010	0.071
	(0.038)	(0.056)	(0.076)	(0.072)
Cohort 2009	0.115	-0.024	-0.002	0.012
	(0.119)	(0.122)	(0.062)	(0.140)
Cohort 2010	-0.094	-0.069	0.032	0.014
	(0.070)	(0.048)	(0.058)	(0.052)
Cohort 2011	-0.102	-0.123	-0.060	-0.105
	(0.142)	(0.124)	(0.189)	(0.156)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Non-wage Employment

	J=1	J=2	J=3	J=4
Cohort 2006	0.020	0.043	-0.075**	-0.253***
	(0.056)	(0.079)	(0.031)	(0.052)
Cohort 2007	-0.010	-0.051	-0.136*	0.020
	(0.066)	(0.061)	(0.077)	(0.039)
Cohort 2008	-0.026	-0.114**	-0.027	-0.032
	(0.037)	(0.046)	(0.057)	(0.059)
Cohort 2009	-0.018	0.133	0.075	0.065
	(0.072)	(0.096)	(0.080)	(0.116)

	J=1	J=2	J=3	J=4
Cohort 2010	0.017	-0.003	-0.111**	-0.092
	(0.065)	(0.047)	(0.054)	(0.058)
Cohort 2011	-0.007	0.020	-0.086	0.004
	(0.164)	(0.171)	(0.139)	(0.155)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Agricultural Employment

	J=1	J=2	J=3	J=4
Cohort 2006	-0.054	-0.009	-0.021	0.038
	(0.084)	(0.069)	(0.068)	(0.050)
Cohort 2007	-0.064	-0.084	-0.093	-0.007
	(0.073)	(0.070)	(0.091)	(0.081)
Cohort 2008	-0.013	-0.100**	-0.068	-0.080**
	(0.044)	(0.051)	(0.050)	(0.039)
Cohort 2009	-0.136	-0.131	-0.043	-0.066
	(0.123)	(0.286)	(0.115)	(0.128)
Cohort 2010	0.093	0.081	0.035	0.083
	(0.071)	(0.054)	(0.064)	(0.078)
Cohort 2011	0.074	0.058	0.018	0.044
	(0.256)	(0.181)	(0.422)	(0.254)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Non-agricultural Employment

	J=1	J=2	J=3	J=4
Cohort 2006	0.054	0.009	0.021	-0.038

	J=1	J=2	J=3	J=4
	(0.082)	(0.068)	(0.067)	(0.048)
Cohort 2007	0.064	0.084	0.093	0.007
	(0.075)	(0.072)	(0.080)	(0.082)
Cohort 2008	0.013	0.100*	0.068	0.080*
	(0.046)	(0.052)	(0.048)	(0.041)
Cohort 2009	0.136	0.131	0.043	0.066
	(0.124)	(0.290)	(0.111)	(0.127)
Cohort 2010	-0.093	-0.081	-0.035	-0.083
	(0.073)	(0.051)	(0.063)	(0.077)
Cohort 2011	-0.074	-0.058	-0.018	-0.044
	(0.257)	(0.196)	(0.418)	(0.257)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Employment in an Informal Enterprise

	J=1	J=2	J=3	J=4
Cohort 2006	-0.012	-0.031	-0.055	0.137**
	(0.081)	(0.045)	(0.106)	(0.064)
Cohort 2007	-0.017	-0.024	0.062	-0.093
	(0.055)	(0.073)	(0.063)	(0.111)
Cohort 2008	0.050	0.090*	0.074*	0.065
	(0.042)	(0.051)	(0.043)	(0.053)
Cohort 2009	-0.079	-0.055	-0.046	-0.102
	(0.144)	(0.082)	(0.239)	(0.119)

	J=1	J=2	J=3	J=4
Cohort 2010	0.025	0.012	0.047	0.019
	(0.042)	(0.050)	(0.050)	(0.053)
Cohort 2011	-0.020	-0.051	0.027	0.072
	(0.109)	(0.117)	(0.089)	(0.134)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Informal Employment

