

Telecom regulators: Don't get rolled by Rewheel

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Will the merger between T-Mobile and Sprint make consumers better or worse off? A central question in the review of this merger—as it is in all merger reviews—is the likely effects that the transaction will have on consumers. In this post, we look at one study that opponents of the merger have been using to support their claim that the merger will harm consumers.

Along with my earlier posts on data problems and public policy ([1](#), [2](#), [3](#), [4](#), [5](#)), this provides an opportunity to explore why seemingly compelling studies can be used to muddy the discussion and fool observers into seeing something that isn't there.

This merger—between the third and fourth largest mobile wireless providers in the United States—has been characterized as a “4-to-3” merger, on the grounds that it will reduce the number of large, ostensibly national carriers from four to three. This, in turn, has led to concerns that further concentration in the wireless telecommunications industry will harm consumers. Specifically, some opponents of the merger [claim](#) that “it’s going to be hard for someone to make a persuasive case that reducing four firms to three is actually going to improve competition for the benefit of American consumers.”

A number of previous mergers around the world can or have also been characterized as 4-to-3 mergers in the wireless telecommunications industry. Several econometric studies have attempted to evaluate the welfare effects of 4-to-3 mergers in other countries, as well as the effects of market concentration in the wireless industry more generally. These studies have been used by both proponents and opponents of the proposed merger of T-Mobile and Sprint to support their respective contentions that the merger will benefit or harm consumer welfare.

One particular study has risen to prominence among opponents of 4-to-3 mergers in telecom in general and the T-Mobile/Sprint merger in specific. This is worrying because the study has several fundamental flaws.

This study, by Finnish consultancy Rewheel, has been cited by, among others, Phillip Berenbroick of Public Knowledge, who in [Senate testimony](#), asserted that “[Rewheel](#) found that consumers in markets with three facilities-based providers paid twice as much per gigabyte as consumers in four firm markets.”

The Rewheel report upon which Mr. Berenbroick relied, is, however, marred by a number of significant flaws, which undermine its usefulness.

The Rewheel report

Rewheel's report purports to analyze the state of 4G pricing across 41 countries that are either members of the EU or the OECD or both. The report's conclusions are based mainly on two measures:

1. Estimates of the *maximum* number of gigabytes available under each plan for a specific hypothetical monthly price, ranging from €5 to €80 a month. In other words, for each plan, Rewheel asks, "How many 4G gigabytes would X euros buy?" Rewheel then ranks countries by the median amount of gigabytes available at each hypothetical price for all the plans surveyed in each country.
2. Estimates of what Rewheel describes as "fully allocated gigabyte prices." This is the monthly retail price (including VAT) divided by the number of gigabytes included in each plan. Rewheel then ranks countries by the median price per gigabyte across all the plans surveyed in each country.

Rewheel's convoluted calculations

Rewheel's use of the country median across all plans is problematic. In particular it gives all plans equal weight, regardless of consumers' use of each plan. For example, a plan targeted for a consumer with a "high" level of usage is included with a plan targeted for a consumer with a "low" level of usage. Even though a "high" user would not purchase a "low" plan (which would be relatively expensive for a "high" user), all plans are included, thereby skewing upward the median estimates.

But even if that approach made sense as a way of measuring consumers' willingness to pay, in execution Rewheel's analysis contains the following key defects:

- The Rewheel report is essentially limited to quantity effects alone (i.e., how many gigabytes available under each plan for a given hypothetical price) or price effects alone (i.e., price per included gigabyte for each plan). These measures can mislead the analysis by missing, among other things, innovation and quality effects.
- Rewheel's analysis is not based on an impartial assessment of relevant price data. Rather, it is based on hypothetical measures. Such comparisons say nothing about the plans actually chosen by consumers or the actual prices paid by consumers in those countries, rendering Rewheel's comparisons virtually meaningless. As [Affeldt & Nitsche](#)(2014) note in their assessment of the effects of concentration in mobile telecom markets:

Such approaches are taken by Rewheel (2013) and also the Austrian regulator rtr (when tracking prices over time, see rtr (2014)). Such studies face the following problems: They may pick tariffs that are relatively meaningless in the country. They will have to assume one or more consumption baskets (voice minutes, data volume etc.) in order to compare tariffs. This may drive results. Apart from these

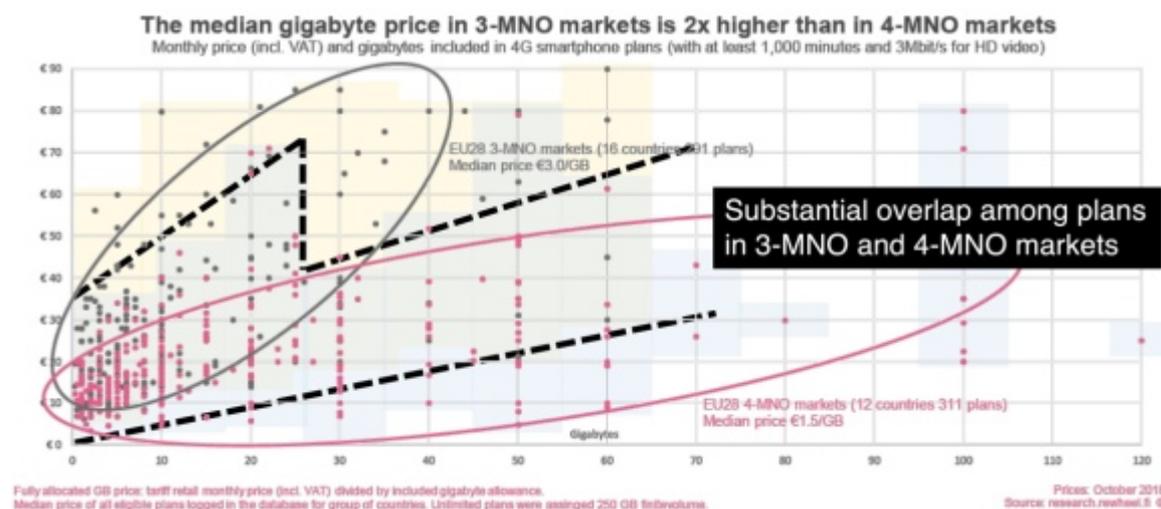
difficulties such comparisons require very careful tracking of tariffs and their changes. Even if one assumes studying a sample of tariffs is potentially meaningful, a comparison across countries (or over time) would still require taking into account key differences across countries (or over time) like differences in demand, costs, network quality etc.

