# **US Economics Analyst** The Reopening of Schools (Choi/Briggs)

- As the upcoming school year approaches, it is still unclear if schools will be able to reopen. While reopening carries virus risks, the costs to the economy and students of keeping schools closed are also substantial.
- School closures directly reduce employment in the education sector, which fell dramatically following widespread school closures in March. We estimate that shutdowns in the education sector directly subtracted 2.2pp from annualized growth in Q2. School closures may also have a large impact on other parts of the economy closely tied to the education sector, such as food providers for meal programs and businesses in college towns.
- School closures also indirectly weigh on employment and productivity by increasing child care needs, which we find caused a large increase in worker absences. Single parents, workers that cannot work from home, and parents with young children are more at risk of not working due to child care needs. We estimate that roughly 24mn workers, or 15% of the labor force, are in at least two of these three situations.
- School closures may also have many other important long-run costs, such as lower-quality education, a lack of social and emotional skill development, mental health problems, food insecurity, and worsening income and educational inequality.
- Preliminary evidence suggests that younger children may be less likely to transmit the virus to others, and international experience also shows that it may be possible to reopen schools without triggering a spike in virus cases. However, countries with successful school reopenings had significantly less virus spread than the US currently has, suggesting much higher risks in reopening for most of the US.
- A growing number of states and districts have already pushed back start dates for in-person instruction. The reopening of schools will likely be a staggered process in the US, and depend crucially on whether the virus spread among the broader population is first managed.

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## The Reopening of Schools

Schools across the US shut down in March as the coronavirus outbreak rapidly spread, with most states eventually canceling in-person schooling for the remainder of the 2019-2020 academic year. With the upcoming school year fast approaching at a time when <u>virus spread</u> is still very high in the US, it is unclear if schools will be able to safely reopen on schedule. In this *Analyst* we assess the economic costs of school closures, the latest evidence on virus transmission in schools, and the likely trajectory of school re-openings in the upcoming academic year.

### **The Economic Costs of School Closures**

We start with the direct economic impact of school closures on the education sector. While school closures were undoubtedly disruptive, a large amount of schooling moved from traditional in-person instruction to virtual instruction, as opposed to being eliminated entirely. Employment in the education services sector nevertheless collapsed across both private education and state and local public education, contributing roughly 1.2mn to the 22.2mn decline in nonfarm payrolls in March and April (Exhibit 1, left).

Using data from the Current Population Survey (CPS), we find that while initial job losses in the education industry were broad-based across occupations, employment of teachers is now back to pre-pandemic levels, while employment of other lower-skilled workers has recovered much more slowly (Exhibit 1, right). These include workers such as lunch staff and custodial workers, who are less likely to be reemployed if schools do not reopen. Even under the optimistic assumption that the employment of teachers and other higher-skilled workers in the education industry reverts to pre-pandemic levels, we estimate that school closures may boost the unemployment rate by roughly 0.2pp if lower-skilled workers are not rehired.



Exhibit 1: Employment in the Education Industry Fell Sharply; Education Employment Remains Depressed, Particularly for Lower-Skilled Workers

Source: US Bureau of Labor Statistics, Goldman Sachs Global Investment Research

What impact did school closures have on GDP? As explained in an FAQ, the Bureau of Economic Analysis (BEA) made several adjustments to account for some schools cutting back on instruction and modifications of the school calendar. While a timely breakdown of quarterly state and local government spending into expenditures for public education is not readily available, we estimate this using data on educational services PCE and the share of state and local government spending on public education.<sup>1</sup> We estimate that shutdowns in the education sector subtracted roughly 2.2pp from annualized real GDP growth in Q2, a sizable contribution to the overall decline. School closures may also have a large impact on other parts of the economy closely tied to the education sector, such as food providers for meal programs and businesses in <u>college towns</u>.

In addition to the direct effects on the education sector, school closures may also affect overall labor supply, if workers drop out of the labor force or are unable to fully return to work because they have to take care of their children staying at home. Academic research suggests that these effects could be large, with child care policies historically having a meaningful impact on labor force participation,<sup>2</sup> particularly for <u>women</u>.

