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Universal Service through Rollout Targets and Licence Conditions: Lessons from Telecommunications in South Africa

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A priority for the post-apartheid government was the extension of basic infrastructure services to the vast majority of citizens that were not serviced under apartheid. The Reconstruction and Development Programme set objectives for each of these utilities that would be achieved in the first decade of democracy, while departmental policy aimed to find means to achieving these targets. The strategy of choice in most sectors was one of ambitious rollout targets being set for utility operators. Targets were set for individual residential service (what we would term universal service) and for community service outside of individual homes (universal access). Whilst most utilities remained under public ownership, in telecommunications there was partial privatisation of the incumbent Telkom and the entry of privately owned mobile cellular operators. This paper examines how rollout targets and licence conditions for universal service have performed in this sector where private operators exist. It examines the failure of the Telkom licence and draws out some lessons for policy.

Licence Conditions and Rollout Targets in Telecommunications

A universal service or access licence condition involves imposing a target for the rollout of either residential or community access over a predetermined time period as part of an operating licence. The target for this service will be uneconomic customers (e.g. low-income households), uneconomic areas (e.g. high cost rural areas) or uneconomic services (e.g. payphones). In the case of telecommunications, this would take the form of a number of residential phone lines, the number of payphones or even more recently in South Africa, a number of Internet labs in schools.

When universal service or access conditions are placed on a private operator that will impact on its profitability, the regulator or government department will then need to grant that company some concession if it is to attract private operators into the market. This might include a reduction in its licence fees (or any other fees and taxes it pays), a period of limited or no competition that allows the firm to make abnormal profits and cross-subsidise, or a reduction in the productivity factor in a price cap (that also allows abnormal profits). The approach is to determine what the specific licence obligations they want will cost, and then look for means to increase the profitability of the firm by the same amount through one of the strategies cited above.

The alternative to licence conditions is to have operators contribute to a universal service fund. These funds are then used to 'purchase' universal service from operators or directly fund consumers. The purchasing of universal service/access can be done through either much the same process as a licence condition - costing the service delivery and then contracting an operator - or it can be awarded through an auction. In an auction, operators bid for a subsidy to implement universal service goals and the bidder that requires the least subsidy wins.

Rollout targets and licence conditions in phase 1 of telecommunications reform in South Africa

In telecommunications, the establishment of new political priorities came at a time of increasing pressure to liberalise the sector from both domestic business, multinationals and foreign governments (through the World Trade Organisation talks on services). Whilst labour and the ANC may have preferred continued state ownership of the public switched telecommunications service (PSTS) operator Telkom, the high level of indebtedness of Telkom severely reduced its ability to achieve the level of infrastructure investment required to achieve the social objectives. The fiscus was also not in a position to fund such investments due to its own high debt levels and large annual budget deficit. The policy outcome was a pragmatic compromise whereby Telkom was partially privatised (30%) and granted a 5-year exclusivity period within which it was required to rollout infrastructure to meet the social objectives.

To ensure that the exclusivity period for the PSTN fulfilled the goals of infrastructure rollout, strict licence conditions were placed on the network provider. In particular, the licence conditions included rolling out 2.81 million new lines over the exclusivity period, of which 2/3rds would be in under-serviced areas and for priority customers (see table 1). Financial penalties would be imposed for failure to reach these targets[1]. The targets were set on the basis of what level of teledensity South Africa should have given its per capita income level. The expectation was that South Africa could aim for a teledensity of 20 phones per 100 people, double its teledensity at the time. This teledensity target was translated into a specific target in terms of number of lines. The mobile operators were not given specific rollout targets because a) they were licenced prior to the consultative policy process, and b) this was considered a luxury service that did not have mass appeal.

The universal service policy embodied in the rollout targets for Telkom, were complemented by universal access policies. These included payphone rollout targets for both Telkom and the two mobile operators (MTN and Vodacom). All three operators also contributed to a Universal Service Fund. However, the contribution to this fund was capped at R20m per annum - R10m for Telkom and R5m for each of the mobile operators. The Universal Service Agency (USA) was established to manage the USF, which was to be used exclusively for the payment of subsidies to assist needy persons towards the cost or access to telecoms and/or to Telkom and other operators to assist them in rollout (RSA 1996).

Table 1: Licence obligations for operators in phase 1

	Rollout Obligations	Community Service obligations
Telkom	• 2.69m lines brought into service of which: • 1.676m in underserviced areas • 20,246 for priority customers • 3204 villages	• 120,000 payphones
MTN	• 60% population coverage in 2	• 7,500 community service

[1] Telkom would pay penalties for missing targets of R450 per line for the first 100,000 lines and R900 per line for each extra line missed. If it misses Priority Customer targets the penalty per unit is R4,500, for schools R900, public payphones R2,250 and villages R1,125.

	years • 70% population coverage in 4 years	telephones in underserviced areas over 5 years • low community service tariff
Vodacom	• 60% population coverage in 2 years • 70% population coverage in 4 years	• 22,000 community service telephones in underserviced areas over 5 years • low community service tariff

Source: Telkom, MTN and Vodacom licences

Licence conditions in phase 2 of the reform of telecommunications in South Africa

Phase 2 of the reform process began in 2001 with a process of determining what reforms should follow the end of the exclusivity period of the PSTN in May 2002 (RSA 2001). The policy direction that emerged was one of gradual 'managed' liberalisation and not an immediate opening to competition in all quarters. The primary components of the policy were as follows:

- A second national operator - the introduction of a single facilities-based competitor with a full PSTS licence, that would include Esitel (the internal telecommunications arm of the state electricity operator Eskom), Transtel (the internal telecommunications arm of the state transport operator Transnet) and a Black Economic Empowerment Partner.
- A single Carrier of Carriers licence - Sentech (the state broadcasting signal distribution company) would be licenced to provide international gateway services to other operators only, and not directly to the end-user
- A single Multimedia licence - Sentech would be licenced to build a network to transport media content (e.g. Internet, video, data)
- Numerous Underserviced Area Licences (USALs) - a number of small and medium enterprise (SME) operators would be licenced to provide local loop public switched telecommunications services to areas with less than 5% teledensity.
- The appointment of a Board by the Minister to oversee the Universal Service Agency
- The inclusion of school internet access as a new universal access goal and the provision of a new e-rate that provides a 50% discount on calls for dialup Internet access in schools.
- The addition of fixed-mobile services[2] to the PSTS licence for both Telkom and the SNO
- The establishment of 2005 as the next phase in the reform process where additional entrants and resale would be examined.

