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Broadband expectations and the convergence of ranks ☆

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ABSTRACT

Broadband Internet service to widely held to be a significant contributor to economic development and global competitiveness, and comparison of adoption rates across countries are common. This paper presents evidence that the relative broadband Internet adoption ranks across the Organisation for Economic Co-Operation and Development ("OECD") countries are converging to the wireline telephone adoption ranks in the mid 1990s. This was a time when wireline telephone service had reached maturity, but before consumers began to abandon traditional telephone services for mobile services and Internet telephone technologies. As such, in the absence of better data on household adoption, wireline telephone rank is a useful proxy for a country's ultimate fixed-line broadband penetration rank. Having such an educated guess available regarding broadband rank should reduce the amount of anxiety over rankings, since similar rankings across the two services implies suitable broadband performance. Large departures, alternately, may be a cause for concern or delight. Like prior analyses, the findings suggest that the adoption of communications services is largely an economic and demographic issue.

Given the apparent importance of broadband Internet service to economic development and competitiveness, there is little surprise that countries are interested in comparing the pace of broadband adoption with their peers. In fact, much of the current communications policy debate is motivated by the relative position of countries with respect to broadband Internet adoption. Further fueling this debate is the semi-annual release of broadband subscription data for its member countries by the Organisation for Economic Co-Operation and Development ("OECD").[1] Significantly, the data, which is expressed in per capita terms, is typically discussed in terms of how countries *rank*, rather than the subscription rate or pace of diffusion.

For a number of reasons, evaluating the rank of raw subscription *per capita* data is flawed, but still widely employed. Most obviously, the type of broadband connection counted by the OECD (i.e., fixed line) is subscribed to by households and small businesses, not individuals, so household and business size influence observed per-capita subscription rates. Countries with identical household broadband subscription rates may have very different per capita subscription rates simply due to differences in household size.[2] For example, the household adoption rate for Greece in 2007 was a meager 7.5%, while household adoption in Poland, the Czech Republic, and the Slovak Republic was four times that rate (at 29.6%, 28.1%, and

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[1] The OECD data is available at: http://www.oecd.org/sti/ict/broadband.

[2] Say broadband connections, B, is equal to some constant share, λ, of households H: $B=\lambda H$. Dividing by population N, the per capita broadband subscription rate is $B/N=\lambda\,(H/N)$, where H/N is the inverse of household size. So, the larger the household size, the lower the per capita subscription rate despite the equal household subscription rate.

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26.5%, respectively). Yet, on per-capita terms, the OECD places Greece above all three countries (Ford 2010). Despite the apparent and documentable defects with using per-capita subscriptions as a measure of relative performance, the rankings are considered in policy circles without any conditioning. Countries not ranked among the highest are "behind," regardless of contributing factors such as household size, income, education, age, and so forth. Ford, Koutsky, and Spiwak (2007, 2008, Forthcoming) have shown that these economic and demographic endowments explain over 90% of the variation in recent broadband subscription rates. Using Stochastic Frontier Analysis, Ford et al. (2008, Forthcoming) show that, with few exceptions, OECD countries are efficiently (or equivalently) converting endowments into subscriptions.[3] Other studies reaching similar conclusions include Hargittai (1999), Murthy (2004), Bauer, Berne, and Maitland (2002), and Wunnava and Leiter (2008), among others.

As for rankings, two important questions are how can policymakers legitimately and usefully compare ranks among countries, and how can one say, "We are behind," if there is no clear indication as to what it means to be "ahead" or "on target"? Answering such questions is difficult at best, so it is not surprising that the dirty work of doing so is often put off for another day. In this analysis, it has been demonstrated that there exists a somewhat exogenous indicator of where a country might be expected to rank in broadband Internet subscription per capita. Providing this expectation is important for policy, since having a target allows a meaningful discussion about being ahead or behind.

In what follows, evidence is presented demonstrating that the relative broadband adoption rankings across the OECD are converging to the wireline telephone adoption rankings in the mid 1990s, a time when wireline telephone service had reached maturity and before consumers began to abandon traditional telephone services for mobile services and Internet telephone technologies. Like prior analyses, these findings suggest that the adoption of communications services is largely an economic and demographic issue, and the angst associated with broadband rankings is likely misplaced.

1. Rank scrambling or sorting?

Broadband, presumably like most high-technology goods and services in each country, follows over time an adoption curve of some sort. Adoption curves of items such as telephone service, color televisions, personal computers, and mobile phones follow familiar patterns: there is a period of fast growth in the early phases of adoption, which eventually slows as the service approaches maturity (i.e., s-curve diffusion). A country that is an early mover will not necessarily achieve the highest level of penetration in the end. While the "race" is continuing, position changes among countries should be expected, as some countries may reach maturity before others. However, this race is more of a marathon than a sprint. As the race progresses, the relative positions among countries should start to look more and more similar to the final outcome, when all countries are at maturity.

The OECD per-capita subscription rates are used by many to track the progress of broadband adoption in the U.S. and other countries. Every six months, the OECD releases its broadband rankings. This rank is based on per-capita connection counts, which is the sum of household connections and business connections divided by population. The formula for broadband adoption used by the OECD for country i at time t is

$$A_{i,t}^{OECD} = \frac{h_{i,t} + b_{i,t}}{N_{i,t}} \tag{1}$$

where $h_{i,t}$ is household connections in country i at time t, $b_{i,t}$ is business connections (of the sort counted in the country) in country i at time t, and $N_{i,t}$ is the population in country i at time t. A major defect in this measure of relative broadband subscription is apparent at first glance. The denominator of Eq. (1) is population rather than a measure of market potential (i.e., the theoretical maximum of potential connections). Households and businesses subscribe to broadband connections, and these connections are shared among many users. Thus, if the country has 100% adoption of both households and businesses, the ratio A^{OECD} is not equal to 1.0 (and is typically well below it). In fact, A^{OECD} in the presence of saturation could be just about anything, given that population bears no particular relationship to the market potential of connections by households and businesses. For households, households size can be used to convert population to a meaningful measure of potential, but there is no established or consistent conversion between potential business connections and population.

Plainly, Eq. (1) is not the statistic of interest. For policy purposes, the metric of greater interest is the percent of households with broadband connections, or

$$A_{i,t}^{H} = \frac{h_{i,t}}{H_{i,t}} \tag{2}$$

where $H_{i,t}$ is the total number of households in country i (or other geographically relevant area) at time t. Business connectivity is rarely an issue (save in rural markets, but the total connection count in such markets is small on a national scale), but can be defined (of the sort counted by the OECD) as

$$A_{i,t}^{B} = \frac{b_{i,t}}{B_{i,t}} \tag{3}$$

[3] The only countries with relatively low efficiency scores are Greece, Slovakia, Ireland, the Czech Republic, and Luxembourg. Despite its relatively high subscription rate, Luxembourg has a low efficiency score because it also has a highly favorable set of endowments.