

B2B

Global business drives over \$120 trillion of B2B commerce annually – but managing this trade is far from efficient. In the US, nearly 70% of B2B volume is still paid by paper checks, which cost up to \$22 to process. Businesses incur over \$2.7 trillion in B2B administrative costs – 80% of which is paid by small business. But a new generation of payment and software solutions is emerging which promises to cut costs by up to 75% and unleash \$1.5 trillion in small business productivity. In this report, we explore the technology players that are attacking this \$1 trillion B2B revenue opportunity.

Ryan M. Nash, CFA

+1 212 902-8963

ryan.nash@qs.com

Goldman Sachs & Co. LLC

The Goldman Sachs Group, Inc.

Table of Contents

Executive summary	3
Setting the stage: The B2B market landscape	6
Today's B2B market: Significant direct and indirect cost burdens, borne by small business	8
How can payment and software solutions help?	15
Who can make money and how much?	25
Challenges in the adoption of B2B payment solutions	40
Catalog of public and private B2B payments and software companies	41
Disclosure Appendix	44

Executive summary

B2B Payments: The biggest untapped market opportunity for the payments industry

We believe B2B payments currently account for \$127tn in payment flows - and we expect this figure to reach nearly \$200tn by 2028, over 5X the volume of the retail payments market. With the vast majority of invoices still processed manually and paid by paper check, we see significant opportunities for business to reduce costs - creating new revenue pools for payment and software companies entering the market with faster, lower-cost invoice processing and payment solutions. While large businesses and enterprises account for over half of B2B payment flows, we see the biggest revenue and cost savings opportunities for small business, where 80% of invoices are still manually processed and paid by check.

B2B solutions can unleash nearly \$1.5 trillion in productivity for global small business

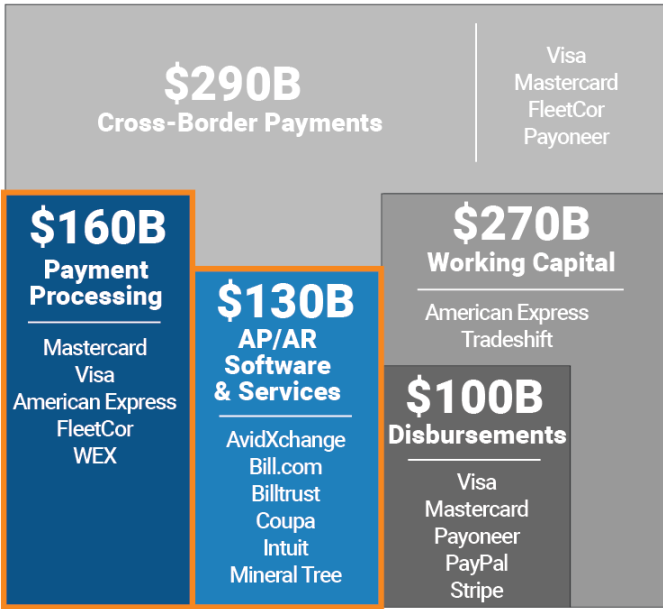
Today, the majority of global businesses still depend on manual, paper-based payment processes that command a steep price tag in terms of time, money, and operating friction. We estimate businesses in North America spend \$187bn annually on accounts payable ("AP") processing - and this estimate captures only direct processing and labor costs. We believe these same businesses are spending closer to \$510bn after taking indirect costs - such as short-term credit and additional fees for cross-border transactions - into account. North America represents only a fraction of the B2B market - and **we believe the total global costs related to AP amount to over \$2.7tn.**

While thus far the digitization of B2B payment flows has been slow - especially among small business - we believe the market is finally poised to accelerate. We see several technological and market changes driving this acceleration, including the adoption by small business of software-based general ledger and accounting systems, the broader emergence of real-time payment infrastructure, and the introduction of novel business and financing services.

The opportunity: A fresh \$1 trillion revenue opportunity in payments & software

We see a significant revenue opportunity for payments companies, software companies, and banks to capture meaningful market share over time, while simultaneously driving substantial cost savings for business. In total, we see a \$950bn global revenue opportunity (with an estimated \$186bn in North America) across invoice processing, AP payment processing, working capital management and factoring, and cross-border payment optimization. Our analysis assumes that B2B payment solutions can drive up to 75% savings in total costs (both direct and indirect) for business, with more savings accruing to small businesses than enterprises.

Exhibit 1: B2B market landscape with key public and private players



Source: Goldman Sachs Global Investment Research

B2B Payments: Who can win?

- **Public companies:** In the public market, we identify several companies we believe are particularly well positioned and should have the highest B2B revenue exposure over the next five years. Among the card networks, we believe Mastercard is best positioned to take a key role in the B2B payment ecosystem and derive a meaningful portion of its revenue from B2B, with B2B potentially representing over half of incremental growth by 2023. We believe both Visa and AmEx could use their incumbent positions to accelerate their growth with B2B as well. We think FleetCor and WEX are best positioned to leverage their existing B2B franchises and augment them with M&A over time - and see up to 35%-40% of their revenue derived from B2B payments in 5 years. We believe Worldpay, PayPal, and Square each have promising B2B growth initiatives that have the potential to be significantly larger. We also see Coupa and Intuit expanding their software franchises with B2B capabilities and payment processing over time.
- **Private companies:** We see a range of private companies benefiting from various parts of the B2B payments ecosystem. In AP & AR invoice software and payment processing, AvidXchange, Bill.com, Billtrust, and MineralTree appear well positioned to gain significant market share given their solid product portfolio and first-mover advantage. Payoneer and Tradeshift also seem well positioned to expand their market positions in cross-border payments and supply chain financing, respectively.

The Future of B2B Payments in Numbers

B2B Payments Volumes

Today



By 2028

\$127 trillion

\$200 trillion

We estimate global B2B volumes will reach over 5 times the business-to-consumer market over the next decade.

Accounts Payable (AP) Costs Today



\$2.7 trillion

What businesses are spending on manual, paper-based payment processing, which is a big burden in terms of time and money.

Small Business Bears the Brunt ...

80%



SMBs account for this much of the total annual spending on labor and accounts payable processing.

Paper Checks Still Dominate

60%

Our estimate for the total number of B2B payments still made by check.

Vs.

80%

Our estimate for the number of small/medium-size business payments made by check.

But AP Automation Can Cut Costs Up to...



75%

The potential net savings for businesses who adopt AP automation solutions.

The Revenue Opportunity

\$950bn

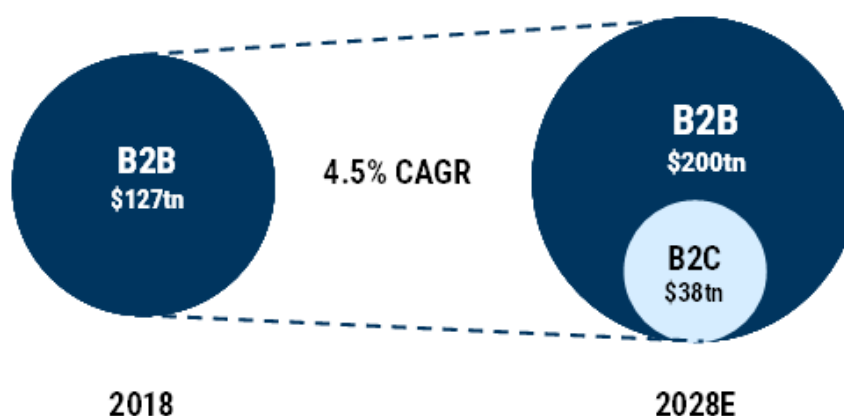
Across the B2B payments universe, we see the largest revenue opportunities in AP invoice processing, AP payment processing, working capital management and factoring, and cross-border payment optimization.

Setting the stage: The B2B market landscape

We estimate that B2B payments currently account for nearly \$127tn in payment flows - and expect this figure to reach nearly \$200tn by 2028, over 5X the volume of the retail payments market. With the majority of invoices still processed manually and paid by paper check, we see significant cost savings opportunities for businesses plus significant new revenue pools for payments and software companies entering the market with faster, lower-cost invoice processing and payment solutions. Although large businesses and enterprises account for over half of B2B payment flows, we see the biggest cost savings and industry revenue opportunities for small businesses, where 80% of invoices are still manually processed and paid by check.

We estimate that B2B payment volumes will reach \$200tn by 2028 - five times the size of the B2C market. We believe global B2B payments account for \$127tn in payment volume today and will reach \$200tn in ten years. We believe North America currently accounts for 20% of the B2B market or \$26tn in payment volume.

Exhibit 2: We estimate B2B volumes will reach \$200tn in the next decade, 5X the size of B2C volumes
Global payment volume estimates, 2018 vs. 2028

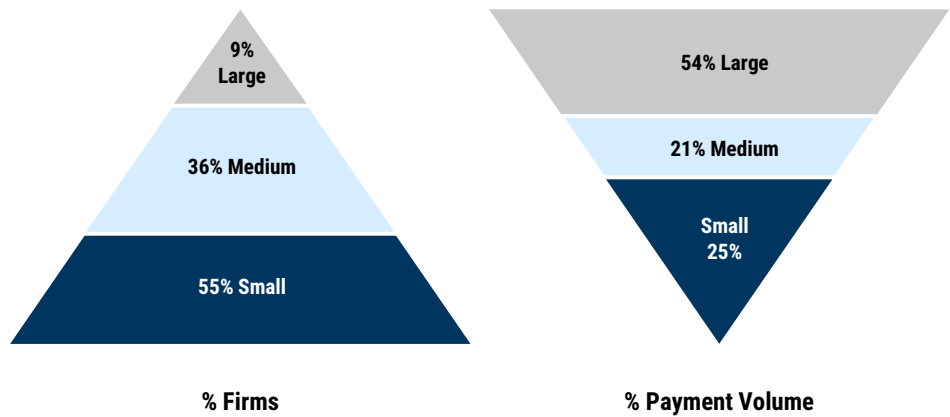


Source: Goldman Sachs Global Investment Research

Large businesses generate just over half of payment volumes...

In the United States, B2B payment flows are dominated by enterprises and large businesses (over \$500mn in revenue), even though less than 10% of firms fall into this category. We estimate that small businesses (under \$25mn revenue) account for only a quarter of B2B payment volumes even though over half of all US businesses fall into this category. We use US firm demographics as a proxy for North America (United States, Canada, and Mexico). Similar to the US and North America, we believe large businesses generate the majority of global B2B volumes - although we believe the international business mix is more heavily skewed towards small businesses.

Exhibit 3: SMBs represent over 50% of firms, but large businesses generate over 50% of payment volume
Distribution of US firms by size; distribution of US payment volume by firm size



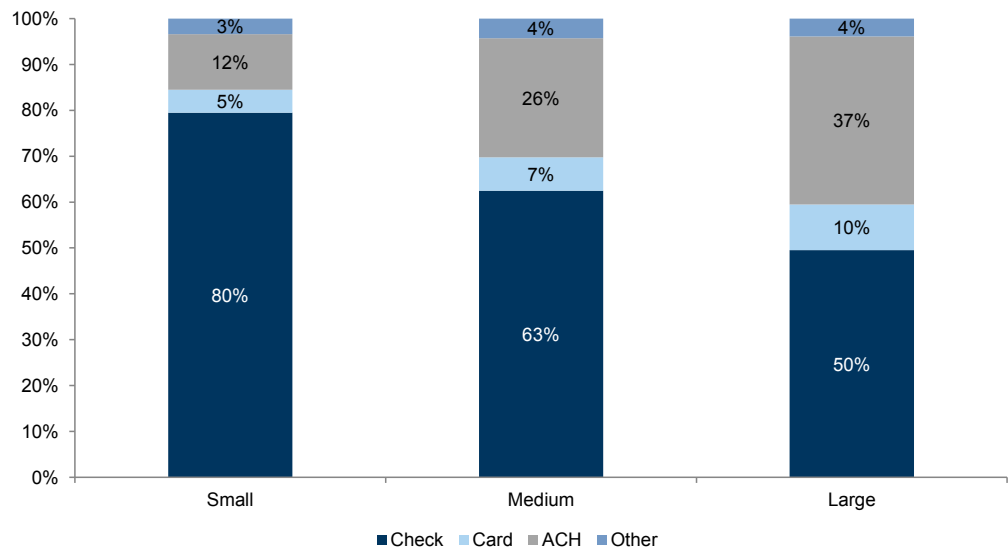
We define business by revenue size as follows: Small business under \$25mn, medium business \$25-\$499mn, large business \$500mn+.