Running in parallel with this policy process was the licensing of a third mobile cellular operator. The initial reform direction anticipated that an additional cellular provider might be viable by 2001, and so built-in a review in 2000. This review resulted in the initiation of a licensing process for the third operator. After considerable delays and litigation (see Ayogu & Hodge 2002 for details), the new entrant (Cell C) finally began services in November 2001.

[2] Fixed-mobile services are defined as services that allow the subscriber to link to the PSTN from either a fixed or mobile device but the mobile device does not allow call handover to other cells, limiting mobility to the local exchange area.

The licence obligations for the operators entering in the second period of reform are listed in table 2. The two categories are rollout obligations and community service obligations.

Only the SNO and the new mobile entrant were given rollout obligations. The perceived success of mobile licensing in phase 1 meant there was not a great need to tamper with the formula. The result was rollout obligations are of a similar pattern to those of the first two operators, but less demanding. With high national coverage already, the emphasis is on network competition rather than additional geographic coverage. For the SNO there is a very different approach to that of the Telkom rollout targets. The emphasis here is on geographic coverage (and points of presence) rather than specific numbers of lines. It has been accepted by the regulator that the only viable entry strategy is to target business users in the metropoles for the first few years until the operator is profitable and has a revenue stream for reinvestment in broader rollout[3]. Again, because the focus is on building network competition rather than bringing new areas into service, different types of obligations are appropriate.

The community service obligations have also shifted in direction. First, there are far greater demands being made on delivery of community service to compensate for lower rollout demands. This demonstrates a shift to focusing on universal access and not service (as in the Telkom licence). Secondly, the obligations are no longer limited to payphones but also include Internet laboratories in schools.

Table 2: Licence obligations for operators in phase 2

	Rollout Obligations	Community Service obligations
Cell C	• 8% geographic coverage in 5 years, 40% with roaming agreements • 60% population coverage in 5 years; 80% through roaming agreements in 1 year	• 52,000 community service telephones in underserviced areas over 7 years • low community service tariff
Sentech (carrier of carriers)	None	None
Sentech (multimedia)	None	• 500 internet labs in rural schools over 5 years
SNO (proposed)	• Coverage of all Metropoles in 5 years; • 80% of territory in 10 years	• 30,000 community service telephones in rural areas over 10 years • 2500 internet labs in rural schools over 10 years

Source: Operator licences

More recently it was announced that cellular operators would have extensive universal service obligations imposed on them for 15-year access to the 1800 MHz and 2.4 gHz spectrum. Initially a once-off licence fee of R700m was mooted, but a deal was struck that reduced the licence fee to R100,000 per annum per frequency pair used, a R5m annual fee, 5% of net operating income and a list of universal service obligations. These included the supply of 250,000 free cellphones over 5

[3] Siyabonga Madyibi, 2003 ICASA, personal interview

years, provision of 4 million free SIM cards over 5 years, more public payphones, Internet labs in schools and multi purpose community centres (Business Day 30 May 2003).

A lesson in rollout obligations - the failure of Telkom residential targets

The failure of the network expansion policy by Telkom during phase 1 of the reform is now relatively well known. As documented in table 3, the failure of the universal service policy was not in the ability of Telkom to finance and physically roll out the required number of lines, but rather their ability to sustain subscription to these lines. There is rapid initial expansion until 2000 in line with the rollout targets set in the licence. However, this growth only lasted until the 2000/2001 financial year when Telkom made a business decision to clamp down on bad debt and enforce more strictly the timely payment of accounts (Telkom annual report 2001). This precipitated mass disconnections from the PSTN that went beyond normal churn. In 2001 there were total disconnections of 1,160,000 lines, resulting in an actual decrease of 530,000 in the total number of active lines despite 630,000 new lines being rolled out. In 2002 a further 606,000 lines were disconnected, resulting in a more modest decline of 36,000 lines in total despite additional 570,000 new lines being rolled out.

Table 3: Network expansion of residential fixed line (000's) 1997-2002

	Total lines	Annual rollout of lines under programme	Annual net change	Cumulative lines rolled out	Cumulative addition to operating lines
1997	4,258				
1998	4,645	354	387	354	387
1999	5,075	495	430	849	817
2000	5,492	621	417	1,470	1,234
2001	4,961	630	-531	2,100	703
2002	4,925	570	-36	2,670	667

Source: Telkom annual reports

Given the massive disconnections from the fixed line network, the policy of rollout targets for exclusivity has to be considered a failure. The cost of policy failure can be summarised as the cost of wasteful investment in the lines that were disconnected, and the deadweight loss to society from the higher prices sustained during the exclusivity period to finance the investment. The cost of the wasted investment has been estimated at R17bn (Hodge 2003), based on Telkom figures on the cost of line rollout to underserviced areas.

The source of the problem with the policy of rollout targets is essentially two-fold. First, that rollout targets are themselves set with a limited information set and in an uncertain environment, making their suitability subject to enormous potential error. Secondly, rollout targets, whether for residential use or payphone access, are inflexible instruments as they currently are implemented, making them unable to adapt to the potential changes in the market that were used in their estimation in the first place.