- The Rewheel report bases its comparison on dissimilar service levels by not taking into account, for instance, relevant features like comparable network capacity, service security, and, perhaps most important, overall quality of service.

Rewheel's unsupported conclusions

Rewheel uses its analysis to come to some strong conclusions, such as the conclusion on the first page of its report declaring the median gigabyte price in countries with three carriers is twice as high as in countries with four carriers.

The figure below is a revised version of the figure on the first page of Rewheel's report. The yellow blocks (gray dots) show the range of prices in countries with three carriers the blue blocks (pink dots) shows the range of prices in countries with four carriers. The darker blocks show the overlap of the two. The figure makes clear that there is substantial overlap in pricing among three and four carrier countries. Thus, it is not obvious that three carrier countries have significantly higher prices (as measured by Rewheel) than four carrier countries.



A simple “eyeballing” of the data can lead to incorrect conclusions, in which case statistical analysis can provide some more certainty (or, at least, some measure of uncertainty). Yet, Rewheel provides no statistical analysis of its calculations, such as measures of statistical significance. However, information on page 5 of the Rewheel report can be used to perform some rudimentary statistical analysis.

I took the information from the columns for hypothetical monthly prices of €30 a month and

€50 a month, and converted data into a price per gigabyte to generate the dependent variable. Following Rewheel’s assumption, “unlimited” is converted to 250 gigabytes per month. Greece was dropped from the analysis because Rewheel indicates that no data is available at either hypothetical price level.

My rudimentary statistical analysis includes the following independent variables:

- Number of carriers (or mobile network operators, MNOs) reported by Rewheel in each country, ranging from three to five. Israel is the only country with five MNOs.
- A dummy variable for EU28 countries. Rewheel performs separate analysis for EU28 countries, suggesting they think this is an important distinction.
- GDP per capita for each country, adjusted for purchasing power parity. Several articles in the literature suggest higher GDP countries would be expected to have higher wireless prices.
- Population density, measured by persons per square kilometer. Several articles in the literature argue that countries with lower population density would have higher costs of providing wireless service which would, in turn, be reflected in higher prices.

The tables below confirm what an eyeballing of the figure suggest: Rewheel’s data show number of MNOs in a country have no statistically significant relationship with price per gigabyte, at either the €30 a month level or the €50 a month level.

Dependent variable: Price per GB at €30 per month

	Coeff.	Std. Err.	t-stat	p-value
Intercept	9.536	6.676	1.43	0.162
Number of MNOs	-1.854	1.692	-1.10	0.281
EU28 country dummy	-0.332	1.955	-0.17	0.866
GDP per capita (PPP)	-1.6E-05	5.5E-05	-0.29	0.771
Population density	0.003	0.004	0.76	0.455
R-squared	0.05			
Observations	40			

Dependent variable: Price per GB at €50 per month

	Coeff.	Std. Err.	t-stat	p-value
Intercept	3.067	2.006	1.53	0.135
Number of MNOs	-0.597	0.509	-1.17	0.249
EU28 country dummy	0.023	0.587	0.04	0.968
GDP per capita (PPP)	1.5E-06	1.7E-05	0.09	0.928
Population density	0.001	0.001	0.56	0.577
R-squared	0.05			
Observations	40			

While the signs on the MNO coefficient are negative (i.e., more carriers in a country is

associated with lower prices), they are not statistically significantly different from zero at any of the traditional levels of statistical significance.

Also, the regressions suffer from relatively low measures of goodness-of-fit. The independent variables in the regression explain approximately five percent of the variation in the price per gigabyte. This is likely because of the cockamamie way Rewheel measures price, but is also due to the known problems with performing cross-sectional analysis of wireless pricing, as noted by [Csorba & Pápai](#) (2015):

Many regulatory policies are based on a comparison of prices between European countries, but **these simple cross-sectional analyses can lead to misleading conclusions because of at least two reasons. First, the price difference between countries of n and $(n + 1)$ active mobile operators can be due to other factors, and the analyst can never be sure of having solved the omitted variable bias problem.** Second and more importantly, the effect of an additional operator estimated from a cross-sectional comparison cannot be equated with the effect of an actual entry that might have a long-lasting effect on a single market.

The Rewheel report cannot be relied upon in assessing consumer benefits or harm associated with the T-Mobile/Sprint merger, or any other merger

Rewheel apparently has a rich dataset of wireless pricing plans. Nevertheless, the analyses presented in its report are fundamentally flawed. Moreover, Rewheel's conclusions regarding three vs. four carrier countries are not only baseless, but clearly unsupported by closer inspection of the information presented in its report. The Rewheel report cannot be relied upon to inform regulatory oversight of the T-Mobile/Sprint merger or any other. This study isn't unique and it should serve as a caution to be wary of studies that merely eyeball information.

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