Source: Visa, US Census Bureau, Goldman Sachs Global Investment Research

...and paper checks dominate the market today.

Overall, we estimate that nearly 60% of B2B payments in North America are still made with paper checks. While this varies by company size – we estimate checks account for up to 80% of small/medium-size business payments vs. roughly half of large business payments – paper checks remain the dominant form of payment across markets despite generating process inefficiencies and high overhead costs. Digital payment forms - including ACH and card - account for only 36% of B2B payments today.

Exhibit 4: We estimate checks still account for approximately 60% of B2B payments in North America
B2B payments mix by firm size, North America 2018



We define businesses by revenue as follows: Small businesses under \$25mn, medium businesses \$25-\$499mn, large businesses \$500mn+.

Source: Goldman Sachs Global Investment Research

Today's B2B market: Significant direct and indirect cost burdens, borne by small business

Today, the majority of businesses still depend on manual, paper-based payment processing, which represents a significant cost burden in terms of both time and money. We estimate businesses in North America are spending \$187bn annually on accounts payable ("AP") processing - and this estimate only captures direct processing and labor costs. In reality, we believe businesses are shouldering up to \$510bn in B2B payments costs when including indirect costs such as short-term credit for receivables financing and cross-border transaction fees. We believe the total direct and indirect B2B payments cost borne by global business is nearly \$2.7tn.

Exhibit 5: We estimate businesses spend over \$510bn in North America and \$2.7tn globally on AP
Estimates for direct and indirect manual AP costs

Cost per invoice using a manual AP management process					World Total
	Small	Medium	Large	Total	
Payment volume (\$bn)	\$6,500	\$5,460	\$14,040	\$26,000	\$127,320
Average invoice (\$)	\$1,000	\$3,000	\$10,000		
Invoices (mn)	6,500	1,820	1,404		
Direct costs	Small	Medium	Large	Total	Total
Processing cost					
Average processing cost per invoice	\$1.47	\$1.31	\$1.16		
Total processing cost (\$bn)	\$10	\$2	\$2	\$14	\$66
	0.1%	0.0%	0.0%	0.1%	0.1%
Headcount Costs					
Invoices processed per month	1,000	3,000	10,000		
Average headcount cost per invoice	\$20.79	\$14.69	\$8.23		
Total headcount cost (\$bn)	\$135	\$27	\$12	\$173	\$849
	2.1%	0.5%	0.1%	0.7%	0.7%
Direct cost per invoice	\$22.26	\$16.00	\$9.39		
Total direct cost (\$bn)	\$145	\$29	\$13	\$187	\$916
Total cost (%)	2.2%	0.5%	0.1%	0.7%	0.7%
Indirect costs	Small	Medium	Large	Total	Total
Cross-border cost					
Cross-border volume				\$3,941	\$23,099
Cost (% volume)				4.4%	4.4%
Total cross-border cost (\$bn)				\$174	\$1,020
Cash management cost					
Inventory financing cost (\$bn)				\$125	\$610
Late fees (\$bn)				\$25	\$122
Total cash management cost (\$bn)				\$150	\$732
Total indirect cost (\$bn)				\$324	\$1,752
Total direct + indirect costs (\$bn)				\$511	\$2,668

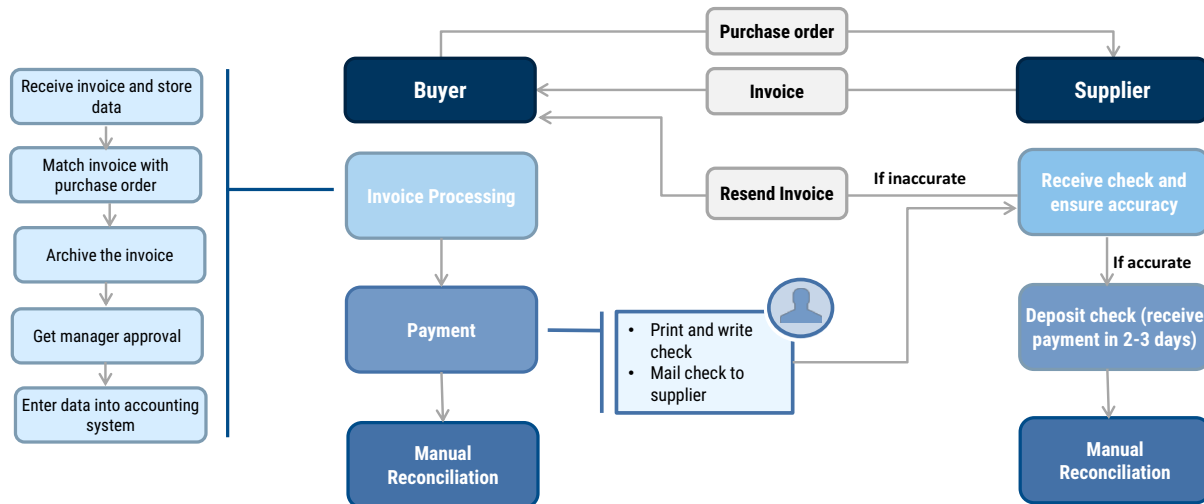
Source: Goldman Sachs Global Investment Research

Manual processing: The direct costs

Traditional payables processes are labor-intensive and inefficient, with manual intervention needed to receive and approve the invoice as well as to make the payment and reconcile accounts. In Exhibit 6, we outline a typical manual accounts payable process. Opportunities to automate these processes can yield significant cost savings.

Exhibit 6: Labor accounts for over half the costs in a traditional, manual AP process

Manual accounts payable process

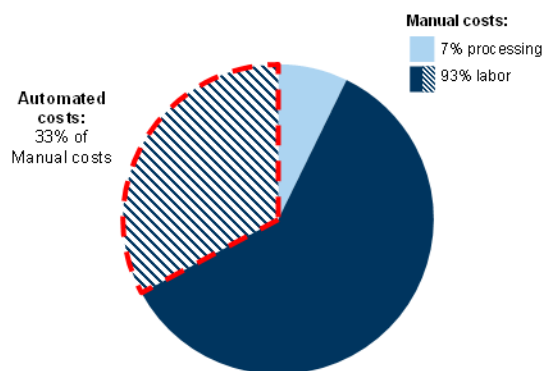


Source: Goldman Sachs Global Investment Research

Labor is the most significant single driver of these costs - we estimate it accounts for over 90% of direct costs incurred (Exhibit 7). According to a survey by Hyland Software, AP employees spend an average of 30% of their time collecting data (e.g., purchase orders and invoices) and answering questions from employees, collectors, or vendors related to the AP process (Exhibit 8). Employees also spend a significant amount of time resolving issues that arise from input errors and tracking down managers for approval. These pain points significantly increase the cost of AP processing.

Exhibit 7: We estimate automated costs are only 33% of manual costs, mainly due to the elimination of significant labor costs

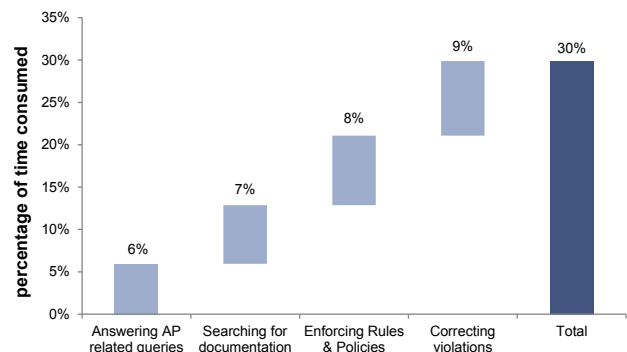
Comparison of manual costs (processing + labor) to automated costs



Source: Goldman Sachs Global Investment Research

Exhibit 8: Accounts payable personnel spend ~30% of their time on routine tasks

AP team work



Source: Hyland Software

Key pain points in manual AP processing include:

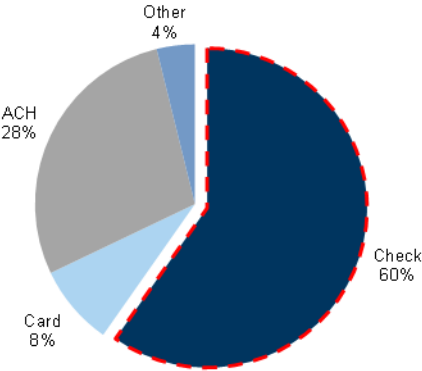
- **Invoice intake:** Invoices are not standardized across suppliers and instead are received in a huge variety of paper and electronic formats with non-standardized data fields. According to AvidXchange, 56% of invoices are received in a manual format (paper, PDF, email, or fax).
- **Data capture:** Given the abundance of non-standard invoice data, data often needs to be manually entered into a company's accounting and ERP systems. This process is costly - both in terms of labor and missed cost-savings opportunities - and prone to human error.
- **Matching:** Invoices must be matched against purchase orders and/or contracts. This process is highly manual, especially when purchase orders/contracts are housed in different systems or departments and prone to errors. Unmatched invoices need to be resolved, which often requires a lengthy dispute resolution process.
- **Approval:** Managers or department heads are frequently called upon to approve invoices for payment and resolve disputes, but tracking down the appropriate personnel can be slow and often results in missed discounts or late payments. This is particularly burdensome for small businesses, where executive officers average 5-10 times higher hourly rates than AP managers, as it substantially increases all-in labor costs.
- **Reporting:** Many companies have multiple back-office systems (purchasing systems, accounting software, ERP systems) that are not integrated with payment and invoicing data flows. This duplicates the data entry process and increases the likelihood of errors.

In 2015, Traxpay reported that 60% of B2B payments require some form of manual intervention that takes at least 15-20 minutes. Manual intervention - to resolve data entry errors, matching errors, duplicate payments - is a slow process that compounds labor costs and causes companies to miss rebates, pre-payment discounts, and even pay late fees.

Paper checks

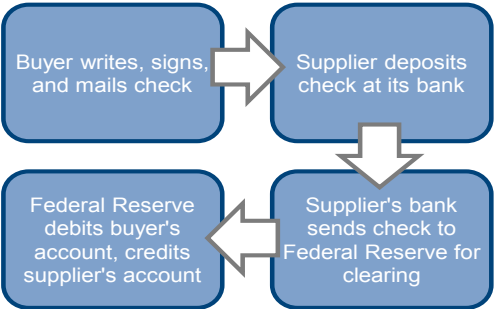
We believe 60% of B2B payments are still made by check, despite the fact checks create maximum inefficiencies for both buyers and suppliers (Exhibit 9). For the buyer, printing the check, obtaining the required signatures, and mailing the check is a manual, time-consuming process. We estimate the supplies alone (paper, postage) cost \$1.55/check. For suppliers, checks can cost \$7-\$10 to process (Billtrust) and take 3-5 days to settle, increasing a supplier’s days payables outstanding (DPO).

