

## Global Economics Comment: What Share of the Population Is Already Immune? (Milo/Struyven)

- With vaccination underway, attention is shifting to when countries will reach “herd immunity,” resulting from both vaccinations and infections. We estimate the current level of immunity for the major economies.
- We focus on representative antibody surveys as the best albeit imperfect proxy for the current share with natural immunity. On the one hand, the inability of antibody surveys to detect individuals who benefit from T-cell protection but whose antibodies have waned likely leads to underestimates of immunity. On the other hand, potentially diminishing protection might offset this underestimation over the medium run.
- Combining antibody surveys and estimated subsequent infections based on fatalities, we estimate that significant population shares of the countries in our survey sample have acquired immunity, with Spain at 11%, England at 13%, India at 14%, Brazil at 15%, the US at 26%, and Mexico at 34%.
- We next estimate immunity in countries without antibody surveys by assuming the same ratio between infections and excess fatalities as in peer countries with available surveys. Specifically, we estimate population shares with immunity that are moderate in Germany (5%), high in Italy (18%) and Russia (27%), and very high in Ecuador (33%) and Peru (39%).
- Relatively large population shares with natural immunity in several major economies should accelerate the vaccine-driven race to herd immunity, especially in the US, Latin America, and urban India.

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## What Share of the Population Is Already Immune?

With vaccination underway and concerns growing about a potential increase in virus transmissibility from a new UK strain, attention is focusing on when countries will reach “herd immunity,” resulting from both vaccinations and natural infections. This note estimates the current level of immunity from coronavirus infections for the major economies.<sup>1</sup>

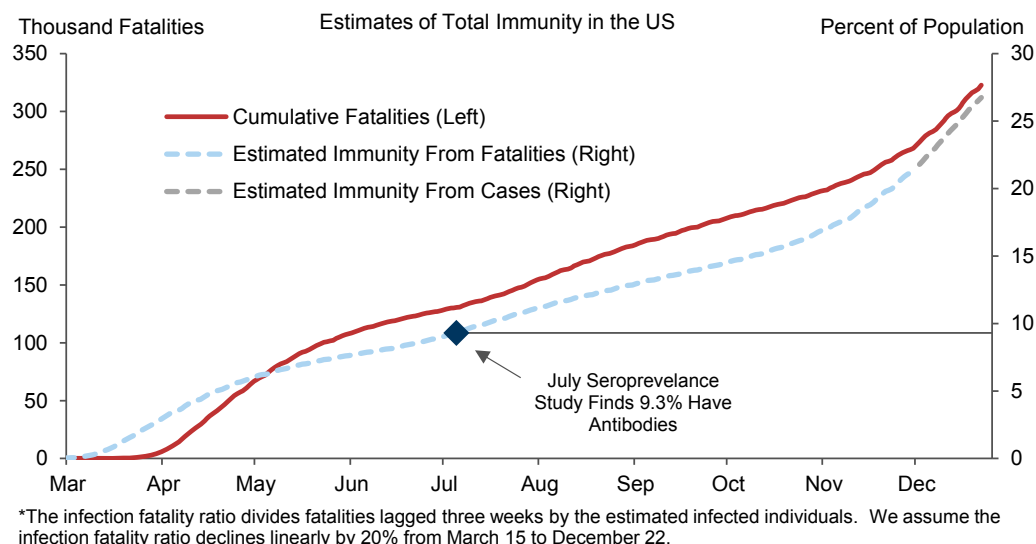
We use nationally representative antibody surveys, which measure the percentage of people with evidence of a specific antibody immune response to Covid-19, as the best proxy for the share with natural immunity. Recent antibody surveys find that the share of totally infected individuals is at least three times higher than confirmed cases in Spain and thirty times higher in Mexico. While typically much more accurate than confirmed cases at estimating prior infections, antibody surveys have shortcomings too. On the one hand, the inability of antibody surveys to detect individuals who benefit from T-cell protection but whose antibodies have waned likely leads to underestimates of immunity. On the other hand, the potential decline in protection over time might limit or offset this underestimation over the medium run.<sup>2</sup> Henceforth in this piece and following the medical literature, we will focus on antibody prevalence as proxy for those with natural immunity.