Survey data suggest that the substantial increase in child care needs due to the pandemic recession has significantly disrupted labor supply. According to the Census Household Pulse Survey, since May roughly 7 million workers per week did not work due to caring for children not in school or daycare, accounting for roughly 14% of virus-related reasons for not working (Exhibit 2, left). Using more granular CPS data, we find that among workers absent from work, the share citing child care as the primary reason has surged in the months immediately following the school closures to historically high levels (Exhibit 2, right).





Source: US Bureau of Labor Statistics, Goldman Sachs Global Investment Research

<sup>1</sup> Schooling enters GDP both through personal consumption expenditures of education services, as well as state and local government expenditures on public education. We assume a slightly smaller decline for public education, proportional to the relative declines between private employment and state and local government employment in the education sector.

<sup>2</sup> See for example Francine Blau and Lawrence Kahn, "Female Labor Supply: Why is the United States Falling Behind?" American Economic Review, 2013.

To assess the potential labor supply impact from school closures in the upcoming year, we look to see how many workers might be affected due to increased child care needs. We merge CPS data on demographics and work status with <u>occupation-level data</u> from the Dallas Fed on the ability to work from home. Using a panel regression, we find that single parents, parents with younger children, and parents with less ability to work from home are more likely to either be absent from work or to drop out of the labor force altogether due to child care needs (Exhibit 3). While the regression coefficients are not large in magnitude, they are based on a sample without widespread school closures, and school closures will likely significantly magnify labor supply reductions for workers in these three situations.<sup>3</sup>

Exhibit 3: Single Parents, Parents with Young Children, and Parents with Less Ability to Work from Home Are More Likely to Stop Working Due to Child Care



Source: US Bureau of Labor Statistics, Federal Reserve Bank of Dallas, Goldman Sachs Global Investment Research

Exhibit 4 breaks down the labor force into these three categories, grouping workers based on whether their youngest child is above or below 10 years old, whether they have an above or below average ability to work from home, and whether they are a single parent or married. We find that roughly 30% of the pre-virus labor force has children at home, with roughly 15% of the labor force, or around 24mn workers, falling into at least 2 out of the 3 risk categories.

<sup>&</sup>lt;sup>3</sup> For instance, in one striking anecdote, a CDC study found that school closures in Kentucky in 2008 due to an influenza outbreak led to an adult having to miss work to provide child care in 29.1% of households in which the child's school had to close.



Exhibit 4: A Significant Share of the Labor Force Likely Requires Child Care Support Without Schools

Source: US Bureau of Labor Statistics, Federal Reserve Bank of Dallas, Goldman Sachs Global Investment Research

While the number of workers not working due to child care reasons during school closures in May<sup>4</sup> might serve as an approximate upper bound, the labor market effects could still be felt for many other workers through either a reduction in their hours worked, or lower productivity in the hours they do work. The extent to which these workers will cut back on their labor will likely also depend on factors such as whether child care centers open or federal support for child care needs.<sup>5</sup>

In addition to these short-run economic costs, school closures may also have many other important long-run costs. These include negative effects from lower quality education,<sup>6</sup> the lack of social and emotional skill development, increased rates of depression and anxiety, food insecurity, worsening income inequality if lower income households are less able to work from home, and worsening educational inequality if poorer households have less access to remote learning. While many of these costs are not immediate in nature, they may have very important and long-lasting societal consequences.

### **Schools and Virus Transmission**

In theory, schools are a natural area where the virus can easily spread, with a large number of people in close proximity indoors. However, growing evidence suggests that children may be less likely to become infected than adults, and it is now clear that children are much less likely to show serious symptoms from the coronavirus, with a

<sup>&</sup>lt;sup>4</sup> Slightly more than 6 million workers according to the Census Pulse Survey.

<sup>&</sup>lt;sup>5</sup> Some households may have informal care arrangements, such as extended family who they do not live with; however, this may be less possible currently due to social distancing guidelines, especially for older people such as grandparents.

<sup>&</sup>lt;sup>6</sup> Meyers and Thomasson find that the 1916 polio pandemic, which led to quarantines and closed schools, led to less educational attainment for affected children, particularly children of legal working age who dropped out of schools.

fatality rate close to zero for school-age children. This suggests that the reopening of schools may not pose a very high level of risk for schoolchildren themselves.

Much less is known, however, about how easily children transmit the virus to others, such as fellow students, teachers, and family members. Other respiratory viruses like influenza are known to spread easily among schoolchildren, and the key concern is that outbreaks in schools will eventually spill over into outbreaks in the broader population that is at greater risk.

