China’s Telecommunications Universal Service in a Competitive Environment

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Abstract
Universal service in telecommunications is an important issue in reducing the regional disparity of China. In the era of a monopoly telecommunications market, the monopoly firm is obliged to provide universal service, and cross-subsidies are the primary way of funding universal service. The deregulation and competition in China’s telecommunications has caused great ambiguity in the provision of universal service. On the one hand, the new entrants are not willing to provide unprofitable service; on the other hand, how the original obligation of the incumbent firm should be redistributed becomes an urgent issue.

This paper discusses the history and current status of China’s telecommunications universal service. We found a clear correlation between China’s regional disparity and telecommunications infrastructure deployment. We also explore the theoretical foundations for universal service provision. Lastly, we propose the several steps the Ministry of Information Industry of China should take to solve the problem of universal service in telecommunications.

Key Words
Universal Service; Regulation; Competition; Incentives

1. Introduction
Telecommunications universal service traditionally refers to public access to voice-grade telephone lines. Universal service policies aim to cater to people whose
telecommunications needs are not met by the free market, including providing basic services to rural and high-cost areas as well as to low income households. Universal service in telecommunications has long been a familiar policy debate in North America. It has sprung to prominence in China only recently, however, due to continued telecommunications market liberalization, and the need to ensure fairness and continuation of universal service in a competitive environment. China seeks to implement “one family, one telephone” in urban area and telephone services in every rural administrative village.

There are two major rationales for providing universal service in telecommunications. The first one is “necessity”: basic telecommunication ought to become a necessary service for any citizen. According to the Global Human Rights Manifesto, getting telecommunication service——universal access is a basic human right. However, in both developing and developed countries, there are still a large number of people not being able to get basic telecommunication service.

The second is the concern for economy development and spatial inequality. The improvement of basic infrastructure has a significant effect in accelerating economy growth and increasing social welfare. Compared with other infrastructures, telecommunication can create stronger positive externality. Modern telecommunications is an indispensable aid in meeting basic human needs. It can race cultural barriers, overwhelm economic inequalities, even compensate for intellectual disparities. It is efficient in enhancing people’s communication skill and reducing transaction costs. Recent econometric studies have found evidence of a causal link between telecommunications development and economic growth: while the penetration rate of China increases by 1%, the GDP will increase by 0.5%\(^2\), which shows that insufficiency of basic telecom infrastructure indeed constrains economy

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2 Reference 1
The distribution of telecommunication infrastructure and economic development has shown obvious spatial inequality. Figure 1 and table 1 demonstrate that telephones penetration rate and GDP per capita in the eastern, middle and western part has a linear relationship\(^3\). The lack of telecommunication infrastructure has been a big constraint to the development of underdeveloped areas; on the other hand, the underdevelopment of economy reduces the consumption of telephones directly.

**Figure 1: Telecommunications facilities per capita at the year-end of 2001**

![Figure 1: Telecommunications facilities per capita at the year-end of 2001](source: <china statistical yearbook 2002>)

**Table 1  Telephones per 100 people VS. GDP per capita in the year-end of 2001**

<table>
<thead>
<tr>
<th>Region</th>
<th>GDP per capita ((\text{?} ))</th>
<th>Telephones lines per 100 people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western</td>
<td>5006.843</td>
<td>16.97</td>
</tr>
<tr>
<td>Middle</td>
<td>6658.61</td>
<td>20.35</td>
</tr>
<tr>
<td>Eastern</td>
<td>13539.87</td>
<td>41.47</td>
</tr>
</tbody>
</table>

\(^3\) Reference 3
2. The Development of Universal Service in China

History of Universal Service in China

The development of universal service in China is experiencing difficulties with the deregulation of the telecommunication industry.

In the early 1990s, the monopoly provider of China’s telecommunication industry—China Telecom initiated the massive project “telephone connection to every administrative village in the rural districts”. It was mainly funded by telephone installation fee and tax on long-distance calls. From 1992 to 1999, China Telecom spent 100 billion RMB Yuan on new construction and 50 billion on maintenance annually, of which 5 billion and 3 billion were in the category of universal service. However, this just covered the rural and high-cost areas, and didn’t include the low-income urban households\(^4\). With such large inputs, the number of villages with phone connection increased by 10% every year.