Exhibit 9: 60% of B2B volume still flows through checks
B2B payment mix



Source: Goldman Sachs Global Investment Research

Exhibit 10: Check processing



Source: Goldman Sachs Global Investment Research

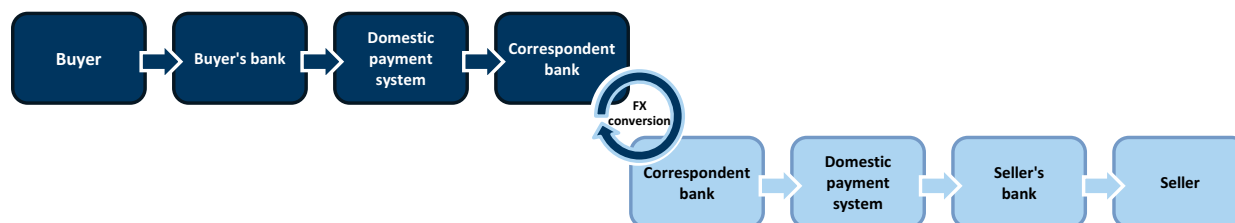
Indirect costs more than double spending on accounts payable

Cross-border payments

Funds cannot be directly transferred between banks in different countries. Instead, funds must be routed through correspondent banks, which have relationships with both the sending and receiving banks. This process is slow, transactions can take 3-5 days to clear, and costly. We estimate the transaction and FX fees average 4.0% - 4.5% of volume.

Exhibit 11: The majority of cross-border payments flow through correspondent banks, which charge hefty settlement and FX fees

Bank-to-bank cross-border payment flow

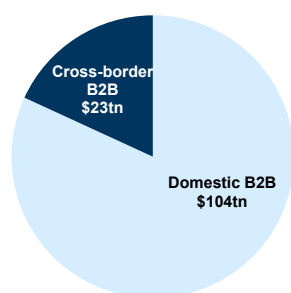


Source: Goldman Sachs Global Investment Research

Based on WTO estimates of global goods and services trade flows, we believe cross-border volumes account for nearly one-fifth of B2B payments (Exhibit 12). With non-bank cross-border payment rails just beginning to emerge, we believe over 95% of cross-border volume still flows through banks. Assuming an average transaction size of \$5,600 (per our analysis of SWIFT transaction data), bank fees of \$35-\$50 per transaction (consistent with industry data), and a FX spread, we estimate bank transfers generate around \$1tn of revenue (Exhibit 13).

Exhibit 12: Nearly one-fifth of B2B volume flows cross-border...

B2B volume, 2018



Source: World Trade Organization, Goldman Sachs Global Investment Research

Exhibit 13: ...yielding roughly \$1tn in revenue

Estimated revenue from B2B cross-border bank transfers

Cross-border opportunity	Revenue	% revenue
Cross-border volume (\$bn)	\$23,099	
via banks	\$21,944	95%
via alternate providers	\$1,155	5%
Cost to send via Bank		
Number of transactions		
Daily transactions ('000s)	15,105	
Annual transactions ('000s)	3,927,201	
Average transaction value (\$)	\$5,588	
Cost per transaction	\$45	0.81%
FX margin	\$189	3.38%
Total cost to send (\$bn)	\$917	4.18%
Cost to receive via Bank		
Average cost to receive transaction	\$23	
Annual transactions ('000s)	3,927,201	
Total cost to receive (\$bn)	\$88	0.40%
Total cost via bank (\$bn)	\$1,006	4.58%
Total cost via alt. provider (\$bn)	\$14	1.25%
Total cost - Current (\$bn)	\$1,020	4.42%

Source: World Trade Organization, SWIFT, McKinsey, Goldman Sachs Global Investment Research

Cash flow/working capital management

Manual AP processing is time consuming, often causing buyers to miss pre-payment discounts, rebates, or pay late fees. We estimate that each year late fees cost businesses an average of \$25bn in North America and \$122bn globally. Our estimates assume 5% of all invoices are 30 days past due.

Suppliers often do not receive payments until 30-60 days after sending an invoice or providing a service. This makes it difficult for small businesses, which often run with minimal working capital buffers, to manage cash and maintain minimum liquidity thresholds needed to operate. Many small businesses have to either rely on (1) a credit line – which can carry substantial interest costs, or (2) invoice factoring services – which purchase receivables at a steep discount.

- Small businesses draw on both commercial and personal credit lines. APRs for small business loans and credit cards typically run in the mid- to high-teens, depending on credit score, while APRs for personal credit cards can run in excess of 20%. With US payment terms averaging 30 days, interest costs add up quickly – we estimate small businesses could spend anywhere from \$600 to over \$850 just to cover a one-month \$50,000 shortfall (Exhibit 14).
- Invoice factoring services offer an alternative to credit lines – allowing businesses to sell outstanding invoices at a discount in exchange for cash. The process is fairly straightforward: factoring companies advance a certain percentage of the invoice (typically 70-90%) in cash and pay back the remainder of the invoice – less the factoring fees – after the customer pays. The factoring fee can be a flat fee, a tiered fee based on the length of time the invoice is outstanding, or a “prime plus” fee where interest is accrued each day the invoice is outstanding. In Exhibit 15, we provide an illustrative example of the potential loss if a business sells a \$50,000 invoice to a factoring company under each of these three models.

Exhibit 14: Cost to carry \$50,000 credit for 30/60/90 days

	APR	Cost to carry		
	Average	30 days	60 days	90 days
Business Loan	14.99%	\$616	\$1,232	\$1,848
Commercial credit card	17.99%	\$739	\$1,479	\$2,218
Personal Loan	14.99%	\$616	\$1,232	\$1,848
Personal credit card	21.12%	\$868	\$1,735	\$2,603

Source: American Express, JP Morgan, Goldman Sachs Global Investment Research

Exhibit 15: Cost to sell \$50,000 invoice to a factoring company

Assumptions				
Invoice value	\$50,000			
Prime rate	5.0%			
Factoring model				
	Fee	30 days	60 days	90 days
Flat fee	5.0%	\$2,500	\$2,500	\$2,500
Fee		5.0%	5.0%	5.0%
Tiered fee	2.0%	\$1,000	\$2,000	\$3,000
Fee	per month	2.0%	4.0%	6.0%
Prime plus	prime	\$417	\$833	\$1,250
Fee	+ 5.0%	0.8%	1.7%	2.5%

Source: Goldman Sachs Global Investment Research

Ultimately, we believe businesses spend over \$125bn in North America on supply chain financing and over \$610bn worldwide. Our estimates assume SMBs turn to short-term financing solutions (30 days at a 9% average APR) to finance around a third of their invoices each quarter, while large businesses do not use supply chain financing solutions.

Exhibit 16: We believe businesses in North America spend over \$125bn on supply chain financing...

North America financing costs (\$bn)

Mths/yr need financing	% invoices financed				
	10%	20%	30%	40%	50%
2	\$44	\$64	\$83	\$103	\$122
3	\$55	\$79	\$104	\$128	\$153
4	\$66	\$95	\$125	\$154	\$183
5	\$77	\$111	\$145	\$179	\$214
6	\$88	\$127	\$166	\$205	\$244

We assume businesses pay a 1-2% annual fee to access 30-day financing at a 9.00% APR.

Source: Goldman Sachs Global Investment Research

Exhibit 17: ...and global businesses are collectively spending over \$610bn

Global financing costs (\$bn)

Mths/yr need financing	% invoices financed				
	10%	20%	30%	40%	50%
2	\$216	\$311	\$407	\$502	\$598
3	\$270	\$389	\$508	\$628	\$747
4	\$324	\$467	\$610	\$753	\$897
5	\$378	\$545	\$712	\$879	\$1,046
6	\$432	\$623	\$814	\$1,005	\$1,196

We assume businesses pay a 1-2% annual fee to access 30-day financing at a 9.00% APR.

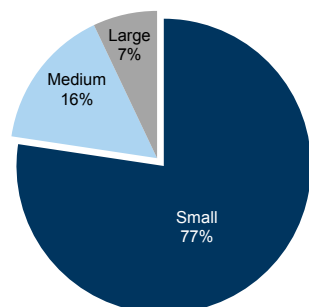
Source: Goldman Sachs Global Investment Research

Small businesses bear the brunt of AP costs

Accounts payable processing benefits significantly from economies of scale. As such, we believe small businesses account for nearly 80% of spending on labor and accounts payable processing (Exhibit 18). Consequently, they stand to benefit the most from AP automation (Exhibit 19).

Exhibit 18: Small businesses spend the most on AP...

Total spend on AP by company size

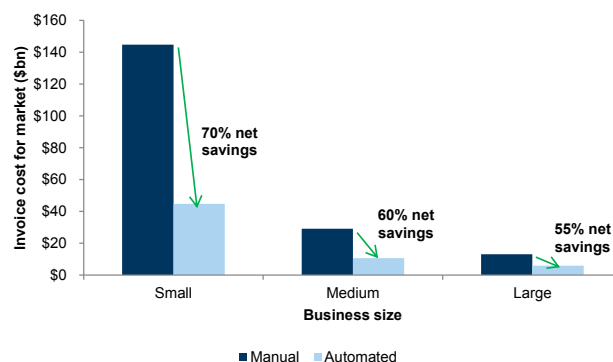


We define businesses by revenue as follows: small businesses <\$25mn, medium businesses \$25-499mn, large businesses \$500mn+.

Source: Goldman Sachs Global Investment Research

Exhibit 19: ...positioning them to be the biggest beneficiaries of AP automation

Estimated net savings by business size



Source: Goldman Sachs Global Investment Research

How can payment and software solutions help?

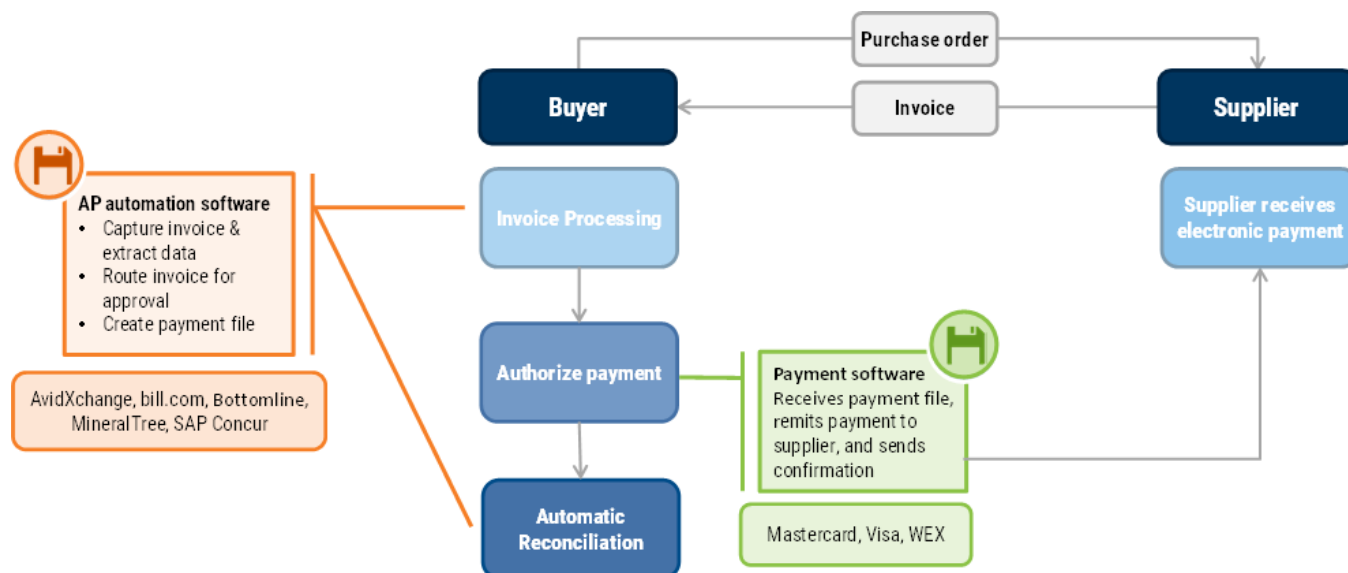
Today, organizations are focused on automating accounts payable processes to generate G&A savings. We see this as the biggest near-term opportunity in B2B payments, but over the longer term see significant opportunities for specialist providers to supply working capital and cash management solutions.