Targets are subject to uncertainty

Given that Telkom was able to physically roll out the target number of lines but unable to sustain the demand for them, suggests that the targets themselves were inappropriate. Rollout targets are determined through a simulation of expected demand and cost for the operator over the rollout period. The simulation is an information-intensive exercise that by necessity makes use of estimates or assumptions about the value of certain key parameters. The estimation of what are suitable targets is sensitive to the accuracy of the assumptions made, and also to unanticipated shocks to any of the variables. The expected variation will increase, the longer the time period over which the targets are set and the extent to which the sector or consumers undergo change in that period. If assumptions are inaccurate or the demand/cost dynamics of the sector change unexpectedly in the in rollout period, then the targets will no longer be suitable. This may result in targets not being met (or sustained) or in targets being easily achieved. The former is a far greater problem for social delivery because investment is wasted in the process. The latter is still problematic because it implies that there has been a distribution of surplus from consumers to producers as producer concessions exceeded actual cost to producers.

In a dynamic sector such as telecommunications one should expect a high level of uncertainty, making any simulation exercise subject to considerable uncertainty. This uncertainty would be compounded by the fact that it would be difficult to get good estimates of the potential demand amongst unserviced low-income consumers. The result is that the targets set in the licence had a large potential to be inappropriately high or low. With hindsight, we can argue that they were set inappropriately high given the many changes in the market that took place since 1996 when the targets were set. What follows is a discussion of some of the changes that took place in the market and their impact on the ability of Telkom to achieve the targets set.

Target Assessment

Telkom was set the target of expanding residential lines by 2.69m by 2002. Given that there were approximately 2.95m residential lines in existence in 1997 when the rollout period commenced, this target translates into a 5.24m residential lines by 2002. The exclusivity period only offered a temporary period of cross-subsidisation because of the expectation of competition at the end, and the understanding that any contributions to the universal service fund (USF) would not be used extensively for subsidisation of individual consumers, if at all. Therefore any network expansion could not target uneconomic/unprofitable consumers because these required ongoing subsidy. It had to rather target profitable consumers who were in profitable areas but were denied access by apartheid, or profitable customers in uneconomic areas where the additional cost of expanding the network into these areas would be covered by the temporary subsidy. The rollout targets would be achievable and sustainable if the size of these two groups of profitable customers exceeded the targets.

Table 4 below assesses the potential market for residential fixed line services in 2003 based on the affordability of the service. Affordability is determined by whether the household's expenditure on telecommunications (as a percentage of income) is above the fixed fee (with a reasonable amount of expenditure left for usage). The

fixed fee used is that of prepaid Telkom service, because this is the lower of the two and we assume that low-income consumers rationally would take up the prepaid service[4]. Two different estimates of expenditure as a percentage of income are used for the analysis - the 1995 Income and Expenditure Survey (IES) by StatsSA, and a 1999 update of this estimate based on the Bureau for Market Research (BMR) Surveys. The 1995 figures are probably on the low side because a lack of availability of telephone services to low-income groups may have limited their expenditure on communications. The 2000 IES by StatsSA has similar estimates to the 1995 IES, but problems with that database suggest they may be inaccurate.

The results of this analysis suggest that the targets set were reasonably challenging - requiring a penetration of the potential market of between 73% and 88%. To put this in perspective, the penetration rate of the potential market for 1995 was 62% and for 1997 was 65%. As is noted in the table, actual penetration of this potential market was considerably lower at between 41-50% depending on assumptions over expenditure figures. Given that penetration rates were around 65% previously, this suggests that there were considerable unanticipated changes in consumer demand for fixed line residential services during this rollout period. Two such changes are analysed below - demand substitution to cellular and the impact of rate rebalancing.

Table 4: Potential market analysis for fixed line residential services (2003)

	1995 IES expenditure patterns		1999 IES expenditure patterns	
Decile	Telecoms Exp. As % of income	Average spend (rands)*	Telecoms Exp. As % of income	Average spend (rands)*
1	0.51%	3.71	1.18%	8.61
2	0.65%	6.79	1.59%	16.61
3	1.06%	16.12	2.10%	31.93
4	1.30%	25.61	2.71%	53.61
5	1.58%	41.78	3.42%	90.41
6	1.77%	63.67	4.10%	147.29
7	1.96%	101.15	3.94%	202.74
8	2.46%	187.99	4.07%	310.89
9	2.24%	273.74	3.98%	487.86
10	2.01%	552.83	4.22%	1162.21
Potential market analysis				
Deciles that can afford		6-10		5-10***
*Potential market***		5950000		7140000
Target/potential		88%		73%
Actual penetration of potential		50%		41%

*Nominal expenditure growth from 1995 based on Reserve Bank consumption expenditure growth figures

** this is based on the number of deciles that can afford the service times the number of households (11.9m)

*** Decile 4 has been excluded because although expenditure can cover the monthly fee, it leaves only sufficient spend to make 6 minutes of calls. This means it is unlikely households in this category will subscribe.

[4] Using 2003 Telkom tariffs, any houshold spending less than R480 per month on a fixed line telephone service would prefer to use prepaid Telkom to the postpaid option.

Demand substitution

A primary source of unanticipated changes in consumer demand came from the introduction of cellular services - in particular the prepaid cellular package. Hodge (2003) takes a detailed look at why consumers with low expenditures on communications would prefer cellular prepaid to a fixed line residential service. In essence, although prepaid cellular has considerably higher usage rates than fixed line, it also has no monthly fees. Therefore the actual usage rate including contribution to fixed fees, is lower than fixed line for low usage levels. Hodge (2003) estimated the point where spend was equalised for the same number of minutes to be approximately R85 in 2002 using certain assumptions about usage patterns. Table 5 updates these estimates using a) 2003 tariff rates and b) the actual usage patterns experienced by the operators as per their regulatory tariff filings. The result for an average of usage patterns is almost the same as the previous estimate at R82 for prepaid fixed line to prepaid cellular. As the prices faced by consumers of each product impact their calling pattern, the estimate is higher for those on cellular networks (they call other cellular subscribers more often) than for those on the fixed line networks.