In 1999, China Telecom was broken up and the businesses of mobile, paging and satellite were divested and became independent corporations. As a result, the entire telecommunication industry was made up of seven operating companies—China Telecom, China Unicom, China Netcom, China Jitong, China Railcom and China Satellite. However, the universal service was still born by “China Telecom”. In the meanwhile, the telephone installation fee was abolished and cross-subsidy lost effectiveness. The shortage of funding slowed the pace of providing universal service. Therefore, the original goal that every village would have telephone connection by 2000 was not realized. By the end of 2000, the proportion of rural administrative villages with telephone connection was 82.9%. Almost all the villages that didn’t have telephone connection were located in the middle and western part of China. In the first quarter of 2001, the rural telecommunications subscribers increased only by 2.81 million households. At the same time, operating revenue of local telephone business

\(^4\) Reference 4
continued to decline, reaching 4.78 billion RMB Yuan; the net profit was negative 150 billion, a 15.4% increase compared with that of 2000\textsuperscript{5}.

In 2002, China’s telecommunications industry experienced a second round of reform. After this reform, the market share distribution of telecommunication industry has changed greatly. The market of telecommunication was made up of six operating companies — — China Telecom, China Netcom, China Mobile, China Unicom, Chinasat and China Railcom and about 4000 companies that provide value added and wireless business. China Mobile became the biggest operating company in China; China Netcom was the third, and China Unicom lowered to the fourth place. The remaining market was taken by China Satellite and China Railcom. None of these companies has a market share above 50%, the telecommunication industry is more became more competitive\textsuperscript{6}.

In the era of monopoly, the task of universal service was carried out by the monopoly provider China Telecom. However, in the competitive market environment, how to provide universal service in such conditions is becoming a real problem.

Figure 2

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\textsuperscript{5} Reference 5
Current Stage of Universal Service in China

China is a vast country in terms of its population and territory. For some historical reasons, there exists a huge disparity in its economic development across regions. China’s 31 provinces, autonomous regions and cities under the direct guidance of the central government are geographically categorized into three regions: the eastern region, the central region and the western region. In terms of their levels of economic development, the eastern region is the most advanced, the central region is the next and the western region is the most backward. The eastern region includes 12 provinces and cities under the direct guidance of the central government: Beijing, Shanghai, Tianjin, Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangxi, Guangdong and Hainan. The 9 provinces in the central region are: Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Huan. The western region has 10 provinces and autonomous regions: Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia and Xinjiang. In the following table we can see how big the gap is.

<table>
<thead>
<tr>
<th>Region</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern region</td>
<td>9298.877</td>
<td>10032.02</td>
<td>10693.4</td>
</tr>
<tr>
<td>Central region</td>
<td>4852.37</td>
<td>5136.056</td>
<td>5285.528</td>
</tr>
<tr>
<td>Western region</td>
<td>3810.008</td>
<td>4051.929</td>
<td>4216.937</td>
</tr>
</tbody>
</table>

The GDP per capita in all the three regions has steadily increased year by year. The growth rates of the eastern region have been the greatest and those of the central region have been the least. There are clearly huge gaps among the regions. By the end of 1997, the GDP per capita in the eastern region was 1.91 times that of the central region and 2.44 times that of the western region. The gaps were enlarging as time goes by; at the end of 1998, the two ratios increased to 1.95 and 2.48, and they were

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6 Reference 6
Highly correlated with the regional disparity is the imbalance of telecom deployment across the three regions. By the end of 2001, the penetration rate in China has reached 25.9%, the main lines was 13.90%, the city telephone penetration rate was 20.40%, and household phone rate was 11.55%. By geography, the rates for the eastern region was 41.47% 20.81% and 21.24% respectively, the household phone rate was 16.76%; for the central region the were 20.35%, 12.02%, 18.14% and 10.25%; the western region had the lowest rates among all the categories: 16.97%, 9.22%, 21.68% and 7.21%.( data source: http://www.mii.gov.cn)

<table>
<thead>
<tr>
<th>Level of China’s Telecommunications Service in 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Telephone Penetration Rate</strong></td>
</tr>
<tr>
<td>(per hundred people)</td>
</tr>
<tr>
<td>The whole nation</td>
</tr>
<tr>
<td>Eastern</td>
</tr>
<tr>
<td>Central</td>
</tr>
<tr>
<td>Western</td>
</tr>
</tbody>
</table>

More specific measures of ICT diffusion and adoption, especially those pertaining to the “new ICT” of internet, e-commerce and wireless technologies, further confirm the disparity among the three regions.