Payables automation

Managing the AP process is a significant hurdle and cost center for many businesses. Numerous solutions have emerged to address different pain points in the payables process:

- **Pre-payment solutions** are improving the procurement process, aggregating bills, automating invoice processing, and streamlining approval workflows.
- **Payment solutions** are replacing manual check payments with electronic alternatives including ACH, card, virtual card, and push payments.
- **Post-payment solutions** are helping companies with account reconciliation and cash management.

Exhibit 20: Numerous solutions have emerged to streamline pre-/post-payment workflows and facilitate payments
Opportunities for automating AP processes



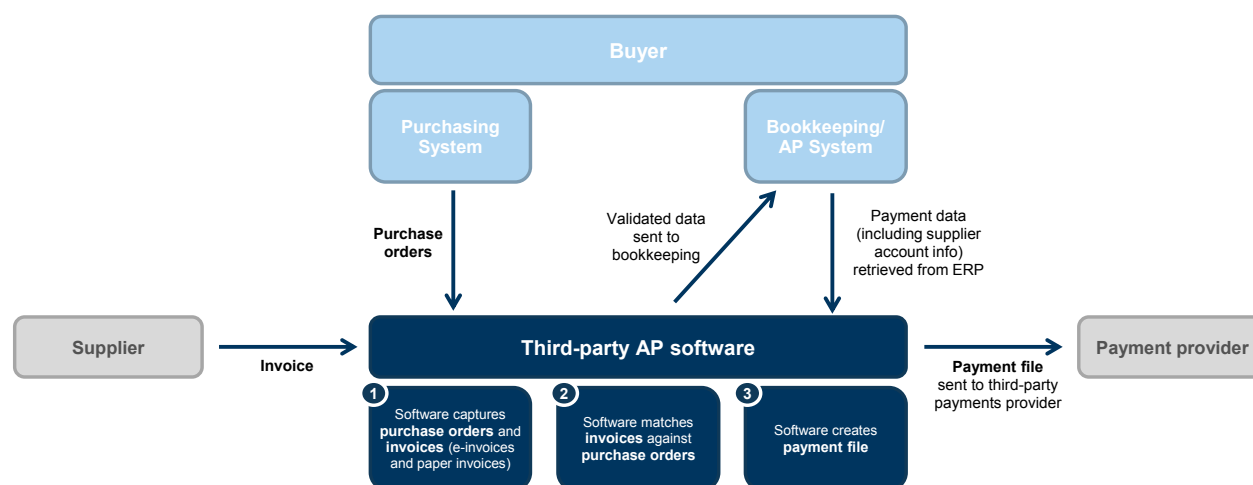
See "Who can make money and how much?" for a detailed breakdown of different vendors' AP processing and reconciliation solutions

Source: Goldman Sachs Global Investment Research

These pre- and post-payment solutions often integrate directly with a company's existing back office software (Exhibit 21).

Exhibit 21: These solutions integrate directly with a company's back office software

Typical ERP integration



Source: Basware, Goldman Sachs Global Investment Research

Payment Solutions: Cutting the cost burden of paper checks

To reduce the pain points associated with paper checks, providers are pushing a variety of electronic payment alternatives including ACH/EFT, cards, virtual cards/single-use accounts, and push payments. We summarize these four alternatives below:

- **ACH:** In ACH transactions, funds are transferred between bank accounts over the Automated Clearing House (ACH) network – an electronic payment network. Typically, the buyer sends payment instructions to its bank. The buyer's bank bundles all of the ACH requests it has received and sends them to the ACH operator. The ACH operator then distributes these requests to the appropriate receiving banks. ACH has been gradually taking share from paper checks and, based on a survey by the CRF and NACHA, is expected to exceed check volume by 2020. However, ACH remains slow due to wide technology gaps between the 12,000+ banks in the United States. Transfers typically take one to two days to process and clear, and ACH records provide limited detail on the nature of the transaction (sender, recipient, amount). The lack of underlying transaction details (such as the specific item being invoiced) makes it difficult to reconcile payments. However, Mastercard has been working to bring same-day (and eventually real-time) ACH to the United States after acquiring VocaLink - the United Kingdom's leading-edge instant payment clearing system.
- **Cards:** B2B card payments (travel and entertainment, fleet, P-cards, etc.) operate the same way as B2C card payments. The supplier charges the card, and the supplier's gateway/acquirer captures the request and sends it to the acquiring bank. The acquiring bank sends a request to the issuing bank over the card network, and the issuing bank decides whether or not to authorize the transaction. Authorization

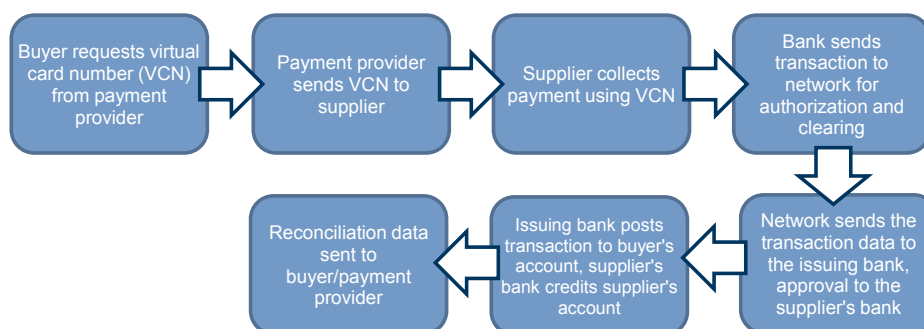
is then sent back over the card network to the acquiring bank and through the acquirer to the merchant.

Although corporate credit cards first emerged in the 1970s, their usage continues to grow at a rapid clip - with US commercial card volume outpacing US consumer card volume growth by about 110bps in 2017.

- **Virtual cards/single-use accounts:** A virtual card is a single-use account number that processes against a predetermined credit limit equal to the amount to be paid. The virtual card is created by an application that can be hosted by a payment provider (e.g., WEX), bank issuer, or the card network. The virtual card application provides a secure, convenient way for users to sign in, request a card, and specify how it will be used (including things like amount, timeframe, supplier name, number of transactions). Virtual card payments can either be made in real-time or in batches.

Virtual card transactions include rich remittance data that makes it easier for suppliers to reconcile accounts compared to ACH transfers, which only provide the sender's name and the amount transferred. Using virtual cards for international payments could also help to minimize cross-border fees and other surcharges since transactions do not need to be routed through a correspondent bank. While virtual card solutions have been in existence for 10-15 years, growth is inflecting given a heightened focus on cash management, product maturity, and and regulation-driven demand in verticals like healthcare, construction, and online travel.

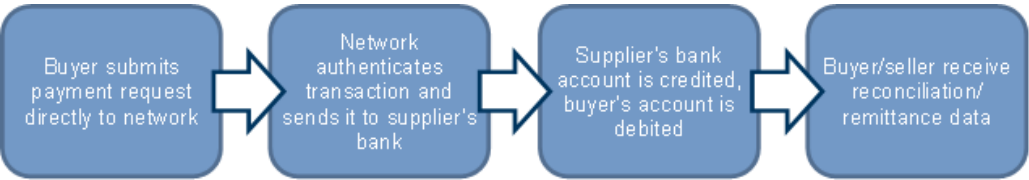
Exhibit 22: Virtual card payments



Source: Goldman Sachs Global Investment Research

- **Push payments:** Push payments reverse the traditional payment process as buyers initiate the transaction and proactively “push” funds into the supplier’s account.
Push payments offer clear time and cost savings: transactions are settled in real time, giving companies better visibility on cash flows, and run on the networks’ debit rails - so we would expect pricing to begin to approximate current debit card spreads over time. Push payment transactions also provide rich data records with details about the underlying transactions, making it easier for businesses to track payments and reconcile accounts, and security, since transactions only require a debit card number (versus the recipient’s bank account information, which is needed for ACH).

Exhibit 23: Push payments



*Also referred to as direct debit, buyer-initiated payments (BIP), and straight-through processing (STP)

Source: Goldman Sachs Global Investment Research

Quantifying the savings

Reducing direct costs - paper, postage, payment processing and labor

We see automating the pre-payment process as the largest immediate revenue opportunity for the industry.

We see automating pre-payment workflows - from receiving the invoice through authorizing the payment - as the biggest near-term opportunity. A number of solutions have already emerged targeting small and mid-sized businesses, which currently shoulder nearly 80% of manual processing costs worldwide.

Where are the inefficiencies and where are the savings? AP automation speeds up invoice processing and cuts labor costs. This combination not only drives down costs and allows companies to reallocate headcount to higher-value work, but enables growing companies to scale their AP operations without increasing headcount. Speeding up AP processing also positions companies to capture rebates and pre-payment discounts.

Exhibit 24: Time savings is the biggest benefit of using AP automation solutions

Various steps involved in AP management (pre-payment)

Pre-payment process	Process description	Inefficiencies in the process	How AP automation can help?	Nature of savings
Capturing data from invoices	Manually enter data from each invoice into the company's ERP	<ul style="list-style-type: none"> - Invoices received in numerous formats (paper, email, or fax) - Time spent on manual data entry - Data inaccuracies from manual entry 	Automatically reads and captures data from the invoices (using OCR, other technologies)	Time savings
Matching invoices against POs/contracts	Match each invoice against a PO or contract to ensure the invoice is valid	<ul style="list-style-type: none"> - Time spent manually matching each invoice - POs are typically spread across different departments - Difficult to ensure accuracy - Time spent addressing unmatched invoices 	Automatically matches invoices to POs through integrations with the company's other systems and accounting software	Time savings
Approvals	Get the necessary approvals to process the payment	<ul style="list-style-type: none"> - Time delays when payments require multiple approvals - Time spent by AP personnel answering approver's questions since no centralized system exists for the approver to independently check the accuracy - Time spent by approver 	Automatically notifies the Approver once the invoice is matched with the PO and approver can send approval through the App/solution itself	Time savings
Writing and sending checks	Writing and sending checks	<ul style="list-style-type: none"> - Time from receiving the approval to the payment being processed could take 7-10 days - Time spent writing checks - Inaccuracies in checks - Postage costs - Lost/misplaced checks 	Once the invoice is approved, the solution can process payments in real-time or one business day if buyers pay via ACH, virtual card, or a push payment.	Time savings, postage/paper cost savings

Source: Goldman Sachs Global Investment Research

Based on our conversations with users and providers of AP automation solutions, we estimate that SMBs pay an average of \$16-\$22 to manually process an invoice, but that this can be reduced to \$6-\$7 (60%-70% net savings) after adopting AP automation (Exhibit 25). Our key assumptions driving the analysis are as follows:

■ **Payment mix**

- We believe checks currently account for 65%-80% of B2B payments for SMBs.
- After shifting to AP automation solutions, we think ACH will account for 40-50% of payments, virtual cards will account for approximately 30% of payments, and checks will only account for 15-25% of payments.

■ **Headcount**

- We assume a SMB's typical AP team includes clerks, analysts, supervisors, and a manager. Our headcount assumptions reflect an estimate of the industry average, but actual headcounts vary substantially depending on the industry, scale of the business, and existing processes.
- We think AP automation can drive 70-80% time savings for AP staff. In our analysis, time savings are represented in USD, but in reality companies do not recognize hard dollar savings through headcount reduction since excess staff will typically be reallocated to higher-value work.

- **Software solution pricing:** AP automation solutions typically charge a fixed fee per invoice, plus a nominal monthly subscription fee for the solution. Based on our interactions with various solution providers, we assume pricing of \$1.25-\$1.50 per invoice.