Table 5: Fixed line - cellular spend equalisation levels for different usage patterns (2003)

	Prepaid-cellular spend equalisation level	Postpaid-cellular spend equalisation level
Telkom usage patterns	R65 (32 min)	R102 (51 min)
Cellular usage patterns	R98 (49 min)	R157 (79 min)
Average of usage patterns	R82 (41 min)	R130 (65 min)

Using these estimates of consumer preferences for cellular over fixed line, we can then reassess the targets set for Telkom. This is done through assessing the impact that cellular has on the potential market for fixed line connections. We can expect that consumers who can afford the Telkom line but spend at a level that makes them prefer cellular, will always adopt cellular rather than the fixed line. This eliminates them from the potential market for fixed line.

Table 6 presents the results of this adjustment of potential market for fixed lines based on the introduction of cellular prepaid. Two estimates are presented for each expenditure pattern used in the initial analysis. One uses the average spend equalisation level for prepaid fixed line and cellular, and the other a higher estimate of this spend equalisation level (substituting one decile higher away from Telkom). The use of a higher estimate is justified on the basis that other factors enter the consumption decision on the choice of technology, and all of these factors favour a choice of cellular over fixed line. These advantages of cellular include a significantly lower waiting time for a phone, the additional utility from mobility, no financial penalties for reconnection, a second-hand market for phones that reduce connection charges, per second billing for the first minute, and the additional utility from free added service and handset features (e.g. voicemail, caller ID, directory, etc) [5].

[5] For a more detailed discussion see Hodge (2003)

The results suggest that this demand substitution had a significant impact on the ability of Telkom to realise the targets set in its licence. In only one case does the revised potential market remain above the rollout targets set. This is for the low estimate of demand substitution and the 1999 IES expenditure patterns. In all other cases the potential market for fixed line shrinks below the targeted number of lines for Telkom. The scenario of the high 1999 IES estimate for expenditure and the high estimate for cellular demand substitution seems relatively realistic, given that the actual penetration rate of this potential market sits at 62%, which is in line with the 1995 and 1997 potential market penetration rates achieved by Telkom.

Table 6: Revised potential market analysis for fixed line based on the introduction of cellular prepaid (2003)

	Low estimate*		High estimate**	
	1995 IES expenditure patterns	1999 IES expenditure patterns	1995 IES expenditure patterns	1999 IES expenditure patterns
Deciles switching to cellular	5	4	5 & 6	4 & 5
Potential market for fixed line with cellular substitution	4760000	5950000	3570000	4760000
Target/potential	110%	88%	147%	125%
Actual penetration of potential by fixed line	62%	50%	83%	62%

* Makes use of the average prepaid fixed line -cellular spend equalisation level
** Assumes one more decile will prefer cellular due to other factors

The result of this demand side substitution is reflected in access figures for different household income levels using household survey data in table 7. It shows that while household ownership has improved dramatically from 30.6% of households in 1998 to 39.9% in 2001, this has been entirely due to mobile networks and not fixed line. In fact, the proportion of households with fixed lines has actually declined over this period (from 29.2% to 28.7%). In contrast, the proportion of households owning a cellular phone increased from 2.14% in 1995 to 20.73% in 2001. For 11.2% of households, the cellular phone was their only connection to the telephony networks, up from only 1.5% in 1998. It is therefore safe to argue that cellular has been the success story of improved access in South Africa - not fixed line - despite the huge investments made in fixed line through the exclusivity period.

Table 7: Percentage Household Ownership of a Telephone by income group and Location (1998 & 2001)

	1998			2001		
Monthly Income	Fixed line	Mobile	Total*	Fixed line	Mobile	Total*
Up To R499	5.6%	0.1%	5.6%	5.6%	4.9%	9.7%
R500-R899	7.0%	0.3%	7.1%	9.4%	6.2%	14.7%
R900-R1399	15.3%	0.5%	15.4%	15.0%	9.3%	22.4%
R1400-R2499	31.3%	2.0%	32.3%	23.6%	15.1%	35.5%
R2500-R3999	51.9%	6.4%	54.8%	41.3%	24.0%	56.3%
R4000-R5999	66.3%	12.6%	71.2%	52.8%	36.4%	73.3%
R6000-R9999	77.4%	22.9%	83.1%	62.7%	48.6%	85.7%
R10000+	87.9%	42.2%	92.7%	75.9%	59.7%	93.9%
Location						
Rural	4.4%	1.3%	4.8%	6.4%	8.8%	13.2%
Urban	49.1%	10.7%	51.4%	43.5%	28.6%	57.6%

All Households	29.2%	5.8%	30.6%	28.7%	20.7%	39.9%

* Note that some households will have both fixed line and mobile connection making the total less than the sum of fixed line and cellular ownership columns
Source: AMPS 1998, 2001

Rate rebalancing

Rate rebalancing has been identified by a number of commentators as another reason why Telkom experienced such high disconnection rates during the rollout period. This is because rate rebalancing in preparation for competition results in the price of local calls increasing and the price of long-distance calls decreasing. This is seen to have a detrimental effect on residential access because they typically make far more local than long-distance calls, resulting in an increase in the average bill. However, the demand for a phone is dependent on both access charges (installation cost and monthly exchange access) and the price of calls or usage (including local, national long distance and international long distance). This is because a consumer needs to be connected to the network before they are able to make a call. The decision process is therefore to weigh up the usage and non-usage utility they receive from having access and if it exceeds the cost of access then they will choose to subscribe. The impact on the consumer from rate rebalancing is therefore a combination of changes to access fees and usage tariffs.

The nominal and real changes in tariffs for Telkom from 1997 to 2003 is documented in Table 8. A listing of the changes to each usage tariff (local, long-distance, mobile, international) does not provide a useful picture of how a consumer's monthly spend is likely to change as a result of the tariff increases. Instead, table 7 lists an average tariff per minute that a consumer faces. This is determined by multiplying the tariff for each service by the proportion of total call minutes that the service comprises for the average consumer. These proportions are taken from the annual tariff filings made by Telkom. International calls are excluded because the average tariff is not listed in the Telkom filings. However, this makes up a small proportion of average residential call minutes and is likely to make up even less for low-income households that is the focus of this assessment.