While the evidence is preliminary and far from conclusive, studies so far suggest some grounds for optimism. For instance, a large study based on comprehensive contact tracing in <u>South Korea</u> found that children under 10 were roughly half as likely as adults to transmit the virus to others, while children between the ages of 10 and 19 transmitted the virus at similar rates to adults. Other studies have also suggested that young children are less likely to spread the virus, as summarized in Exhibit 5. However, a recent study found large outbreaks in a <u>Georgia summer camp</u> even for younger children, while another recent study has shown that children may carry high <u>viral loads</u>.

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Study	Sample	Findings
Park et al.	59,073 contacts of 5,706 coronavirus patients in South Korea.	Found high coronavirus rates in contacts of children aged 10-19 (18.6%), but relatively low rates in contacts of children 0-9 years (5.3%). However, this was measured in the middle of school closure, and only 57 contacts of young children were traced.
Armann et al.	1,500 students and 500 teachers in Saxony, Germany after schools reopened.	Coronavirus cases were detected in 3 of the 13 schools surveyed, but the infection did not spread throughout the school or the nearby community. Only 12 out of 2,000 individuals came back positive for antibodies, indicating a low level of community infection. Overall, the study found little evidence that schoolchildren pass on the virus to each other.
Fontanet et al.	Twin studies of high schools and elementary schools in a town in France.	In high schools, antibody testing showed that 38% of students, 43% of teachers, and 59% of nonteaching staff were infected. In elementary schools, the study identified three students in three different elementary schools who attended classes with acute coronavirus symptoms; no evidence of any spread to other students.
Zhu et al.	Meta-analysis of studies from China, Singapore, South Korea, Japan, and Iran.	Concludes that data suggests that children have not played a substantive role in intra-household transmission of the coronavirus, in contrast to other viruses such as H5N1.
Li et al.	Review of 16 studies across countries that investigated the role of children in the transmission of COVID-19.	Preliminary evidence from large and targeted, population, and school studies suggest that children may be less likely to infect others.
Viner et al.	Meta-analysis of 18 contact-tracing studies.	Clear evidence that children have a lower susceptibility to the virus, but weaker evidence that children play a lesser role in transmission.
National Centre for Immunisation Research and Surveillance	735 students and 128 staff that were close contacts of 9 students and 9 staff with COVID-19 in Australian schools.	No teacher or staff member contracted COVID-19 from any of these initial cases; two students may have contracted COVID-19 from the initial cases.
Heavey et al.	Contact tracing of six infected people in schools, including two high school students, an elementary school student, and three adults in Ireland.	No confirmed secondary cases from the three students, including the 924 child contacts and 101 adult contacts identified in a school setting.
Danis et al.	Study of a cluster of cases in France.	A 9-year old boy was found to have exposed over 80 classmates at 3 schools, but no secondary contacts became infected despite numerous influenza infections within the schools.
Posfay-Barbe et al.	Families of 40 children under the age of 16 with COVID-19 in Geneva, Switzerland.	In only 3 cases was a child the suspected initial case; in all other households, the child developed symptoms after an adult in the family.
Public Health Agency of Sweden	Comparison between Finland and Sweden, who applied different measures regarding school closures.	Found no difference in the lab confirmed cases of school-aged children in Finland or Sweden, and little transmission in both countries to teachers.
Szablewski et al.	Roughly 600 staff and children in a summer camp in Georgia.	Of the 344 staff and children with available test results, 260 (76%) tested positive. 51% of children aged 6 to 10 were infected, while 44% of those aged 11 to 17 were infected. Attack rates increased with increasing length of time spent at the camp.

Source: Goldman Sachs Global Investment Research

Other countries that have reopened schools also show that it is feasible to do so without triggering a spike in overall virus cases or among students and school staff.

Many countries have reopened schools successfully as judged by the overall number of new cases, with the notable exception of Israel (Exhibit 6). Very importantly, however, these countries had relatively low local infection rates when reopening schools. In contrast, the US currently has a much higher level of daily new infections nationwide and in many states, with nearly 200 daily cases per million in the US compared to 20 daily cases per million or less for most countries that reopened schools.