For larger companies, we estimate invoices cost roughly \$9 each to process, which can be reduced to roughly \$4 (55% net savings) with AP automation. Large companies usually rely on ERP accounting software, which often provides account reconciliation and invoice matching, but rarely provides integrated payments. As a result, we believe roughly 50% of invoices are still paid with paper checks. AP automation should not only increase electronic payment adoption across large companies, but reduce the time spent by the AP staff managing the AP process by 65%-70%.

Exhibit 25: We see potential for net savings of ~70% for SMBs and ~55% for large companies who adopt AP automation

Key assumptions, costs, and savings for SMBs from using an AP automation solution

Cost per invoice using a manual AP management process				
Processing costs (paper, postage, processing)				
Split of Payment Process used to pay major suppliers				
		Small	Medium	Large
Payment Method	Cost			
Checks	\$1.55	80%	63%	50%
ACH	\$0.30	12%	26%	37%
Virtual Cards	\$1.25	5%	7%	10%
Others	\$4.00	3%	4%	4%
A Average processing cost per invoice		\$1.47	\$1.31	\$1.16

Headcount Costs			
	Small	Medium	Large
Invoices processed per month	1,000	3,000	10,000

	Salary (\$/hour)	Headcount		
AP Clerk	19	3	6	10
AP Analyst	24	1	3	5
AP Supervisor	29	0	1	3
AP Manager	38	1	1	2
Total Headcount		5	11	20

	Headcount cost per Invoice		
AP Clerk	9.98	6.65	3.33
AP Analyst	4.16	4.16	2.08
AP Supervisor	0.00	1.66	1.50
AP Manager	6.65	2.22	1.33
B Total headcount cost per invoice	\$20.79	\$14.69	\$8.23

	Small	Medium	Large
A+B Total cost per invoice	\$22.26	\$16.00	\$9.39

Cost per invoice using an AP management software/service				
Processing costs (paper, postage, processing)				
Savings in processing costs				
		Small	Medium	Large
Payment Method	Cost			
Checks	\$1.65	25%	15%	10%
ACH	\$0.30	42%	50%	55%
Virtual Cards	\$0.80	30%	32%	35%
Others	\$4.00	3%	3%	0%
C Average processing cost per invoice		\$0.90	\$0.77	\$0.61

Headcount Costs			
	Small	Medium	Large
Invoices processed per month	1,000	3,000	10,000

	Reduction in working hours on AP		
AP Clerk	80%	75%	70%
AP Analyst	80%	75%	70%
AP Supervisor	75%	70%	65%
AP Manager	75%	70%	65%
Total Headcount	2	3	7

	Headcount cost per Invoice		
AP Clerk	2.00	1.66	1.00
AP Analyst	0.83	1.04	0.62
AP Supervisor	0.00	0.50	0.52
AP Manager	1.66	0.67	0.47
D Total headcount cost per invoice	\$4.49	\$3.87	\$2.61

	Small	Medium	Large
C+D Total cost per invoice	\$5.39	\$4.64	\$3.22

E Software/service charge	\$1.50	\$1.25	\$1.00
----------------------------------	---------------	---------------	---------------

C+D+E Total Cost per invoice	\$6.89	\$5.89	\$4.22
-------------------------------------	---------------	---------------	---------------

Absolute savings	76%	71%	66%
-------------------------	------------	------------	------------

Net savings	69%	63%	55%
--------------------	------------	------------	------------

Savings based on our 10-year forecasts for AP automation adoption and payment method mix. Absolute savings reflects processing and labor savings; net savings includes software/service charges.

Source: Primary research, Goldman Sachs Global Investment Research

Beyond AP automation...

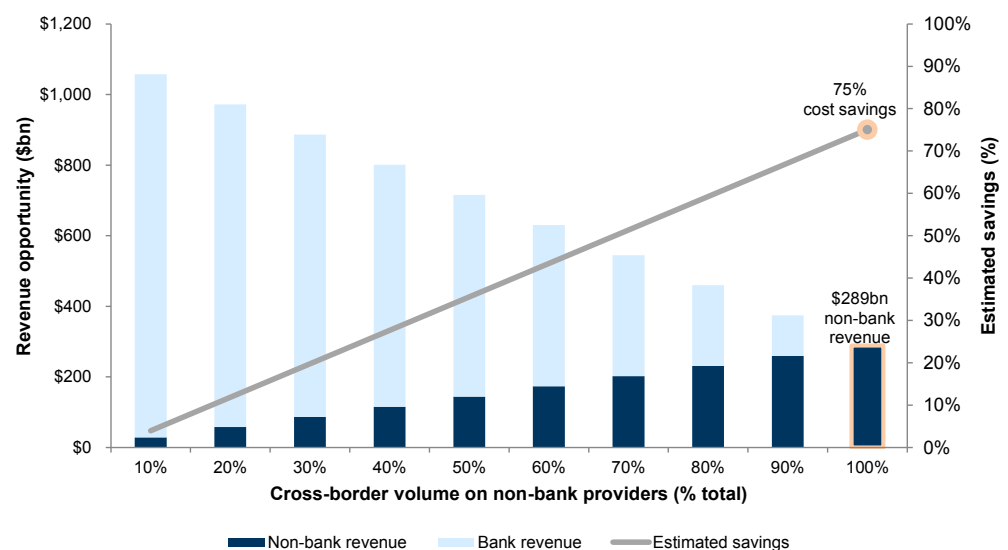
In addition to general AP automation solutions, more targeted solutions have emerged for cross-border payments, disbursements, short-term financing, and specific industry verticals.

Cross-border payments

We see a significant opportunity for cross-border providers that can undercut bank pricing by eliminating correspondent bank fees and locking in FX rates. In Exhibit 26, we show the incremental revenue opportunity for non-bank providers and corresponding savings for companies as volumes shift from banks to non-bank providers. Our analysis only captures savings on transaction and FX fees, and does not factor in the value of faster settlement times. However, with cross-border bank transactions taking up to 3-5 days, we see faster settlement times as a catalyst for faster adoption of non-bank solutions.

Exhibit 26: Ultimately, we believe companies can cut costs 75%, a ~\$290bn opportunity for non-bank providers

Cross-border transfers: Estimated cost savings (%) and revenue opportunity (\$bn)



Currently ~95% cross-border volume goes through banks.

Source: Goldman Sachs Global Investment Research

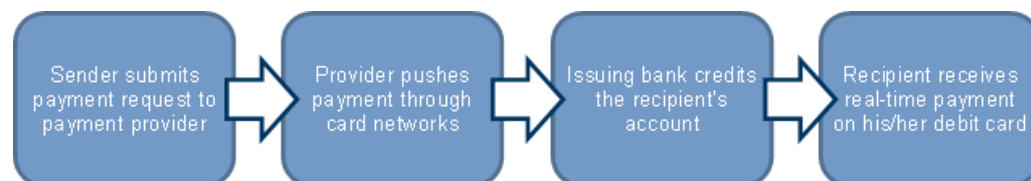
The players: Beyond banks and credit card networks, solution providers include established niche players (Cambridge FX), traditional remittance providers (Western Union), and start-ups such as Payoneer, GoCardless, and TransferMate. These providers offer faster settlement times (e.g., Payoneer offers instant transfers between Payoneer accounts), low fees (GoCardless charges 1% per transaction and TransferMate charges a flat \$5 fee on transfers under \$5,000), and the opportunity to lock in real-time FX rates. See our company catalogue for more details.

Disbursements

Disbursements are push payments - funds are "pushed" from the buyer's account into the supplier's account (Exhibit 27). There are two primary use cases for disbursements

in B2B: (1) payments to suppliers and (2) direct payroll for contractors, freelancers, and 1099 workers. We expect disbursement solutions to see the fastest adoption in the gig economy, where companies need to pay contractors, resellers, and suppliers. This includes both freelancers and contractors in the Sharing Economy - including Uber and Lyft drivers, Airbnb hosts, and food delivery couriers.

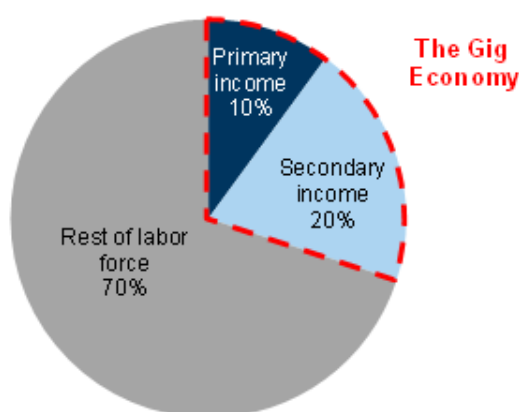
Exhibit 27: Disbursements (direct debit/push payments)



Source: Goldman Sachs Global Investment Research

The “Gig Economy” opportunity: We estimate that 30% of US workers participate in the gig economy on either a full-time basis or as a supplemental source of income and collectively earn over \$1.3tn in 2018.

Exhibit 28: Contract workers represent ~30% of the US labor force... US labor force



Source: US Bureau of Labor Statistics, Federal Reserve, Cornell ILR, Goldman Sachs Global Investment Research

Exhibit 29: ...and will collectively earn about \$1.3tn in 2018 Estimate of US gig economy

US population ('000s)		% employed	
Population (adults)	328,055		
Population (16+)	214,843		
US labor force ('000s)		% employed	
Labor force	162,245		
Employed	155,965		
Gig economy		no. workers	% employed
All workers	46,790	30.0%	
Primary source of income	15,752	10.1%	
Secondary source of income	31,037	19.9%	
Earnings (\$mn)		Weekly	Annual
Primary source of income	826	41,297	
Secondary source of income	781	39,030	
Market size (\$mn)		1,310.835	

Source: US Bureau of Labor Statistics, Federal Reserve, Cornell ILR, Goldman Sachs Global Investment Research

Shifting check payments to digital disbursements eliminates the inefficiencies tied to paper checks and gives contractors faster access to funds. Assuming 1.5% pricing, we see a \$20bn revenue opportunity in the United States and - assuming the same mix of gig workers in the global economy - a \$96bn global revenue opportunity.

While our revenue opportunity is limited to “gig workers,” we see a larger opportunities as the rest of the labor force pushes for faster access to their paychecks. Based on the size of the US labor force and average hourly earnings, we believe there is an opportunity to process over \$6.8tn in Direct Payroll. Assuming the same 1.5% pricing, this would equate to over a \$100bn revenue opportunity just within the US.

The players: Card networks are the chief infrastructure providers for direct debit payments, but there are a number of providers who offer disbursement solutions that run over the networks’ rails or operate their own closed-loop supplier payment

networks. We see privately held Payoneer as one of the leaders in disbursement processing, with over 4mn users collecting payments from major marketplaces and networks including Amazon and Airbnb. Within our coverage, Square has also launched a domestic disbursement solution that allows its customers to pay contractors via direct deposit for \$5 per month. See our company catalogue for more information.

Working capital and financing solutions

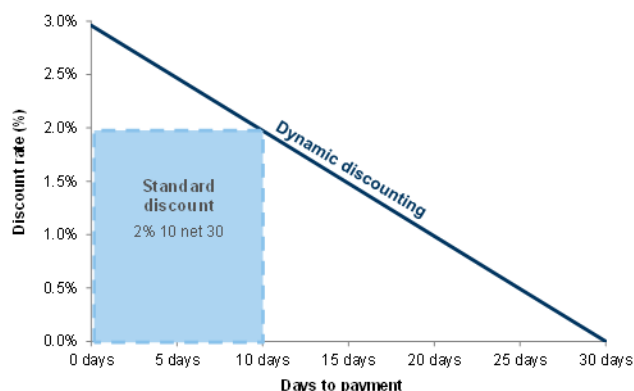
Automating AP processing allows businesses to pay and get paid faster. For buyers, this means avoiding late fees and capturing pre-payment discounts and rebates. For suppliers, this means better working capital and cash flow management.