Table 8: Real changes in tariffs for fixed line (1997-2003)

	Monthly fees	Average tariff per minute	Average tariff per minute (cell use at 1997 level)
Postpaid 1997	R44.69	R0.18	R0.18
Postpaid 2003			
Nominal	R47.23	R0.51	R0.38
1997 rands	R32.13	R0.35	R0.26
Real change	-28%	94%	49%
Prepaid 2003			
Nominal	R76.2	R0.54	R0.42
1997 rands	R51.83	R0.37	R0.29
Real increase	16%	106%	66%

The tariff changes show that although the average usage tariff increased significantly from 1997 to 2003 (up 94% for prepaid users and 106% for postpaid users), there was a real decrease of 28% in the monthly access fees for those consumers taking up the prepaid Telkom service. As monthly fees are commonly used as a measure of

affordability, this would suggest that fixed line residential service actually became more affordable during the exclusivity period. However, a more complete picture needs to determine how the rise in usage charges affected the monthly bills of consumers and their welfare. This can be done by fitting a telecommunications demand function to the household at each initial expenditure level and determining the change in behaviour from the increase in the average tariff. This change in usage behaviour can then be translated into a change in spend through applying the new average tariffs and monthly access fees. Table 8 shows the results of such an exercise making use of a constant elasticity demand function with an elasticity of -0.2[6]. It makes use of real price changes from 1997 to 2003.

The impact of tariff rebalancing has been twofold. First, high real increases in usage charges would increase the spend on usage by consumers and further decrease their welfare through a reduction in actual usage. Second, real decreases in the monthly fee will reduce their expenditure on access and increase their welfare. The total impact on expenditure and welfare will depend on how significant each item (usage spend and access fees) in the consumption bundle. The results in table 9 show that for consumers who have a low monthly spend are actually better off from the rate rebalancing (i.e. the drop in access fees outweighs the increase in usage spend). Any household that spent R60 or less in 1997 (R90 in 2003) sees no increase in spend and those who spent less than R53.90 actually see a welfare increase[7]. for consumers who could afford to spend. There is also a welfare increase for consumers who at 1997 tariffs could not subscribe to a residential service but can do so under the new tariff structure (spends between R32.13 and R44.69 at 1997 prices or R47.23 to R65.70 at 2003 prices). These results are contrary to the common wisdom on the impact of tariff rebalancing. Of course, this is a sector where we would expect real decreases in tariffs due to technological and efficiency changes, so consumers are still worse off than they could have been.

Table 9: Estimations of the change in usage and monthly bills of residential consumers under tariff rebalancing

	Monthly spend on communications in 1997						
	40	R50	R60	R70	R80	R90	R100
1997 tariffs							
Usage (minutes)	No usage	30	87	145	202	259	316
2003 Prepaid tariffs (1997 rands)							
Usage (minutes	21	26	75	125	174	223	272
*New spend (R)**		41.80	60.00	78.20	96.40	114.61	132.81
% change in spend		-16%	0%	12%	21%	27%	33%
Welfare change (R)		5.32	-8.31	-21.94	-35.57	-49.20	-62.83
2003 Prepaid tariffs (cell use at 97 levels) (1997 rands)							
Usage (minutes	27	27.43	79.08	130.73	182.38	234.04	285.69
*New spend (R)**		40.08	55.06	70.04	85.02	100.00	114.98
% change in spend		-20%	-8%	0%	6%	11%	15%

[6] The choice of elasticity was based on estimates for Peru (Torero et al 2001) and are in line with expectations that usage is relatively price inelastic. Sensitivity tests show that in the results are not that sensitive to higher and lower elasticity levels.

[7] The lower spend figure for no losses in welfare are due to the deadweight loss from lower usage levels.

Welfare change (R)		7.82	-1.12	-10.05	-18.99	-27.92	-36.85

Note: a constant price elasticity of usage of -0.2 was used
* includes both usage expenditure and monthly fees

Tables 8 and 9 also present analysis of real increases in tariffs and their expenditure/welfare effects if cellular calls as a proportion of total calls from fixed phones remained at their 1997 level. This is another unanticipated change in the market resulting from the success of cellular that has significantly impacted on the average tariffs of fixed line users. Cellular call rates from fixed line are considerably higher than both local and long-distance call rates, and their proportion of non-international call minutes has increased from 2.3% to 15.5%. This increase in cellular calls has alone contributed to a 45% increase in real tariffs for postpaid and a 40% increase in real tariffs for prepaid fixed line (out of a total of 94% and 106% respectively). If this change did not take place, the 1997 spend level at which consumers would not increase their spend from tariff rebalancing would rise to R70 (or R100 in 2003 prices), up from the current R60 (or R90 in 2003 prices).

These results do not fundamentally change our assessment of the suitability of the rollout targets. This is because that analysis is based on the affordability of the fixed fee, which has decreased under rate rebalancing, and it was a rather blunt analysis using income deciles rather than a greater level of subdivision of the market. However, a more complete analysis would determine at what usage levels do consumers get sufficient surplus on their usage to cover the fixed fee. This approach would then set a minimum spend that makes a fixed line both affordable and desirable[8]. In this case, the unanticipated increase from greater cellular calls would impact the affordability benchmark and the suitability of the target.

Other demand uncertainties

Other sources of possibly unanticipated demand changes that may also have impacted on the suitability of the rollout targets include increasing preference for payphone access, reductions in expenditure on communications and lower than expected income growth. One can also add to this list a range of cost uncertainties.

A further source of demand substitution that the operator most likely faces, is increasing preference for public payphones. In their decision on whether or not to subscribe to a fixed line, the household will take into account the relative cost of cellular, but also the relative cost and utility from payphone use. Payphone use does not come with a fixed monthly fee, which means that total spend for the household will be lower than a residential phone for a large range of usage levels, despite the fact that average usage charges for payphones is higher than a residential service. However, that fact that a household is not able to receive calls except by prior arrangement and that they are often some distance from the home, result in a lower utility for households. The decision on whether or not to get a residential phone in cases where households are able to afford it, will depend on how the consumer weighs up the utility gains and losses of payphone use. Whilst a determination of what this point may be for certain income deciles is beyond the scope of this paper, it is apparent that the rapid rollout and greater access to payphones that form part of

[8] This approach was loosely used in the case where a decile whose mean expenditure on communications lay only marginally above the fixed fee level was excluded. However a more scientific approach needs to be used.

the universal access policy must have lowered the disutility of household from payphone use. This is because the average distance to a payphone for any household would have been reduced through this rollout. As such, it must have increased the expenditure point below which households prefer payphone access to a residential service.