Take the numbers of subscribers of the Internet service as an example, the number of subscribers of Internet service in the east region has consistently been about 70 percent of the total Internet users of the whole nation while the number of the western region has been about 10% only. It was not until the end of 2000 that the proportion of the western region reached 14% (See Figure 3).
According to the Information Technology Union, universal service in telecommunications has five stages:

<table>
<thead>
<tr>
<th>Stage 1: Network establishment</th>
<th>Stage 2: Wide geographic reach</th>
<th>Stage 3: Mass market take-up</th>
<th>Stage 4: Network competition</th>
<th>Stage 5: Service to individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>The penetration rate of firms</td>
<td>0%-30%</td>
<td>20%-80%</td>
<td>70%-100%</td>
<td>100%</td>
</tr>
<tr>
<td>The penetration rate of households</td>
<td>0%-20%</td>
<td>5%-30%</td>
<td>20%-85%</td>
<td>75%-100%</td>
</tr>
</tbody>
</table>

Universal service goal type  
Technological (acquire new)  
Geographic (maintain regional)  
Economic (stimulate economy)  
Social (achieve national)  
Libertarian (individual right to
Examples of universal service goals

<table>
<thead>
<tr>
<th></th>
<th>technology)</th>
<th>parity)</th>
<th>cohesion)</th>
<th>communicate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long distance service linking all major centers; public telephones where demand warrants.</td>
<td>Telephone service available in all population centers; widespread adoption of telephony in business.</td>
<td>Widespread residential uptake of telephony; meet all reasonable demands for telecoms.</td>
<td>Telephone affordable to all; telephone service adaptable to special needs (e.g., disabled)</td>
<td>Everyone can meet basic communication needs; public access to advanced services.</td>
</tr>
</tbody>
</table>

Typical universal service policy measures

<table>
<thead>
<tr>
<th></th>
<th>License conditions on network roll-out</th>
<th>Profitable licenses subject to unprofitable obligations</th>
<th>Control speed of price rebalancing</th>
<th>Targeted subsidies</th>
<th>Identify and meet non-market demand.</th>
</tr>
</thead>
</table>


Perhaps we can describe China’s telecommunications development in the second and third stage —— public access. Therefore, current universal service policy should focus on public access, aiming at spatial equality.

### 3. Financing Universal Service in a Competitive Environment: Recipes from Economic Theory

In the era of a monopoly telecommunications market, the monopoly firm is obliged to provide universal service, and cross-subsidies are the primary way of funding universal service. Cross-subsidies imply that some users are charged prices above cost to subsidize other users who are charged below cost. For example, business firms subsidize the households, long-distance call subsidizes the local telephone calls, urban areas subsidize rural areas. There exist some problems with cross-subsidy: first, it is
not efficient, because it distorts investment and consumption decisions by separating price from cost; second, it is not transparent, being difficult to determine who receive the subsidy and where it comes from; third, with subsidy, the firms have less incentive to reduce costs in high cost areas or provide better service to low income users. The distortion in price and cost does increase consumption; however, it decrease the supplier’s incentive to provide service.

Deregulation and competition become the common trend of telecommunication industry in the whole world in order to improve efficiency. One of the side effects of this is the provision of universal services in telecommunications. On the one hand, the new entrants are not willing to provide unprofitable service; on the other hand, how the original obligation of the incumbent firm be redistributed becomes an urgent issue to address?

In a competitive market environment, the mechanism of cross-subsidies is hard to maintain. Most countries want to establish a competitively neutral mechanism to provide universal service. That is, any firm shouldn't benefit or suffer to break the neutral rule. For example, the incumbent firm has advantage over other firms if it is allowed to maintain monopolies over certain services for universal service provision; the incumbent firm has disadvantage over other firms if new entrants can choose to serve the most profitable customers without universal service obligation.

Under “competitively neutral mechanism”, the realization of universal service obligation can be divided into two stages——funding universal service and provision of universal service. There are two typical methods to finance universal service. One is through countries’ general tax system, the other is through a universal service fund.