We start by “nowcasting” natural immunity in countries with an available antibody survey in two steps. First, we estimate the population share with immunity at the latest survey date. For example, we use the Lancet [survey](#) estimate that 9.3% of the US population had antibodies in July (and 1/3 in New York state) as our July estimate of US immunity. Second, we estimate immunity from new infections after the survey by combining the infection fatality ratio (IFR) implied by the survey and subsequent new fatalities. The dotted line in Exhibit 1 shows our estimate that 22% of the US population had immunity three weeks ago and assumes a modest decline in the IFR over time, reflecting [better treatments](#). Combined with our estimate of an additional 4pp of immunity over the last three weeks (based on additional fatalities predicted using confirmed cases), we estimate that 26% of the US population has now acquired immunity.

<sup>1</sup> This note does not consider potential cross-immunity from other viruses nor the limited number of actual vaccinations to date.

<sup>2</sup> Wise (2020) finds that infected individuals maintain a T-cell response even six months after infection and Sekine et al. (2020) find T-cell responses in all infected patients despite only detecting antibodies in some patients. Suarez et al. (2020) find minimal evidence of reinfections.

**Exhibit 1: We Estimate Immunity Combining Antibody Surveys and Subsequent Infections Estimated From Fatalities**

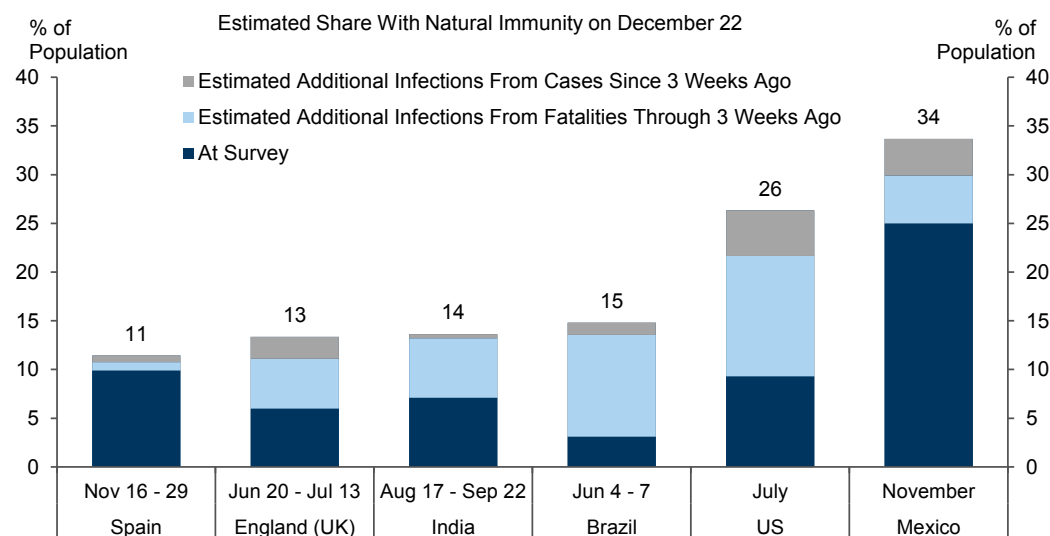


Source: JHU CSSE, Anand et al. (2020), Goldman Sachs Global Investment Research

Exhibit 2 presents our immunity estimates on December 20<sup>th</sup> for countries with available high quality antibody surveys. We estimate immunity as the sum of infections from antibody surveys (dark blue), infections since the survey until three weeks ago (light blue), and infections over the last three weeks (grey). We estimate that significant shares of the countries in our survey sample have acquired immunity, with Spain at 11%, England at 13%, India at 14%, Brazil at 15%, the US at 26%, and Mexico at 34%. While highly uncertain, our method would imply a very elevated immunity level of around 70% in the Indian state of Delhi and generally elevated levels in crowded urban Indian dwellings.<sup>3</sup>

<sup>3</sup> Combining Delhi’s August Survey, which found a share of 29.1% of antibodies and recent Delhi fatalities trends, our methodology suggests a population share with immunity in Delhi at around 70%. Consistent with significant heterogeneity, the national September survey estimated 15.6% prevalence in crowded urban dwellings, 8.2% prevalence in non-crowded urban dwellings, and 4.4% in rural areas.