	J=1	J=2	J=3	J=4
Cohort 2006	0.017	-0.016	-0.012	0.173***
	(0.061)	(0.050)	(0.089)	(0.058)
Cohort 2007	0.009	-0.008	0.086	-0.098
	(0.061)	(0.069)	(0.075)	(0.111)
Cohort 2008	0.039	0.096*	0.069	0.093**
	(0.033)	(0.053)	(0.043)	(0.043)
Cohort 2009	0.013	-0.060	-0.072	-0.102
	(0.152)	(0.079)	(0.069)	(0.120)
Cohort 2010	-0.058	-0.038	0.023	-0.017
	(0.052)	(0.043)	(0.044)	(0.051)
Cohort 2011	-0.030	-0.024	0.053	0.044
	(0.193)	(0.221)	(0.169)	(0.197)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Time-related Underemployment

	J=1	J=2	J=3	J=4
Cohort 2006	0.022	0.077	-0.102	-0.246*
	(0.279)	(0.123)	(0.077)	(0.148)
Cohort 2007	-0.048	-0.094	-0.180	-0.105
	(0.099)	(0.104)	(0.134)	(0.124)
Cohort 2008	-0.027	-0.105	-0.060	-0.124*
	(0.078)	(0.079)	(0.057)	(0.069)
Cohort 2009	-0.099	-0.007	-0.027	-0.070
	(0.114)	(0.177)	(0.225)	(0.145)
Cohort 2010	0.148*	0.086	0.057	0.081
	(0.079)	(0.076)	(0.070)	(0.078)
Cohort 2011	-0.207	-0.177	-0.151	-0.191
	(0.323)	(0.227)	(0.171)	(0.148)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Income-related Underemployment

	J=1	J=2	J=3	J=4
Cohort 2006	-0.038	-0.019	-0.086	-0.106**
	(0.046)	(0.059)	(0.072)	(0.045)
Cohort 2007	0.010	-0.002	-0.011	0.104
	(0.072)	(0.080)	(0.084)	(0.091)
Cohort 2008	-0.008	-0.038	0.018	-0.036
	(0.049)	(0.062)	(0.046)	(0.098)
Cohort 2009	-0.156	0.021	0.024	-0.033

	J=1	J=2	J=3	J=4
	(0.138)	(0.162)	(0.366)	(0.115)
Cohort 2010	0.093	0.076	0.046	0.104
	(0.100)	(0.083)	(0.083)	(0.094)
Cohort 2011	-0.088	-0.100	-0.102	-0.038
	(0.216)	(0.104)	(0.137)	(0.122)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Having a Second Job

	J=1	J=2	J=3	J=4
Cohort 2006	-0.008	0.006	-0.044	-0.222**
	(0.062)	(0.066)	(0.038)	(0.105)
Cohort 2007	-0.021	-0.032	-0.179**	0.006
	(0.061)	(0.056)	(0.072)	(0.067)
Cohort 2008	0.013	-0.035	0.137**	0.049
	(0.048)	(0.056)	(0.063)	(0.055)
Cohort 2009	0.041	0.371**	0.129	0.190
	(0.079)	(0.147)	(0.100)	(0.180)
Cohort 2010	-0.013	-0.094	-0.119**	-0.107
	(0.064)	(0.062)	(0.059)	(0.066)
Cohort 2011	-0.214**	-0.000	-0.101	-0.107
	(0.108)	(0.098)	(0.154)	(0.124)

Notes: Standard errors in parentheses. *** p < 0.01, ** p < 0.05, * p < 0.10.