Another demand uncertainty is the percentage of expenditure that the household spends on communications. This percentage is not independent of changes in preferences and above inflation price changes for more essential items. This is particularly relevant to poor households that are the target of universal service policies such as rollout targets. These households have limited degrees of freedom on their expenditure on more essential items such as food, shelter and transport. Above inflation increases in the prices of these items will cause the household to reduce expenditure on all other items, including communications. The extent to which expenditure is reduced on an item depends on the priorities and preferences of the household. Whilst the data on expenditure on communications saw an increase from 1995 to 1999, the trend thereafter may have been towards a reduction in expenditure on communications. This is because of high above inflation increases for food and fuel (and therefore transport) for South African households. This would change the size of the potential market for residential phone lines and also result in some households that previously could afford a phone disconnecting (which is what we observed in 2001/2.

Finally, income growth may not have been as high as estimated in the initial drafting of the rollout targets. In the assessment of the targets above I assumed that all income deciles experienced the same level on expenditure growth. However, there is sufficient evidence to suggest that there is growing inequality in South Africa and that the lower-income deciles are not maintaining the level of income growth as the top deciles.

Rollout targets are inflexible

Inflexible targets

Although it has been argued that rollout targeting as a policy is full of enormous uncertainty making the outcome a bit of a lottery, it is still possible to improve the policy even if we cannot improve the estimation process for the targets. After all, we cannot entirely fault the bureaucrats for failing to anticipate the enormous changes to the market from the introduction of cellular and particularly prepaid cellular. However, we can fault the bureaucrats for drawing up an inflexible contract with the operator that did not allow them to renegotiate the targets in light of changes to the market.

Once partial privatisation has occurred and the private partner has management control, the licence with all its conditions becomes a binding contract. An optimal contract in the face of considerable uncertainty must accommodate the uncertainty through increasing the flexibility and scope for renegotiation in the contract. It must also put in place effective monitoring of those aspects of the contract that are subject to such uncertainty. The licence for Telkom did neither. The rollout targets were laid out with the appropriate fines but no scope for renegotiation. This meant that once it became apparent that large numbers of subscribers were disconnecting, the programme continued to be implemented. If it had been stopped, some of the wasted

investment could have been saved to the benefit of consumers. Even more wasteful investment could have been saved if effective monitoring was in place. Whilst the regulator was tasked with such monitoring, it failed to do so and relied on annual accounting for targets by Telkom[9]. The regulator negotiated a deal with Telkom to allow indebted customers to not be disconnected but moved to the prepaid package (and repay debts) only in June 2002[10]. By this time around 1.7m lines had already been disconnected.

Inflexible technology

A further source of inflexibility in meeting the rollout targets was the limited use of different technologies. The policy-makers at the time granted a degree of flexibility by permitting Telkom to make use of fixed wireless technologies. This technology had been shown to be lower cost for low-density areas because it eliminated the need for lengthy cabling that would occur with fixed wire technologies. However, in such a technologically dynamic sector such as telecommunications, this level of flexibility was inadequate. As it turned out, low-income consumers were best served by mobile cellular technologies where the low fixed costs associated with connecting a customer, meant that they were able to offer low usage schemes with low or no monthly rental but higher call rates. The cost of connecting an individual consumer is important in determining tariff structures in network industries as it determines the minimum monthly access fee that an operator is willing to charge to recoup the fixed costs. Operators will connect customers who do not contribute to the common costs of the network as long as their revenue covers the incremental costs of connecting that customer. The lower these incremental connection costs, the lower the revenue requirement from the customer and so the lower the fixed fee.

In contrast, the high cost of connecting an individual consumer for fixed line limits the extent to which it can reduce its monthly fee. For fixed wireless the cost of connecting a customer is reduced by the cost of laying the line to the home, but it still requires trained technicians to install the received in the home. This raises the individual connection costs above that of cellular. Cellular also benefited from positive externalities associated with offering a mobile service. Extension of coverage to provide mobility for its core contract customers meant that towns and villages that by themselves had insufficient demand to warrant a transmission tower, were now profitable based on the sum of their demand and the 'passing trade' of mobile customers from urban areas.

Another technology that emerged in the 1990s that has also been effectively used to service low-usage customers in other countries are the so-called fixed-mobile technologies. These permit mobility within the range of a single transmission tower but no mobility between transmission towers. Again, a feature of this technology is the low cost of connecting an additional subscriber, enabling a tariff package more suitable to low-income consumers. Telkom initially did not have the rights to use this technology, and only in the legislative changes of August 2001 did they gain the right to the technology. However, by this stage the rollout period was almost complete and so it could not be operationalised.

[9] Mathyssen, ICASA, personal interview 2003. The monitoring system is now only being implemented.

[10] Business Day, 7 June 2002

The limited technological flexibility that Telkom enjoyed for the rollout period was also constrained by tariff inflexibility. The lower connection charges offered by fixed wireless provided scope for a low-usage scheme below that of the prepaid option that Telkom did introduce. However, if it was to do this, limitations on price discrimination would have forced it to offer the same price to all potential subscribers. Given that such a tariff scheme designed for fixed wireless may not be profitable for fixed wire service, the inability to price discriminate would prevent Telkom from introducing such a low-usage scheme in the first place. This is because it might be taken up unprofitably by consumers in other areas already served by fixed wire (either new or existing customers).