Economists typically think that subsidies should be financed through tax and

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7 reference 8
transfer system so as to reduce price distortion and dead weight loss (Atkinson-Stiglitz). However, most countries have used “universal service fund” because the problems in general tax system will make the cost much higher than other methods, especially for those developing countries with inefficient tax system. “universal service fund” requires all the telecommunication firms to contribute to it and any firm who provide universal service has the right to get subsidy. In theory, universal service fund provide a wider tax base and reduces the potential for “cream skimming” (the firm can serve the most profitable customers without universal service obligation). Besides that, universal service fund is more transparent, the cost is much lower, and it is more close to the “competitively neutral” compared with cross-subsidies. There are also some problems with universal service fund. The first is how to distribute the share of the fund to different firm; the second is how to use this fund. In theory, the fund should be taxed at a certain rate from firms’ profits. However, because of asymmetry between regulators and firms, most countries collect fund at a certain rate from firms’ revenues?

The use of universal fund and the provision of service can be realized through auction. Because of the problem with asymmetric information, the firms won’t have the incentive to provide accurate information about their costs, the mechanism of auction can be used to overcome this problem.

Besides, the allocation of operation licenses could be linked to the universal service obligations. For example, in Mexico, Telmex was required as part of its privatization to install payphones in 20,000 rural areas over a five-year period to meet the policy goal of ensuring some telephone access in all villages with at least 500 residents (Wellenius 2000)

4. International Experience in Telecommunications Universal Service

Now let’s see two cases about universal service in two countries, one is America, the leader of world telecommunication industry; the other is Peru, whose development of
telecommunication is much similar with china.

**The United States**

Telecommunication industry in America has also experienced a process from monopoly to competition, its switch in ways of providing universal service will help China in some sense.

At the time of AT&T, universal service in America was defined as “every household has a telephone”, that meant the telephone charge is low enough so that everyone can use, including low-income family and rural residents. In order to provide universal service, AT&T used cross-subsidies to finance it, such as long distance all subsidizes local telephones, international call subsidizes domestic call, low cost areas subsidize high cost areas, business users subsidize households. With this method, AT&T had no incentive to reduce cost and its monopoly’s power over the market also increases. This broke the competition rule and also maintains a very profitable market. However, in the attack of new entrants’ cream skimming, the cross-subsidies were difficult to maintain.  

Since 1984, while the telecommunication in America became a competition market, the concept and policy of universal service had changed greatly. The universal service is not just telephone service, but also changed according to FCC, that is, the definition of universal service is dynamic. The FCC has listed a set of services that will benefit from universal service support: Voice grade access to the public switched network, touch-tone, single-party services, operator, directory, and emergency services, and access to long distance.

According to the telecommunications Act of 1996, the universal service policy

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8 reference 8
supports three groups:

1) Support for low-income subscribers

In America, since 1984, low-income subscribers have enjoyed programs subsidizing access to network—Lifeline Assistance and Link Up America. The former reduces the monthly telephone bill of program participants by $7 in most states, and the latter one subsidizes initial connection charges. These two programs are funded by interchange carriers.

2) Support for rural and high-cost areas

A program named new universal service fund (not official name) will substitute the Universal service fund, Long-term support and DEM weighting in subsidizing the rural and high-cost areas, it is financed by collecting tax from telecommunication firms’ end-user revenue. The federal subsidy for 25% of the difference between the efficient provision and a national rate of benchmark. The states are expected to cover. The remaining 75% of the difference with their own universal service programs. The US law has prescribed that any eligible company, which can provide universal service, no matter which technology it uses, has the right to get the subsidy.

3) Support for schools, libraries and health care providers

Two categories of services are defined. The first group will enjoy rate support: rates will be capped for these institutions at (in the case of rural health care providers) or below (in the cases of schools and libraries) rates for “similar services (provided) to other parties”. The second category of services, “advanced telecommunications services”, should merely be “accessible to these institutions.

Peru

In 1990s, Peru switched from monopoly to competition gradually, and its universal
service policy had also greatly changed. It focused on enlarging universal access (especially rural areas). The cross-subsidy was abolished. Meanwhile, the government had established universal service fund, which was collected by OSIP-TEL since 1994, and it cost 1% of telecommunication industry's gross revenue. This fund would be used to provide subsidy to the telecommunication service in certain areas.

1. Areas where the universal service supports: the rural areas, capital of local regions, and villages and towns in some important places (defined by the government)

2. the governance sector of universal service——OSIP-TEL censors the items of service, and lists those items which can get subsidy, then reports it to the leadship.

3. After confirming the list of service items, OSIP-TEL begins to prepare bidding files and chooses operating company that provides universal service through public bidding. The bidding files have prescribed the supported group, the technology, the maximum subsidy and pricing rules in detail.