Effects on Desire for Additional Work

	J=1	J=2	J=3	J=4
Cohort 2006	0.063	0.048	-0.041	-0.369***

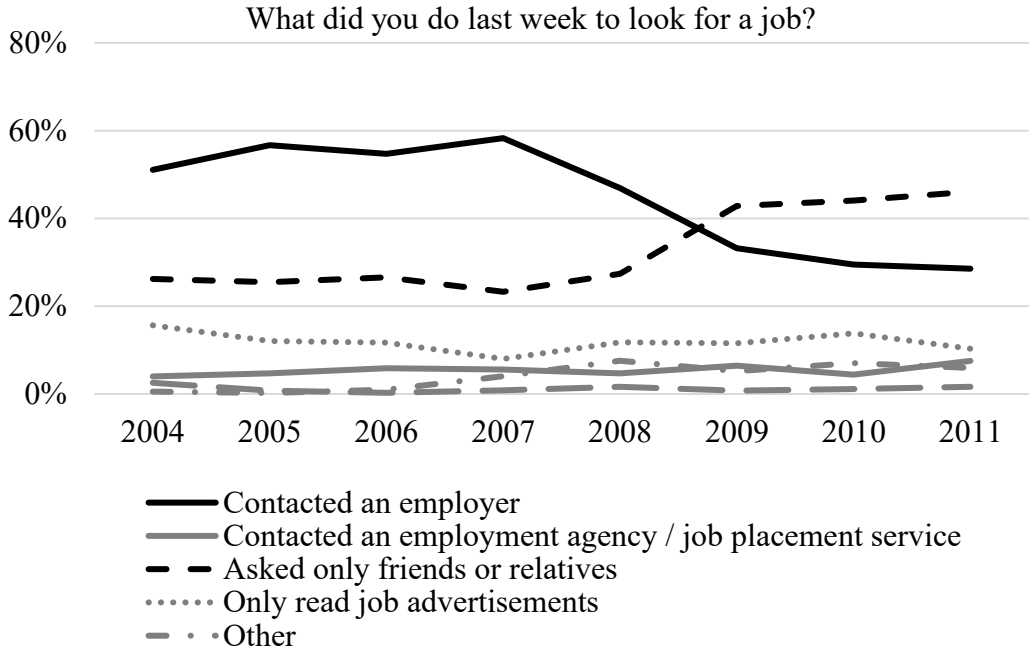
	J=1	J=2	J=3	J=4
	(0.113)	(0.121)	(0.042)	(0.126)
Cohort 2007	-0.026	-0.077	-0.222*	-0.017
	(0.069)	(0.076)	(0.124)	(0.052)
Cohort 2008	-0.000	-0.122	-0.058	-0.089
	(0.056)	(0.099)	(0.059)	(0.061)
Cohort 2009	-0.163	-0.006	-0.032	-0.091
	(0.179)	(0.073)	(0.149)	(0.124)
Cohort 2010	0.063	-0.008	-0.052	-0.015
	(0.070)	(0.047)	(0.051)	(0.050)
Cohort 2011	-0.099	-0.084	-0.118	-0.104
	(0.181)	(0.215)	(0.163)	(0.155)

Notes: Standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

7. Mechanisms

The expansion of mobile phone infrastructure helps reduce information asymmetry on both sides of the labor market: firms and workers. Hiring through social networks-based referrals is a common practice (Breza & Kaur, 2025), and mobile phones, which can be carried at all times (unlike landlines), facilitate continuous communication. As a result, workers can stay in touch with contacts outside their region, while firms can more easily reach potential employees. In Peru, job search patterns shifted during the study period. Figure 6 shows that, since 2008, workers have increasingly relied on friends and family rather than direct contact with employers.

Figure 6. Contact type to look for a job, 2004-2011



Source: ENAHO (2004-2011)

Better communication benefits not only the interaction between workers and firms but also improves communication between firms and their suppliers. This can enhance production processes, such as better supply chain management, a reduction in stock-outs and production interruptions, and the ability to engage in additional activities, all of which increase production and reduce waste (Aker & Mbiti, 2010). Mobile phones can be viewed as an integral input in the factors of production (Nsabimana & Funjika, 2019) or as a technological innovation that increases labor productivity.