Community service obligations and coverage requirements

The problems and failure of the Telkom Rollout targets have been very visible. However, there were also unique in that they prescribed residential rather than community service rollout. The fulfilment of the other obligations appears to be far more successful. The cellular operators have far exceeded their coverage requirements and the community service and payphone rollout has been completed. However, this does also not imply that they have been entirely successful because they may not have been achieved at least cost to government and they may not have been placed in areas of most need. If a government commits itself to universal access for necessary political reasons, then its objective should be to deliver these as efficiently as possible. This implies least cost and effective targeting of those in need.

As noted previously, easy achievement and exceeding of targets implies that the costs to the operators has been below that of the concessions granted to them. The result is that universal service is then more costly than it should have been, with a distribution of surplus from consumers (who pay higher prices or are denied additional tax revenues) to producers. This may have been the case with the cellular licences where coverage exceeded the licence conditions (coverage reached 90% of the population by 2000) and the community phones. There is more likely to be a conservative (and therefore higher) estimation by government bureaucrats of the potential cost of the obligations to the operator. This is because of information asymmetries over cost and expected revenue information that place the operators in a stronger bargaining position. Also, the successful delivery of these obligations is an easier and more visible means of assessing the performance of bureaucrats and politicians by the voters, while a higher cost than necessary is less visible. This gives bureaucrats an incentive to err on the side of caution when assessing costs to ensure the operator does deliver on the obligations.

Furthermore, the delivery by the operators themselves may not have been the least subsidy method available to the industry as a whole. The least subsidy depends on both the cost of providing the service that will differ with different technologies, but also whether the operator can exploit operating externalities in an area to reduce the cost. Licences are currently technologically constrained, especially the mobile operators. Even the relatively broad technological freedom of the fixed line and underserviced area licences still lack the use of mobile technology. As noted previously, the coverage externalities of operating a network selling mobility, means

that they may have coverage in certain remote and unprofitable markets that can be exploited in putting in community payphones. Similarly, for certain areas a strong contender to provide some of these community service phones at a lower price would be the USALs who could capture the economies of scope from operating in the area and benefit from special treatment that lowers their costs already. It is also questionable whether an operator such as Telkom will exploit the least cost technology at its disposal in all areas. Whilst the operator has a technology choice, it is likely to choose an appropriate technology for each area, and then be locked into that technology choice in an area. It will also have a large part of the country on fixed line technology already, limiting its choice in those areas.

The other potential problem with these seemingly successful rollouts is that the distribution of the phones by the operators may not have been in line with most need. There has not been effective control and monitoring over where the phones are placed beyond rather broad definitions of underserviced areas. In this situation, operators have an incentive to place phones where there is least cost to themselves within these broad constraints. The up side of this is that it might partially solve the problem raised above (though still leaves us with the problem of concessions being higher than costs). However, the down side is that areas of most need may not be serviced, and a lack of co-ordination amongst operators leads to a clustering of phones in high revenue-potential urban and semi-urban areas. Anecdotal evidence from Pretoria townships is that operators are placing phones in areas where there is proven demand through the profitable use by small shop-owners. The placement of phones near the shopowners then reduces the demand for the independent provision of phone service by the shopowner, often forcing them to stop their service. Clearly this does nothing to improve access as the areas are already serviced.

Why has the use of licence obligations continued?

Licence conditions in phase 2

The lack of a residential rollout target for the SNO and USALs in the second phase of reform shows that there has been some learning from the Telkom rollout failure. However, licence conditions for universal access still remain an important feature of the delivery of universal service. Furthermore, the recently announced obligations for the cellular operators for spectrum access have elements of residential provision (free handsets and SIM cards) that appear more vulnerable to failure like the Telkom targets. Given the demonstration that poor users are adopting cellular above fixed line, it is tempting to welcome the switch in strategy to put more focus on cellphone access[11]. However, the strategy of continuing to use licence obligations to achieve this still raises questions. As already noted, licence obligations are less flexible and are subject to great uncertainty because of the lengthy time period over which they are implemented. There is also the concern over whether the government is getting a good deal given the concessions on spectrum fees it has made - in terms of both least cost and sustainability.

[11] Afterall I argued this myself at the TIPS forum last year

Whilst cellular phones may currently seem to be the best means of reaching the poor at lowest cost, are we not making the same mistake as with Telkom in assuming no better alternative will arise? In fact, it is entirely plausible that the fixed-mobile technologies that the USALs are likely to use might offer a better package for consumers. These technologies have the benefits of low consumer connection fees, enabling a lower monthly access fee. They also should offer lower call rates given the lower technical requirements for cell handover that increases the cost of mobile networks. These technologies have enjoyed enormous success in India amongst poor households and at competitive call rates. Should we not be collecting the spectrum fees from the cellular operators and buying fixed-mobile phones for the poor? There is at least sufficient uncertainty that it seems imprudent to commit to one technology for the next 5 years.

Why stick to licence conditions?

The initial use of licence conditions can be understood in terms of the policy and institutional environment at the time. First, the policy of exclusivity seemed to make sense as a means to fulfil a number of competing government objectives. Not only did it force the operator to focus on universal service issues, but it enabled the state operator to improve its value, it enabled time to establish a regulator and it ensured that consumers were not faced with an immediate rate rebalance. Given that there would be no competition for subsidies beyond mobile (which was assumed to be unable to compete for low-income households), it seemed to make little sense to use fund contributions to a universal service managing agency who would then disburse them back to the operator. Administrative costs would be minimised by internalising the process with the operator, and there would be no informational or bargaining gains from putting it with the USA. Furthermore, as the USA still needed to be established, using the USA to disburse funds would again delay the rollout of universal service further. The initial intent was to make greater use of the USA and USF contributions in the second phase of reform where competition for subsidies was feasible, needy individuals would have been identified and a capacity was established in the USA to manage the process.