While we expect invoice and payment processing solutions (domestic + cross-border) to experience the fastest adoption, we also see tremendous opportunities for working capital management and cash management (i.e., dynamic discounting) solutions. Dynamic discounting takes standard prepayment discounts, such as 2% 10 net 30 (i.e., a 2% discount if the buyer pays within 10 days following invoice issuance), to the next level. With dynamic discounting, a buyer can set an APR and the supplier can decide how early it wants to be paid based on that APR. Working capital and cash management solutions are only beginning to emerge, but we expect competition to intensify and to see more solutions that offer direct interfaces between the supplier and buyer, allowing them to negotiate discounts, and offer real-time payments.

Exhibit 30: With dynamic discounting, the buyer sets an APR and the seller can choose when it wants to be paid based on the APR
Discount rate (%)

APR (%)	Days to payment			
	0	10	20	30
6%	0.5%	0.3%	0.2%	0.0%
9%	0.7%	0.5%	0.2%	0.0%
12%	1.0%	0.7%	0.3%	0.0%
15%	1.2%	0.8%	0.4%	0.0%
18%	1.5%	1.0%	0.5%	0.0%
21%	1.7%	1.2%	0.6%	0.0%
24%	2.0%	1.3%	0.7%	0.0%

Exhibit 31: This provides more flexibility than traditional “all or nothing” discounts
Illustrative example of dynamic discounting



Source: Goldman Sachs Global Investment Research

Source: Goldman Sachs Global Investment Research

Beyond specific financing solutions, a complete “procure-to-pay” working capital solution would enable an organization to manage its business more efficiently by raising purchase orders based on current inventory levels and FX movements, automatically approving invoices after the procurement process is complete, processing payments, reconciling accounts, and using analytics to forecast net cash and make decisions around raising short-term debt or paying down debt. We see a significant opportunity for these solutions to gain traction with larger organizations that have complex, global supply chains.

Who can make money and how much?

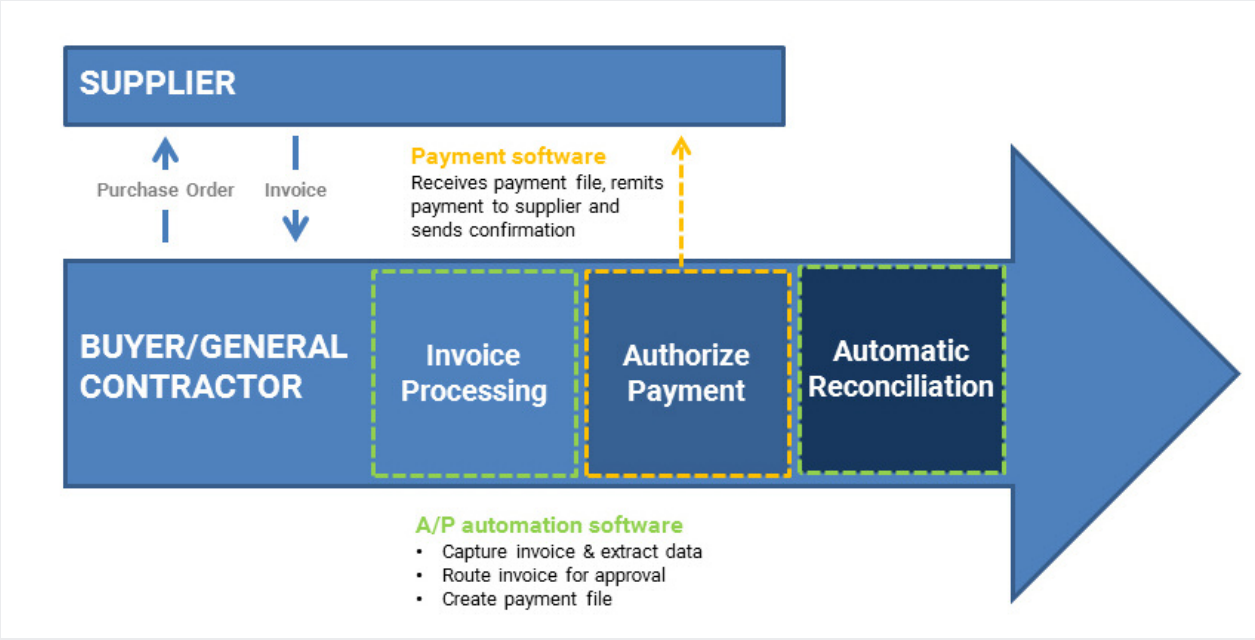
Payment processors, software companies, banks, and services providers are vying to help businesses take control of manual, paper-based payables processes - but in many cases, competition is not the only force at work. Partnerships are becoming vitally important for vendors across the B2B market looking to distribute complete solutions to SMBs. We see meaningful revenue opportunities for all these groups:

- **Payments companies:** Payment companies - including card networks, merchant acquirers, and virtual card providers - are responsible for transferring funds between the buyer and the supplier to settle an invoice. Payment processing is often integrated with ancillary software and services provided by other vendors. In many cases, payment companies serve as the aggregator of software and services solutions because of their position at the heart of the B2B ecosystem.
- **Software and services companies:** Software and services companies provide workflow solutions and ancillary software that integrates with traditional ERP and accounting software to help ease pain points for businesses. In the core accounts payable market, a range of vendors offers software to automate AP processing - receiving and matching invoices and purchase orders, streamlining the approval process, and reconciling payments in the company's general ledger. A number of vendors also provide specialized solutions for cross-border payments, disbursement payments, and solutions to help companies bridge cash shortfalls and finance working capital.
- **Banks and financial institutions:** Payment companies and software/services providers often work with banks to distribute their solutions to market, given that in many cases banks retain the core client relationship. Payment processors (like FleetCor and WEX) and software/services providers (like AvidXchange and MineralTree) will often "white label" their solutions to banks or partner with other companies offering payments services, such as accounting firms. This enables the providers to reach a significant number of companies while minimizing sales and marketing costs.

A Small Business Case Study

Consider the example of an independent general contractor who wishes to automate his supplier payments. The home contractor might bank at a regional bank (such as Fifth Third) and hear about Fifth Third’s Expert AP offering, which is white label solution provided by AvidXchange. The contractor can use Fifth Third Expert AP to automate the entire accounts payable process from receiving the invoice to making payments. If the contractor pays by virtual card or Fast ACH, the payment will be powered by Mastercard. In this case, the economics would be split between Fifth Third (the distributor), AvidXchange (the software/services provider), and Mastercard (the payment processor).

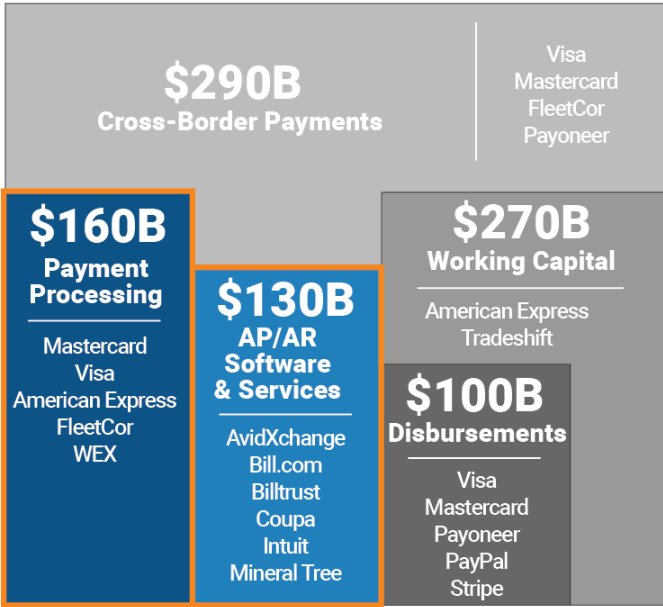
Exhibit 32: How the B2B payments process works for small business.



Source: Goldman Sachs Global Investment Research

Overall, we see a \$300bn revenue opportunity in core payment processing and AP software/services - and a \$950bn revenue opportunity when taking into account specialized B2B solutions for cross-border payments, disbursements, and working capital financing. We see this broader B2B revenue opportunity reaching \$1.5tn by 2028.

Exhibit 33: B2B market landscape with key public and private



Source: Goldman Sachs Global Investment Research

Card networks: B2B payments represents the next frontier

Apart from niche corporate payments such as travel and entertainment (T&E), card networks have historically focused on consumer payments. However, they have now started to concentrate significant attention and resources on the B2B payment opportunity - and we believe even modest penetration in the B2B market can drive meaningful revenue upside for the card networks over time.

We believe 5%-10% of B2B payments can be automated by 2023, which represents a revenue opportunity of around \$12bn for the card networks, depending on pricing and the split between the network, software provider, and bank (Exhibits 33-34).

Exhibit 34: We believe 5%-10% of AP payment volumes could be automated by 2023...

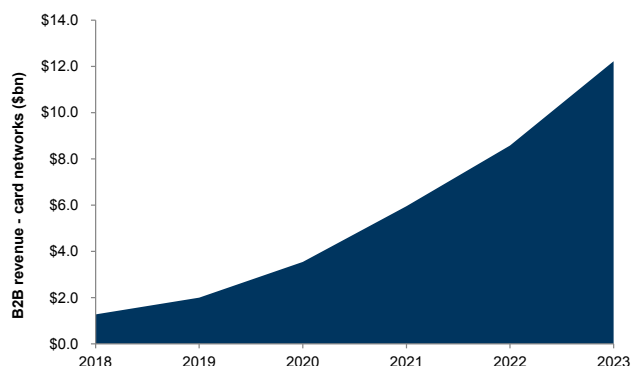
Card network revenue opportunity (\$mn), 2023

2023 Market penetration	Card network pricing (%)					
	0.05%	0.06%	0.07%	0.08%	0.09%	0.10%
5%	4,074	4,888	5,703	6,518	7,332	8,147
6%	4,888	5,866	6,844	7,821	8,799	9,777
7%	5,703	6,844	7,984	9,125	10,265	11,406
8%	6,518	7,821	9,125	10,428	11,732	13,035
9%	7,332	8,799	10,265	11,732	13,198	14,665
10%	8,147	9,777	11,406	13,035	14,665	16,294

Source: Goldman Sachs Global Investment Research

Exhibit 35: ...roughly a \$12bn opportunity for the card networks

Card network revenue opportunity (\$mn), 2018-23



GS base case assumes 7.5% market penetration by 2023, 10bp pricing for card networks.

Source: Goldman Sachs Global Investment Research

Among the card networks, we expect Mastercard to be the biggest beneficiary of B2B payments growth given it currently has the most comprehensive suite of B2B product offerings including Fast ACH (through VocaLink), Mastercard Send, and virtual cards (Exhibit 35). Overall, we believe B2B payments (ex-T&E) could account for as much as 20% of Mastercard's revenue by 2023.

Exhibit 36: We believe Mastercard has the most comprehensive suite of B2B payment products...

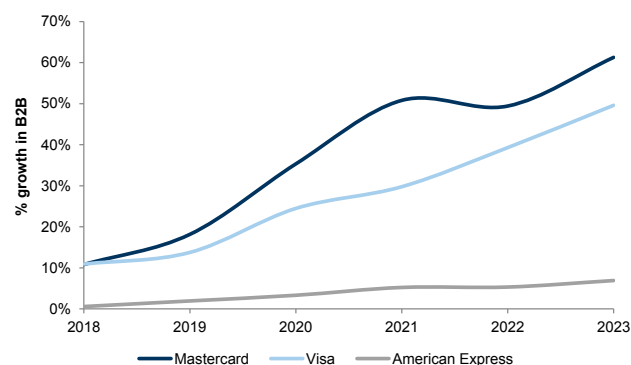
Network comparison

Network comparison		V	MA	AXP
B2B	Commercial Cards	+	+	++
	Virtual Cards	+	++	+
	Fast ACH	--	+	--
B2B/B2C/G2C	Push payments	+	+	+
	Lending	--	--	+

Source: Goldman Sachs Global Investment Research

Exhibit 37: ...and should be the biggest beneficiary of B2B growth over the next 5 years

% growth in B2B, 2018-23



GS base case assumes 7.5% market penetration by 2023, 10bp pricing for card networks.