For the period analyzed (2004-2011), the main impact of mobile phone infrastructure likely occurred through facilitating communication within social networks for both workers and firms, and to lesser extent, through the creation of new jobs to meet the demand for mobile-related services (Aker & Mbiti, 2010). However, the potential for mobile phone–based applications to improve the delivery of financial, agricultural, health, or educational services (Aker & Mbiti, 2010) was likely limited during this period, as these applications

depend on internet access through mobile phones, which was probably still low in Peru in the analyzed period.[1]

8. Preliminary Conclusions

The preliminary evidence suggests that mobile phone infrastructure affected the composition and quality of employment more than aggregate employment levels. The estimates show a shift from agricultural to non-agricultural employment for the 2008 cohort, along with changes in employment type and working conditions.

The covariate-balance results suggest that aggregation should be handled carefully. The 2006 and 2007 cohorts are closer to the not-yet-treated comparison group, while later cohorts appear more similar to never-treated districts. Future specifications should account for infrastructure-selection concerns, since America Movil and TdP may have prioritized districts with characteristics correlated with labor-market outcomes.

Future work will examine heterogeneous effects by education, age, and gender, with particular attention to workers with tertiary education, young workers, and women.

A remaining question is whether the observed changes reflect workers finding better information about existing jobs or the creation of better jobs during a period of strong economic growth in Peru.

9. References

El comercio. (2021, July 23). *La historia de la revolución de la telefonía móvil en el Perú*. https://elcomercio.pe/185-aniversario/1990-l-la-historia-de-la-revolucion-de-la-telefonia-movil-en-el-peru-l-bicentenario-noticia/

Infobae. (2023, December 9). *De ser la tercera empresa de telefonía más importante del Perú, a quedar en el olvido: ¿qué pasó con Nextel?*

[1] In 2011, only 36.5% of the population had internet access (INEI, 2011), and by 2016, just 50% of those users accessed the internet through their mobile phones (BBVA, 2017).

https://www.infobae.com/peru/2023/12/09/fue-la-tercera-empresa-de-telefonia-mas-importante-del-peru-pero-desaparecio-que-paso-con-nextel/

Latin Spots. (2005, August 12). *América Móvil compró TIM Perú*. https://www.latinspots.com/noticia/amrica-mvil-compr-tim-per/8885

MTC Secretariat of Communications. (2004). *ESTADÍSTICAS DE SERVICIOS PÚBLICOS DE TELECOMUNICACIONES A NIVEL NACIONAL* [Annual Review].

OSIPTEL. (2008). *Annual Report 2008*. https://www.gob.pe/institucion/osiptel/colecciones/1366-memorias-anuales

OSIPTEL. (2012). *Management report 2007-2012*. https://www.gob.pe/institucion/osiptel/informes-publicaciones/1074703-informe-de-gestion-2007-2012

OSIPTEL. (2014). *THE TELECOMMUNICATIONS BOOM*.

Peruvian government portal. (2006a, February 23). *Perú es el país más prometedor para América Móvil*. https://www.gob.pe/institucion/osiptel/noticias/178872-peru-es-el-pais-mas-prometedor-para-america-movil

Peruvian government portal. (2006b, April 3). *Claro invertirá US$ 200 millones en nuestro país*. https://www.gob.pe/institucion/osiptel/noticias/178885-claro-invertira-us-200-millones-en-nuestro-pais

Peruvian government portal. (2006c, August 14). *Crece cobertura de celulares*. https://www.gob.pe/institucion/osiptel/noticias/178481-crece-cobertura-de-celulares

Peruvian government portal. (2006d, September 19). *Slim anuncia fuerte inversión*. https://www.gob.pe/institucion/osiptel/noticias/178509-slim-anuncia-fuerte-inversion

Peruvian government portal. (2006e, September 22). *Concesionarán banda móvil que fue de BellSouth*. https://www.gob.pe/institucion/osiptel/noticias/178490-concesionaran-banda-movil-que-fue-de-bellsouth

World Bank. (2025). *Mobile cellular subscriptions (per 100 people)* [Dataset]. https://data.worldbank.org/indicator/IT.CEL.SETS.P2?end=2024&start=1960&view=chart

10. Appendix

Appendix xx. mobile phone service district level with mobile phone infrastructure

Appendix 2. America Movil's entry occurred during a period of rapid economic growth in Peru.