Agency failure

Probably an important reason why the department of communications may have decided to continue to use licence conditions in the second period was that the USA suffered institutional failure on a similar scale to the Telkom rollout disaster. It failed to deliver on its mandate both to develop universal access and service targets for the country and use the USF monies to enhance access. It is not apparent what the precise reasons were for the organisation failure of this agency. However, whilst it initiated a process of defining what the goals for universal access would be, this task was never completed during the first phase of reform (USA 1998, 1999). It also decided to throw all its eggs into one basket and back the establishment of telecentres with all the USF monies. Telecentres are facilities that offer more than just access to voice telephony, but also other information and communication technologies (e.g. fax machine, scanners, computing facilities and Internet access). According to Benjamin (2001), the USA initially set targets for hundreds of telecentres but the cost was higher than expected and the progress slower. The first centre was only established in 1998 and only 34 were operational by 2000. Many of these telecentres subsequently failed.

Benjamin (2001) argues that the South African styled telecentres were inappropriate for delivering broad access to telephony. This is because they provided far more than was necessary and this raised the cost of such centres dramatically. A typical South African telecentre costs about $40,000 and includes 5 computers with Internet access amongst other communication devices. The higher cost has limited the number of telecentres and this has therefore limited the extent of improvement in telephony access brought about by the USF. Building telephony access would require a focus on lower cost payphones that can then be more broadly deployed.

In essence, the managing agency performed no better than licence conditions. It misunderstood demand and miscalculated costs of delivery. The result was an unsustainable programme that did not improve access significantly. Tasking this agency with even greater levels of responsibility for universal service would be political suicide. The second phase of reforms tried to address the institutional failure of the USA through the appointment of a Board to oversee the operations of the agency. It also tried to address some of the problematic aspects of universal access rollout by tasking the USA to establish a geographical information system (GIS) to keep a record of the rollout of payphones and telecentres by the operators[12] and determine the best use of funds for achieving the targets.

However, the damage was already done in that a second round of licence conditions were imposed and the contributions to the USF limited. During the latter part of the initial reform period, ICASA also was required to determine what would be the future contribution to the USF by operators. The amendment to the Act provided an upper limit of 0.5% of annual turnover (RSA 2001). The initial recommendation by ICASA was to have operators who do not have community service obligations stipulated in their licence to contribute the maximum 0.5%, and 0.4% for those who do have obligations (ICASA 2002a). However, this position was contested on the basis that there was no clear guideline from the USA as to what it would use the funds for. Because of the failure of this agency it lacked a clear plan for improviing access and a history of wasteful projects. ICASA was therefore forced to reconsider its recommendation and subsequently dropped the initial recommendation for a flat 0.2% contribution by all operators[13]. Hence agency failure in phase 1 of reform has diminished the universal service provisions in phase 2.

Bureaucratic budget maximisation

Licence obligations also remain in part because of the desire by the regulator and the department of communications to have more funds and control over the development of the sector. Currently all fees raised in the sector (licence fees, spectrum fees) are taken into the general fund of government overseen by the National Treasury. A member of ICASA has admitted that the desire to impose licence obligations is that it kept more of the money in the sector for its development than would be the case if they were to be at the mercy of the budget allocation from the Treasury. This is a clear case of bureaucratic incentives to try keep as much funds under their control,

[12] This will allow them to guide operators where to install their payphones in the future according to greatest need

[13] Mandl Msimang, ICASA, personal interview 2003

rather than permit these funds to enter the general 'pot', and let the political process determine their best use.

Concluding Remarks

The goal of any government that has universal service priorities should be that these are delivered, and that they are delivered with least cost. Licence conditions as a means to achieve universal service have been shown to be problematic in telecommunications. The failures of this approach seem to be greater, or at least more visible, with residential targeting than with community access. The particular failures in the case of South Africa have hinged around a lack of flexibility being built into the rollout contracts, a lack of flexibility in technology use, and not achieving the lowest cost for fulfilment of these obligations. Targets set for a large number of years are inherently risky given the large number of assumptions that must go into their calculation and the degree of market change that can occur in the time period. This is especially true of such a dynamic sector as telecommunications.

This suggests that the use of licence conditions can be improved through writing more flexible contracts so that both parties can respond to market changes or poor prior assumptions made in drawing up the original targets. Improved monitoring can also ensure that problems are picked up early and operators fulfil their obligations in the manner in which it was intended. However, it also suggests that the use of an alternative system of universal fund contribution and the purchase of universal service from operators might offer a better alternative. Yet it too can suffer from agency failure on a similar scale to the problems that beset licence conditions. Furthermore, whilst policies such as the auctioning of these subsidies by a universal service agency may seem more appropriate on paper, they too can suffer problems in practice such as collusion amongst bidders. However, at the very least they should offer greater flexibility as contracts are not drawn up for long time periods, and least cost technologies can be sought for delivery.

Some of the problems that have plagued the rollout of universal service obligations in telecommunications are also relevant to other utilities with different ownership structures and technological options. In particular, in the ten-year national electrification programme that also prioritises household access has experienced some similar problems. The initial estimates of the cost of the electrification programme and the expected revenue turned out to be wholly off the mark. Eskom did the initial costing based on delivery to primary urban and semi-urban customers. However, as municipalities had jurisdiction over these areas, Eskom was forced to connect greater numbers of rural households to reach its targets - raising the cost of provision. They also miscalculated demand and therefore the revenue from the service. Eskom provided a prepaid tariff with no monthly fees in order not to exclude any households from affording the service. This tariff would cover the fixed costs of connection if consumers used 350kwh of electricity each month. However, the average consumption for these households currently sits at a third of this value, contributing to a ballooning subsidy for electrification. The reason for this is both the higher tariffs for prepaid use, and consumers not switching from alternative energy uses for cooking and heating[14]. This demand substitution problem is partly due to the

[14] The 2001 Labour Force Survey has 83% of households using electricity for lighting but only 51% using it for cooking.

costs of purchasing new electrical appliances. There have also been many quiet disconnections i.e. situations where a connected household stops using the electricity source. In 2000, the electricity regulator estimated that roughly 6.8m households had been connected, whilst expenditure surveys (the IES2000) put the number of households spending on electricity at roughly 6m. This suggests that 800,000 households have quietly disconnected from the programme. As soon as competition is introduced into the electricity market and household subsidies are reduced, Eskom will be forced to charge monthly access fees and this should see a large increase in such disconnections.

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