Source: Goldman Sachs Global Investment Research

Mastercard (MA)

- **Product:** Mastercard's commercial card offerings include travel and entertainment (T&E), fleet cards, purchasing cards, and corporate virtual cards. Beyond cards, Mastercard has developed new commercial solutions including the Mastercard B2B Hub (AP optimization platform), Mastercard Track (global trade platform), Mastercard Send (for cross-border payments), and Fast ACH (through its acquisition of VocaLink). Like the other card networks, Mastercard's commercial card offerings are the most mature (currently about 11% of global volume and growing in the

mid-teens), but it is in the process of rapidly scaling its virtual card and fast ACH solutions.

- **Revenue model:** Mastercard earns an assessment fee on each transaction it processes - with higher fees for cross-border transactions and data processing - and charges additional fees for other payment-related products and services. On the flip side, Mastercard gives its customers volume-based rebates to help stimulate volume growth.
- **Customers:** Mastercard's commercial card products are used by businesses of all sizes worldwide. Mastercard is still in the process of rolling out its newer B2B offerings - including the Mastercard B2B Hub, Mastercard Track, Fast ACH, and Mastercard Send - across its client footprint. Some of these products are designed for narrower audiences; for example, the Mastercard B2B Hub is geared for small- and mid-size companies.
- **Differentiation:** Although Mastercard ranks third in terms of commercial card volume, we think Mastercard has the most comprehensive portfolio of B2B payment products across the card networks with virtual cards, Fast ACH, and Mastercard Send. Mastercard is the leader in virtual cards and the only card network with Fast ACH, a capability it acquired in 2017 with its acquisition of the United Kingdom's leading instant payment clearing system VocaLink. Mastercard is currently bringing Fast ACH to other markets including the United States (launched in the United States in partnership with NACHA in late 2017). Mastercard has partnered with a number of financial institutions to market its cross-border B2B direct deposit solution and has partnered with technology companies - including Oracle, AvidXchange, and Nvoicepay - to integrate its payment products directly into their AP offerings.

Visa (V)

- **Product:** Visa's B2B portfolio includes corporate cards (T&E, purchasing cards), virtual accounts, and Visa Direct. Visa Direct is Visa's push payment solution, which allows businesses to transfer funds between accounts via a debit, prepaid, or credit card number. In addition to its payment solutions, Visa provides data management, analytics, and the ability to integrate its payment and service solutions into third-party offerings. Corporate cards are the most mature of Visa's B2B offerings, while Visa's virtual account and Visa Direct offerings are still scaling.
- **Revenue model:** Visa charges an assessment fee for each payment transaction processed and additional fees for its ancillary services. This is offset by incentives Visa pays to its financial institution and strategic partners to drive volume growth.
- **Customers:** Visa's commercial solutions serve businesses of all sizes across industries. While Visa offers commercial cards globally, Visa originally launched Visa Direct in the United States and expanded into Europe at the end of 2017. Currently, the main B2B use case for Visa Direct is disbursements to independent contractors and microbusinesses. For example, Lyft pays its drivers using Stripe's Instant Payouts solution, which is powered by Visa Direct.

- **Differentiation:** Visa is the global leader in commercial cards and has been working to strengthen its virtual card footprint (WEX recently partnered with Visa to strengthen its international footprint). Visa's virtual card offering powers Stripe's Instant Payout solution, Worldpay's instant payment offering, and First Data's Disburse-to-Debit solution for businesses paying contractors and temporary workers. Visa has partnered with a number of financial institutions, AP companies, and technology companies to distribute its products and services. For example, Visa has partnered with Amazon Business to provide US commercial account holders with full line-item details on Amazon Business customers' purchases.

American Express (AXP)

- **Product:** AXP's commercial offering includes its industry-leading charge and credit cards for small and mid-size businesses and its Corporate Card products and Business Travel accounts for larger companies. Going forward, AXP is focused on the development of a range of supplier payment and business financing solutions, such as purchasing cards, buyer-initiated payments, virtual payments, cross-border payments, and short-term business financing. 90% of AXP's commercial billings are on charge card products, with 10% on credit cards. Additionally, two thirds of AXP's commercial billings come from B2B payments, while the remaining one third comes from T&E spend. B2B spend is typically larger recurring transactions, and has grown at an 11% CAGR since 2015 (5x faster than T&E spend).
- **Revenue model:** American Express offers a range of B2B products which drive processing or transaction fees. AXP also offers volume-related discount / incentives to drive growth.
- **Customers:** American Express's commercial payments segment is used by businesses of all sizes internationally. As of 2017, AXP's commercial billings distribution consisted of 10% international SME, 25% global & large accounts and 65% US small & medium enterprises.
- **Differentiation:** AXP is the #1 commercial issuer globally, with relationships with over 60% of Fortune Global 500 and is the #1 small business card issuer in the US. AXP's unique integrated payments platform allows AXP to have direct relationships with buyers and sellers, creating the opportunity to flexibly price and structure transactions to meet buyer and supplier needs. Additionally, AXP has established various partnerships in order to expand its B2B capabilities. Examples include, its partnership with Ripple to introduce a blockchain solution for cross-border transactions and its recently announced partnership with Amazon to introduce a co-branded credit card aimed at small businesses as well as data-related analytics.

Other Public players

FleetCor (FLT)

- **Product:** FleetCor offers virtual cards, purchasing cards, T&E cards, payroll cards, and cross-border payments within its corporate payments business unit, as well as full AP outsourcing and expense management software. These solutions can be directly integrated with a client's ERP system. Comdata accounts for the majority of

FleetCor's domestic corporate payments business - including its AP automation and domestic virtual card offerings - while Cambridge Global Payments is FleetCor's international payments offering. Outside of its corporate payments business unit, FleetCor offers commercial fleet and lodging cards.

- **Revenue model:** Pricing depends on the customer contract, but is generally based on volume, incentives, and contract duration. For its payment solutions, FleetCor earns interchange on each transaction processed. Corporate payments currently account for 16% of FleetCor's revenue, but we believe the segment could account for as much as 35% of FleetCor's revenue in 5 years assuming 20% organic B2B growth and \$750mn inorganic revenue contribution (assuming leverage is unchanged and half of all M&A is in B2B).
- **Customers:** With the exception of its cross-border payments solution, FleetCor's corporate payment solutions are predominately marketed to businesses in North America (US and Canada). FleetCor has significant client concentrations in fleets, healthcare, and construction (approximately 25% Comdata corporate payments business), and plans to continue expanding its vertical offerings in media and advertising. FleetCor serves companies of all sizes in its domestic payments business, but is re-focusing Cambridge on larger accounts.
- **Differentiation:** While most providers focus on either domestic or cross-border payments, FleetCor offers both domestic and international payments solutions. This gives FleetCor a unique opportunity to cross-sell its domestic Comdata and cross-border Cambridge products across its client base – especially the Comdata virtual card offering. FleetCor also benefits from its scale in virtual and commercial cards – FleetCor claims to be about half of Mastercard's US virtual card business and the second-largest Mastercard commercial card issuer across its product lines.

WEX Inc. (WEX)

- **Product:** WEX provides virtual, credit, debit, and prepaid corporate payment products that can be integrated into clients' AP and reconciliation processes. WEX also operates a payables platform that integrates directly with a company's ERP systems and manages disbursements across ACH, virtual accounts, EFT, and check. Outside of its corporate payments business, WEX offers a variety of commercial fleet payment products.
- **Revenue model:** WEX processes payments and earns interchange on each transaction it processes. WEX's corporate payment business is currently 19% of revenue (2018), and we think its exposure could double to about 40% of revenue by 2023 assuming 20% organic corporate payments revenue growth and \$350mn of inorganic corporate payments revenue (assuming leverage is unchanged and half of M&A spend is on B2B).
- **Customers:** WEX markets its accounts payable solution to enterprises and SMBs across industry verticals. The company sells directly to large enterprises, while it reaches SMBs through AP/vendor management partners and financial institutions (primarily regional banks). WEX sees the greatest demand for AP payments from the United States and currently only originates payments from the United States, but

sees opportunities for future growth around the globe, especially in APAC. Beyond its general accounts payable solution, WEX offers industry-specific virtual card solutions for travel, media, and insurance.

- **Differentiation:** WEX issues both Mastercard and Visa virtual cards, giving customers greater flexibility and a bigger international reach. WEX's corporate payments offerings currently run on the legacy AOC and EFS platforms – with the AOC platform serving enterprises and EFS serving smaller companies – but WEX plans to create one unified platform over the next several years by lifting the best features from both platforms.

Square, Inc. (SQ)

- **Product:** Square is in the early stages of developing a suite of B2B product offerings. Square currently offers Square Payroll for Contractors, a disbursement solution which enables companies to pay contractors via direct deposit (ACH) or check. In addition to its disbursement offerings, Square has partnered with Handshake – a B2B commerce platform for manufacturers and distributors – in June 2018 to enable B2B sellers to accept credit card payments.
- **Revenue model:** Square Payroll for Contractors costs \$5 per contractor per month and allows companies to make an unlimited number of payments to the enrolled contractor. The Handshake app is available on the Square App marketplace for \$39.99/month, and Square earns a fee for processing the credit and debit transactions.
- **Customers:** Square's Payroll solution is aimed at the company's core customer base – small businesses and micro-merchants in the United States. The Handshake app targets a smaller subset of Square's customers, with order solutions specifically designed for manufacturers and distributors.
- **Differentiation:** While Square primarily provides disbursements and only recently began facilitating supplier payments, we see potential for Square to expand its offerings as it builds out its ecosystem. Over time, we also see potential for Square to offer more robust supply chain financing solutions in conjunction with Square Capital.

WorldPay (WP)

- **Product:** Worldpay, through its subsidiary Paymetric, offers domestic and cross-border payment processing, as well as PCI compliance and data security solutions for large enterprises. Paymetric's solutions integrate with any enterprise system, including Oracle and SAP. For eCommerce, Paymetric also provides both web-based and mobile-based payment solutions. Paymetric also offers value-added solutions like invoice processing automation and analytics – which help optimize payments and efficiently manage the client's working capital. Additionally, WorldPay makes domestic and cross-border payments simple, inexpensive and transparent, for its merchant network through its VisaDirect and Bankout services.

- **Revenue model:** As Paymetric offers solutions across the value-chain of B2B payments, pricing depends on the customer contract, but is generally based on volume and contract duration.
- **Customers:** Paymetric serves large companies, which have complex global supply chains and require sophisticated compliance and security capabilities.
- **Differentiation:** Paymetric's broad product suite positions it well to penetrate B2B payments, particularly for large enterprises. Data security, compliance, and cross-border payment processing costs are critical for large companies, and Paymetric offers an integrated solution to help manage them. Worldpay's merchant acquiring services are also complimentary to Paymetric solutions - clients can seamlessly receive and process payments across the globe using Worldpay as their sole payments partner.