As a developed country, the universal service of America focuses on individual access, aiming at making more persons get basic service, now its content of service is not only call, but also data access and internet service; As a developing country, Peru's universal service focuses on public access. It aims at certain group. America is a good example for developed countries that has a nice telecommunication base, while for the developing countries, Peru's case is more practical. Most developing countries have just established its telecommunication network, and haven't reached the level of developed countries. If developing countries now provide universal service to individual, it is not reasonable. We suggest them provide public access first, and individual access after that.

4. Steps for Providing China’s Universal Services in Telecommunications

The provision of universal service is a very complex and large project, and plays an
important role in economy development and spatial equilibrium. At the time of competition, universal service is a game between regulator and companies. Whatever policy they choose, there is no first best strategy, only second best one.

According to the above analysis and other countries’ cases, we give suggestions for China’s universal service as follows:

**First, setting the goals and scopes of universal service.**

In eastern china, especially those developed part with high penetration rate, we suggest access to the internet as universal service. Also, from a long-term perspective, the content of universal service is not unchanged. The internet technology will have a significant impact on universal service. It can be imagined that, in the future, information service should also include in universal service.

From July 1995 to October 2000, the National Telecommunications and Information Agency issued four statements addressing the problem of digital divide in the US, and named digital divide the prime issue in the US economy and human rights. The goal was to make all the Americans to integrate into the network economic and networked society, and to promote the country’s competitiveness. From the trend of America, we can see the direction of china’s universal service in advance.

The object of universal service in china should support two groups: (1) support for the rural and high-cost areas; (2) support for the low-income group.

The eastern part of china is closer to the developed countries, so universal service may mainly support for the low-income group by providing subsidy such as free access or reducing basic telephone charge. The western part is less developed, then the universal service should support for the rural and high-cost areas.
Second, determining quality requirement and pricing policy

After confirming the items of universal service, ministry of information industry should also give the requirements on quality so that suppliers can’t reduce service quality with respect of profits. Nowadays, the quick development of telecommunication technology has given us many new choices on providing universal service. for example, in some areas, using wireless methods(such as PHS, ETS, and DSC - 128-512)will be more efficient than wired ones. It can reduce more costs. There has been a successful trial in Guangdong, Beihai district. We suggest ministry of information industry investigate on the whole country’s universal service, making clear about the distribution of population, geography in every city, town and village, and then decide which technology we should choose.

Thereafter, ministry of information industry should also prescribe the pricing rule. The rule should balance between the supported group and supplier of universal service.

Third, choose the source of tax for funding universal service.

At the time of competition, establishing a universal fund for providing universal service is a common method in the world. How to choose the source of tax for this fund? We suggest collecting tax on operating companies’ end-user revenue. However, tax will bring social welfare losses. In order to finance the fund, meanwhile, to minimize welfare losses, we suggest collect the tax at different rates. For those services that have low elasticity, we choose higher rates; for those that have high elasticity, we choose lower rates.

Fourth, choosing the provider of universal service

After china telecom was split, new china telecom and new Netcom can enter each one’s market. China railcom’s business is also growing up. All these has provided a good environment for the relocation of universal service obligation.

A theoretical model is designed for the provision of subsidy——proxy model:

10 reference 10
subsidy=forward-looking cost – national benchmark price. The forward-looking cost is the forecast of the cost of equipment, the element’s usage, the rate of technological progress.

This method has two main benefits. First, it is competitive neutral; second, to the extent that the cost is not an embedded cost the current cost-plus nature of universal service subsidies is eliminated, local exchange carriers then have strong incentives to reduce the costs.

Even with this proxy model, there still exists asymmetry of information in the evaluation of cost, therefore, in the real-world, we still have to determine the right company and subsidy through auctions. However, the proxy model does give us some basic estimation of the subsidy.  

Of course, it is a complex problem that not only has relation with technology and mechanism design, but also group interest. It is an interesting project which is worth researching.

These steps above are all correlated, therefore, ministry of information industry should make policy with respect of all these factors, and also regard practical probabilities in the realworld.

In addition to this, ministry of information industry should supervise on the providing process of universal service and adjust the policy according to the fact.

Acknowledgement

Financial support from the National Science Foundation of China, the National Social Science Foundation of China and the Tsinghua University 985 Research Funds are gratefully acknowledged.

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