Source: JHU CSSE, Goldman Sachs Global Investment Research

Most countries that have reopened schools have also taken a very cautious approach. This includes limiting class sizes, starting with younger children,<sup>7</sup> sanitizing procedures, mask wearing requirements, and spacing between desks among other restrictions, as shown in Exhibit 7. Notably, Israel quickly returned to full class sizes of up to 40 students per class with few restrictions after an initial phased return, and has since had to close a large number of schools once again. These anecdotes suggest that any reopening of schools in the US should be done by cautiously following public health guidelines.

<sup>&</sup>lt;sup>7</sup> It may make more sense to start with younger children if they are less likely to transmit the virus to others. In addition, the importance of early childhood education and social skill development may be less substitutable with virtual instruction, and younger children have a higher level of child care needs.

### Exhibit 7: Most Countries That Have Reopened Schools Have Done So Cautiously

Country	Date Reopened	New Cases Per Million When Reopening	Precautions	Transmission				
Belgium	5/18	25.1	Started with younger students, with children alternating days and maximum 10 students a class.	No significant increase in coronavirus cases after reopening schools.				
Denmark	4/15	30.6	Started with younger students, limited class size to 12. Social distancing requirements and hourly handwashing enforced.	No significant increase in coronavirus cases after reopening schools.				
France	5/11	16.9	Started with younger students, Limited class size, with facemask requirements in secondary schools.	No significant increase in coronavirus cases after reopening schools.				
Germany	5/4	12.2	Started with older kids, limited class size to 10. Desks spaced 6 feet apart.	Large study of 1,500 students and 500 teachers showed very little virus transmission, with only 12/2000 having antibodies. Another study showed increased transmission among students, but not school staff.				
Greece	6/1	0.6	Started with younger students, limited class size to 15.	No significant increase in coronavirus cases after reopening schools.				
Israel	5/3	10.9	Did not limit class size. After a phased return, few restrictions on schools, and classes quickly returned to full size.	Outbreaks that infected at least 1,335 students and 691 staff.				
Japan	4/24	3.0	Varied between schools, but students generally wore facemasks and observed social distancing.	No significant increase in coronavirus cases after reopening schools.				
New Zealand	5/14	0.2	Initially partially reopened schools on 4/28 to children of essential workers before opening to all students on 5/14. Imposed social distancing measures.	No significant increase in coronavirus cases after reopening schools.				
Netherlands	5/11	16.7	Started with younger students, halved class sizes.	No significant increase in coronavirus cases after reopening schools.				
Norway	4/20	15.1	Started with younger students, limited class size to 15.	No significant increase in coronavirus cases after reopening schools.				
South Korea	6/8	0.9	Limited class size to around 50%; face masks, social distancing, and temperature checks required.	No significant increase in coronavirus cases after reopening schools.				
Sweden	Did not Close	N/A	Never closed schools.	Study showed that antibody prevalence in children and teenagers was 4.7% compared with 6.7% in adults.				
Switzerland	5/11	6.2	Started with younger students, limited class size to 50%, alternated days.	No significant increase in coronavirus cases after reopening schools.				
Taiwan	2/25	0.1	Facemasks required, temperature checks.	No significant increase in coronavirus cases after reopening schools.				
Vietnam	5/18	0.1	Facemasks required, temperature checks.	No significant increase in coronavirus cases after reopening schools.				

Source: University of Washington Department of Global Health, Goldman Sachs Global Investment Research

### **The Outlook for Reopening Schools**

The reopening of schools will likely be a staggered process in the US. Some states plan to reopen schools as scheduled, but following a deteriorating virus situation a growing number of states and districts have pushed back start dates for in-person instruction (Exhibit 8). In several states, the decision is left to each individual district, and many states have issued guidelines for when schools are allowed to reopen, typically based on the number of new infections per day.