**Exhibit 2: The Estimated Share of the Population With Detectable Antibodies Varies Between 11% in Spain and 34% in Mexico**

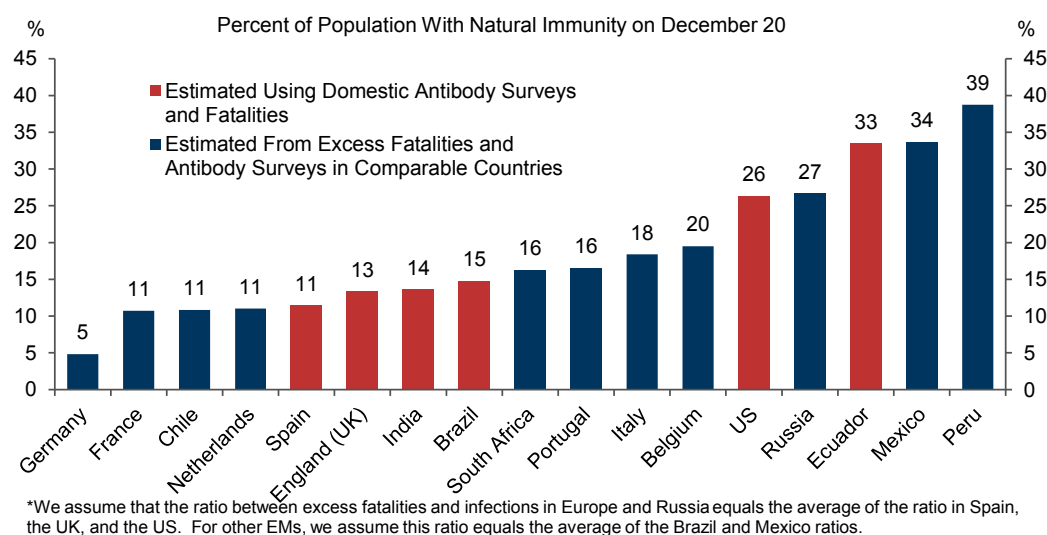


Source: JHU CSSE, Government of Spain, Ward et al. (2020), Murhekar et al. (2020), Hallal et al. (2020), Anand et al. (2020), Government of Mexico, Goldman Sachs Global Investment Research

We next estimate immunity in countries without antibody surveys combining fatalities data and the implied IFRs from comparable countries with surveys. Specifically, we assume that the ratio between excess fatalities—which is the difference between total 2020 deaths and baseline deaths in prior years and which account for cross-country differences in reporting standards—and the number of individuals with acquired immunity is the same across peer countries, with similar demographics and income levels.<sup>4</sup> For developed markets without surveys (and Russia), we use an infection excess fatality ratio of 1.1%, averaging the survey-implied values of Spain, England, and the US. For emerging markets, we use an excess fatality ratio of 0.7%, averaging the survey-implied values of Brazil and Mexico. The somewhat lower EM adjusted fatality ratio likely reflects younger EM populations and the exponential rise of the IFR with age. Applying these adjusted IFRs, we estimate a wide spectrum of population immunity shares that are moderate in Germany (5%) and France (11%), high in Italy (18%) and Russia (27%), and very high in Ecuador (33%) and Peru (39%).

<sup>4</sup> By using excess fatalities, we assume that non-covid fatalities are comparable with prior years.

**Exhibit 3: We Estimate Population Shares with Immunity that Are Moderate in Germany (5%) but Very High in Ecuador (33%) and Peru (39%)**



Source: JHU CSSE, The Economist, Goldman Sachs Global Investment Research

We emphasize that our estimates are subject to caveats. First, antibody surveys tend to underestimate the percent of the population with a prior infection. Second, the length of protection is highly uncertain, especially in light of virus mutation. Third, excess fatality ratios likely vary across peer countries.

That said, we think our estimates rely on relatively better measured data (namely seroprevalence and excess fatalities) than confirmed cases, and are intuitive and in the range of US estimates provided by former FDA commissioner [Scott Gottlieb](#) and data scientist [Youyang Gu](#). While vaccines are unlikely to be prioritized for individuals without antibodies, we do think that our estimate that large shares of the population already have immunity in several major economies is likely to accelerate the vaccine-driven [race](#) to herd immunity, especially in the US, Latin America, and urban parts of India.

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