### Exhibit 8: States Have Pushed Back School Reopening Plans and Have Provided Guidelines for Reopening

- Changes to School Reopening Plans Since Mid-July
- •Hawaii: Delaying the start of the public school year until August 17 (7/30)
- •Minnseota: County must have less than 9 cases per 10,000 residents over a 14-day period to fully reopen (7/30)
- •Oregon: Counties must have 10 or fewer cases per 100,000 residents for three weeks to fully reopen (7/28)
- •New Mexico: Schools will not be able to open for in-person instruction until after September 7 (7/24)
- •New Jersey: parents will be able to opt children into fully online instruction (7/24)
- •Arizona: will not require schools to reopen for in-person learning as expected in mid-August (7/23)
- Iowa: Students must spend at least half of their schooling in-person (7/17)
- •California: Counties on coronavirus watch list will begin the school year with online education only (7/17)
- •Schools allowed to reopen currently: Alabama, Indiana, Iowa, Montana, Nevada, North Dakota, Wyoming

Source: Ballotpedia, Goldman Sachs Global Investment Research

While there are large costs to school closures, many states remain at very high levels of new cases per day, and these states face a much higher risk if they reopen schools early. Parents may also feel uncomfortable sending kids to school if they perceive it to be dangerous, and parents have already reported significant <u>concerns</u>, with many stating that a surge in cases would make them reconsider sending their children to school. As with many other areas of economic activity, the trajectory of school re-openings will depend crucially on whether the virus spread among the broader population is first managed.

### **David Choi**

**Joseph Briggs** 

# The US Economic and Financial Outlook

### **Forecast Changes**

Q2 GDP declined at a 32.9% rate in the advance report (qoq ar). We are launching our Q3 GDP tracking estimate at +25.5% (qoq ar), 0.5pp above our standing forecast. We are also commencing past-quarter GDP tracking for Q2 at -35.0%, reflecting expected downward revisions in some services categories.

THE US ECONOMIC AND FINANCIAL	OUTLO	OK oted)													
	2018	2019	2020	2021	2022	2023	2020				2021				
	2010	2015	2020 (f)	(f)	(f)	(f)	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
OUTPUT AND SPENDING															ī
Real GDP	3.0	2.2	-5.0	5.6	3.6	2.2	-5.0	-32.9	25.5	8.0	8.0	6.5	5.0	4.0	L
Real GDP (annual=Q4/Q4, guarterly=yoy)	2.5	2.3	-4.3	5.9	2.7	2.0	0.3	-10.3	-5.6	-4.3	-1.2	11.7	6.9	5.9	L
Consumer Expenditure	2.7	2.4	-5.2	5.7	4.1	2.3	-6.9	-34.6	27.4	7.5	7.5	6.5	5.0	4.0	L
Residential Fixed Investment	-0.6	-1.7	0.9	7.3	5.1	2.3	19.0	-38.7	32.0	12.0	8.0	8.0	8.0	5.0	L
Business Fixed Investment	6.9	2.9	-5.2	7.2	5.2	3.8	-6.7	-27.0	12.4	11.3	11.3	9.4	6.3	5.8	L
Structures	3.7	-0.6	-7.8	4.7	4.0	2.7	-3.7	-34.9	7.4	7.0	12.0	7.5	5.7	5.3	L
Equipment	8.0	2.1	-9.5	8.2	4.5	2.7	-15.2	-37.7	25.0	15.0	12.0	10.0	5.0	5.0	L
Intellectual Property Products	7.8	6.4	1.9	7.5	6.7	5.7	2.4	-7.2	3.0	10.0	10.0	10.0	8.0	7.0	L
Federal Government	2.8	4.0	4.2	1.2	0.1	0.0	1.5	17.4	-10.0	3.0	3.0	1.0	0.0	0.0	L
State & Local Government	1.2	1.3	0.4	2.0	1.2	1.0	1.1	-5.6	4.0	3.0	3.0	1.5	1.5	1.5	L
Net Exports (\$bn, '09)	-878	-918	-828	-889	-858	-870	-788	-781	-856	-886	-898	-909	-883	-866	L
Inventory Investment (\$bn, '09)	53	49	-99	131	65	60	-81	-316	-50	50	100	150	150	125	L
Industrial Production, Mfg.	2.3	-0.2	-9.8	6.4	4.1	1.4	-5.5	-47.0	19.3	14.4	11.5	9.8	6.9	4.7	
HOUSING MARKET															ī
Housing Starts (units, thous)	1.248	1.295	1.272	1.500	1.578		1.484	1.044	1.218	1.344	1.477	1.420	1.492	1.610	L
New Home Sales (units, thous)	614	685	632	770	832		701	526	621	682	752	739	763	825	L
Existing Home Sales (units, thous)	5.334	5.330	5.126	4.524	4.414		5.483	4.320	5.100	5.602	4.981	4.361	4.372	4.384	L
Case-Shiller Home Prices (%yoy)*	4.1	3.2	-2.1	2.3	1.9	2.0	2.8	-0.5	-1.6	-2.1	-1.0	0.1	1.2	2.3	L
INELATION (% ch. vr/vr)	1														Ē
Consumer Price Index (CPI)	24	18	12	19	18	20	21	04	12	12	14	27	18	17	L
Core CPI	2.4	2.2	13	13	1.0	2.0	2.1	13	0.0	0.0	0.7	15	1.0	1.1	L
Core PCE**	2.0	1.7	1.1	1.2	1.6	1.8	1.8	0.9	0.9	0.9	0.8	1.4	1.4	1.4	
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	2.0	25	0.0	7.0	6.0	5.5		11 1	0.0	0.0	Q 1	77	7 2	7.0	L
Lie Linderemployment Pate (%)	7.6	5.5	9.0 15.1	127	10.0	0.0	9.7	19.0	9.9 16.2	9.0 15.1	14.2	127	12.2	127	L
Pavrolls (thous monthly rate)	193	178	-558	392	233	9.9 215	-303	-4.429	1 400	1 100	625	360	315	270	L
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Federal Budget (FY, \$DD)	-//9	-984	-4,200	-2,700	-1,650	-1,600									<u> </u>
FINANCIAL INDICATORS															
FF Target Range (Bottom-Top, %)^	2.25-2.5	1.5-1.75	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	0-0.25	L
10-Year Treasury Note <sup>^</sup>	2.69	1.92	1.05	1.45	1.65	1.85	0.70	0.66	0.95	1.05	1.15	1.25	1.35	1.45	
Euro (€/\$)^	1.15	1.12	1.13	1.17	1.20	1.22	1.10	1.08	1.10	1.13	1.14	1.15	1.16	1.17	L
Yen (\$/¥)^	110	109	105	104	102	101	108	102	105	105	105	105	104	104	
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\* Weighted average of metro-level HPIs for 381 metro cities where the weights are dollar values of housing stock reported in the American Community Survey. \*\* PCE = Personal consumption expenditures. ^ Denotes end of period.

Note: Annual, Q4/Q4, and Quarterly YoY GDP growth estimates embed our assumption of a downward revisions in Q2 2020 (from -32.9% to -35%, qoq ar). Published figures in bold. Source: Goldman Sachs Global Investment Research.

Source: Goldman Sachs Global Investment Research

# **Economic Releases**

Time				Estimate						
Date		(ET)	Indicator	GS	Consensus	Last Report				
Mon	Aug 03	9:45	Markit US Manufacturing PMI (July final)	n.a.	51.3	51.3				
		10:00	ISM Manufacturing (July)	53.6	53.5	52.6				
		10:00	Construction Spending (June)	+0.7%	+1.0%	-2.1%				
Tue	Aug 04	10:00	Factory Orders (June)	+6.0%	+5.0%	+8.0%				
Wed	Aug 05	8:15	ADP Employment Change (July)	+1,600k	+1,200k	+1,000k				
		8:30	Trade Balance (June)	-\$50.0bn	-\$50.3bn	-\$54.6bn				
		10:00	ISM Non-Manufacturing (July)	54.0	55.0	57.1				
Thu	Aug 06	8:30	Initial Jobless Claims	1,300,000	1,415,000	1,434,000				
		8:30	Continuing Claims	n.a.	16,940,000	17,018,000				
Fri	Aug 07	8:30	Nonfarm Payrolls (July)	+1,000k	+1,578k	+4,800k				
		8:30	Private Payrolls (July)	+800k	+1,326k	+4,767k				
		8:30	Unemployment Rate (July)	10.7%	10.5%	11.1%				
		8:30	Average Hourly Earnings (July)	-0.3%	-0.5%	-1.2%				
		8:30	Labor Force Participation Rate (July)	n.a.	61.8%	61.5%				
		10:00	Wholesale Inventories (June final)	n.a.	-2.0%	-2.0%				

Source: Goldman Sachs Global Investment Research

## **Disclosure Appendix**

### **Reg AC**

We, Jan Hatzius, Alec Phillips, David Mericle, Spencer Hill, CFA, Daan Struyven, David Choi, Joseph Briggs, Blake Taylor and Ronnie Walker, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm's business or client relationships.

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