Coupa (COUP)

- **Products:** Coupa offers payment & cash management, and accounts payable software on top of its business spend management (BSM) platform. At a high level, the Coupa platform delivers an e-commerce-like shopping experience for businesses by cataloguing all of a company's suppliers into a web-based interface where employees can find and purchase materials and supplies on contract. The platform experience is supported by back-end offerings including Coupa Invoice (a modern accounts payable solution for electronic invoicing) and Coupa Pay (a solution for suppliers to offer early payment discounts). Over time, Coupa Pay could expand into other stages of the supplier and employee expense payment process. Beyond its software offerings, management has announced plans to begin offering virtual cards to customers in the near future.
- **Revenue model:** Pricing is primarily subscription-based, with professional services needed for implementation. Access to the core platform and transaction engine is generally priced by enterprise size, while add-on modules like Invoice are priced per-user for high-value personnel. Coupa's average deal size was \$260k in FY18, but deals can reach well into the seven figures for large enterprises. Monetization of Coupa Pay, which was announced earlier this year, is still under consideration.
- **Customers:** Coupa's solutions have largely been marketed to large enterprises based in North America given these customers have established procurement budgets and legacy solutions, which offers Coupa an entrance through the natural replacement cycle. More recently, Coupa has started to expand into the mid-market and international markets.
- **Differentiation:** Coupa is differentiated from competitors in the spend management space by ease-of-use and comprehensiveness of the solution. Whereas competitors may require 4-5 loosely coupled tools to accomplish similar outcomes, Coupa supports the entire business spending workflow from purchase to payment using a natively-integrated platform. Beyond the basic functionality, Coupa uses data from millions of transactions to generate community-based intelligence on suppliers, internal efficiency benchmarking, and role-specific KPIs to improve customers' business processes.

Intuit (INTU)

- **Products:** Intuit offers integrated payments services through its popular QuickBooks Online (QBO) accounting software. In addition to tracking income and expenses, QuickBooks Payments enables customers to accept credit card payments and bank transfers directly within their invoices and information appears in QuickBooks in real time. Intuit also provides customers with the ability to send estimates, convert estimates directly to invoices, and automatically calculate sales tax.
- **Revenue model:** Pricing for QuickBooks Online for small business starts at \$10/month for the basic offering and can reach \$30/month for QBO Plus (most popular). Payments pricing is either \$0/month (pay as you go) for terms of 2.9% + \$0.25 for invoiced cards, 3.4% + \$0.25 for keyed cards, and free for bank transfers, or \$20/mo (desktop only) for terms of 1.6% + \$0.30 for swiped cards, 3.3% + \$0.30 for invoiced cards, 3.3% + \$0.30 for keyed cards, and \$1.00 for bank transfers.
- **Customers:** Intuit primarily markets its QuickBooks solution to small businesses and entrepreneurs. The QuickBooks customer base is roughly 4.3m customers globally.
- **Differentiation:** Intuit benefits from its incumbency position and massive install base of QuickBooks customers, which provides the company with a captive audience for payments, tax prep, and more nascent offerings such as capital. The sizable installed base has also attracted a rich partner community of e-commerce and third-party payments providers including Shopify, Square, and PayPal.

Bottomline Technologies (EPAY)

- **Product:** Bottomline offers solutions that help automate and manage the AP process including cloud-based business payments, a cloud-based settlement network, and vertical-specific software for banks (enabling banks to offer payment, cash management, and treasury capabilities), law firms (legal spend management), and healthcare.
- **Revenue model:** Bottomline's clients charges a mix of subscription fees and transaction fees, depending on the products and services the customer selects. Prices are set in individual contracts Bottomline negotiates with its customers.
- **Customers:** Bottomline serves clients across industries including a number of financial services companies such as Citizen's Bank, BAML, Capital One, Franklin Templeton, Fidelity, HSBC, JP Morgan. Other clients include Tesco, Vodafone and Assa Abloy.
- **Differentiation:** Bottomline's ability to provide vertical and industry specific solutions differentiates it from competitors. Bottomline's treasury management and legal spend management solutions are not offered by most competitors – helping it gain a foothold in larger financial services organizations and law firms.

SAP (SAP SE)

- **Product:** SAP offers several B2B software solutions including SAP Concur (which offers end-to-end travel, expense and invoice management) and SAP Ariba (which offers a procure-to-pay solution allowing buyers and suppliers to manage the

process from procurement contracts to payments). SAP's Ariba Network allows companies to pay millions of enrolled suppliers across a range of industries.

- **Revenue model:** Pricing depends on a company's requirements, as SAP's product suites consist of numerous services including AP automation, supplier management, cyber fraud management, and consulting. Suppliers on the Ariba Network pay a fee to be included on the network - and the fee adjusts as a business's activity on the network changes.
- **Customers:** SAP's solutions are designed for companies of all sizes, from SMBs to the Fortune 500. SAP also offers customized solutions for a range of industries. We note that travel and expense management is a significant part of SAP Concur's service offering.
- **Differentiation:** SAP's solutions are easy to integrate with multiple accounting and other procure-to-pay solutions, making them attractive for medium- to large-scale companies. In particular, SAP's Ariba Network has meaningful scale, connecting suppliers in over 190 countries and facilitating over \$50bn in annual payment volume.

Private companies

AvidXchange

- **Product:** AvidXchange offers AP process and payment automation for mid-size companies, along with procure-to-pay services like purchase order generation and supplier management.
- **Revenue model:** AvidXchange charges \$0.68 per payment and \$1.35-\$1.50 per invoice, with clients committing to a minimum number of monthly transactions.
- **Customers:** The majority of AvidXchange's customers are in the mid-market (\$10-\$200mn annual revenue) and process 500-2,000 invoices per month, with concentration across real estate, media, healthcare, and banking.
- **Differentiation:** AvidXchange's integration with over 140+ accounting systems includes Oracle and SAP at the high end, and QuickBooks enterprise at the low end. Moreover, its procure-to-pay solution helps improve inventory and cash management.

Bill.com

- **Product:** Bill.com provides cloud-based AP automation solutions to small businesses.
- **Revenue model:** Bill.com charges a fixed \$29-\$59/month fee based on the different product features used by the client, plus an additional fee per invoice - \$0.49 for ACH/e-payments and \$1.49 for paper checks. Bill.com also processes cross-border payments for a standard fee of \$19.99/payment.
- **Customers:** Bill.com services small businesses: 50% of its customers generate less than \$1mn annual revenue and 80% generate less than \$10mn annual revenue.

- **Differentiation:** Bill.com developed its entire cloud-based solution in-house whereas some of its competitors rely on third-party modules for parts of their solution (e.g. invoice intake). The company's 100% cloud-based solution works across multiple devices - desktops, phones, and tablets - making it well-suited to smaller companies.

Billtrust

- **Product:** Billtrust's solutions cater to billers and focus exclusively on the accounts receivable process - making it easy for enterprises to deliver invoices and for customers to pay electronically. In addition to its core invoice and electronic payment offerings, Billtrust offers a virtual card acceptance solution, credit decisioning, and collection services. Billtrust's solutions integrate with over 150 different ERP systems.
- **Revenue model:** The vast majority of Billtrust's revenue comes from subscription fees. Billtrust typically charges a fixed subscription fee each quarter based on a customer's expected volume on a tiered pricing model. The company also charges transaction fees for services such as printing invoices.
- **Customers:** Billtrust's solutions are designed for medium- and large-sized enterprises with over \$50mn in revenue, or those who issue anywhere from 5,000-10,000 to 2-3mn invoices per month. Billtrust currently serves about 1,500 enterprises across verticals, with the largest exposures in wholesale distribution, manufacturing, sporting goods, transportation, and senior living.
- **Differentiation:** Most B2B software payment solutions focus on accounts payable - reducing the costs of making payments to suppliers - but suppliers also incur substantial costs (an average of \$1 to issue an invoice and \$7-\$10 to receive paper checks). Billtrust is one of the first companies to develop a comprehensive accounts receivable solution for enterprises, including virtual card acceptance.

Chrome River

- **Product:** Chrome River offers invoice processing, expense management, and analytics solutions for mid-to-large size companies in over 100 countries.
- **Revenue model:** Chrome River charges a monthly subscription fee for its software products, namely Chrome River EXPENSE, INVOICE, AUDIT and ANALYTICS.
- **Customers:** Chrome River primarily serves medium- and large-size companies across various industries, including legal, higher education, beverage distribution, financial services, and engineering.
- **Differentiation:** Chrome River's products work seamlessly across desktops, tablets, and phones - offering an intuitive customer experience. Its product suite covers the complete lifecycle of AP including expense management, invoice processing, payments, and analytics.

C2FO

- **Product:** C2FO's dynamic discounting platform enables suppliers and buyers to negotiate dynamic discounts in exchange for early invoice payments. The solution integrates with a customer's existing ERP system and does not require any changes to the existing accounts payable process or additional headcount.
- **Revenue model:** C2FO typically charges 0.5% of the invoice amount, though pricing does vary based on a customer's requirements. This is cheaper than invoice factoring or a line of credit, which can range from 3%-5% of the invoice.
- **Customers:** C2FO's customers are primarily small and medium-size companies on the supplier side and large businesses on the buyer side. Buyers include Pfizer, Costco, Walgreens, Siemens, Citi, HP, Philips and Macy's.
- **Differentiation:** C2FO's marketplace model is unique in the working capital management vertical of B2B payments ecosystem. Suppliers control the level of discounting and which invoices are being offered at a discount, giving them greater control over and visibility of cash flow. By allowing suppliers to offer discounts directly to the buyer, suppliers can avoid the high fees charged by factoring companies and finance their working capital requirements at a lower rate.

Kabbage

- **Product:** Kabbage provides small businesses with working capital loans (lines of credit up to \$250k) using its online technology platform, which can process loan applications in minutes. Suppliers can also use Kabbage's platform to receive early invoice payments (which buyers finance with short-term loans).
- **Revenue model:** Kabbage provides 6-month or 12-month loans at a rate of 1.5% - 10% per month on the principal. The interest rate (or monthly fee) is based on the revenue and credit history of the business. As an example, if a company finances a \$12,000 loan for 12 months at 5% fee rate, the company pays Kabbage (a) \$1,600 per month - \$1,000 monthly principal + \$600 fee (5% of \$12,000) for the first six months, and (b) \$1,120 per month - \$1,000 monthly principal + \$120 fee (1% of \$12,000) for the next six months.
- **Customers:** Kabbage's customers are primarily small businesses. The company currently has over 115,000 customers with \$3.5bn in loans.
- **Differentiation:** Kabbage has developed unique technology that relies on multiple datapoints to determine a customer's credit score, approve loan amounts, and approve rates within minutes - offering significantly faster funding than its competition.

MineralTree

- **Product:** MineralTree automates the entire AP process - from receiving the invoice and extracting data to payment. MineralTree integrates directly with a company's ERP system, allowing invoices to be automatically matched against purchase orders and recorded in a company's general ledger.

- **Revenue model:** MineralTree charges a monthly subscription fee based on the company's transactions and payment volume.
- **Customers:** MineralTree services middle-market companies (\$5mn to \$500mn revenue) across a range of verticals, with higher concentrations in software and professional services. The company sells directly to consumers and through its partnerships with over 20 banks and American Express.
- **Differentiation:** MineralTree is one of a handful of companies with direct partnerships across all three of the major card networks - Visa, Mastercard, and American Express. Furthermore, MineralTree transfers money directly between the buyer and supplier whereas many of its competitors act as money transmitters (transmitting money from the sender to a clearing account, and then to the recipient).

Nvoicepay

- **Product:** Nvoicepay automates domestic and international payments for enterprises across 170 countries and 140 currencies.
- **Revenue model:** Nvoicepay charges a fixed monthly subscription fee, a variable fee for each payment, and FX fees for cross-border payments.
- **Customers:** Nvoicepay primarily serves medium to large-size companies across various industries, including higher education, technology, engineering, real estate, financial services, and healthcare.
- **Differentiation:** Nvoicepay's ability to process cross-border payments and provide integrated supplier management with discounting solutions differentiates it from competitors.

Payoneer

- **Product:** Payoneer offers an international payments network which allows users to send and receive payments in over 200 countries and 150 currencies. The platform allows users to make single payments or batch-based disbursements.
- **Revenue model:** Payoneer charges a 1% transaction fee for its US Payment Service and up to 2% to make a payment to or withdraw from a bank account. The company charges an additional 0.5% to transfer between currencies. Transfers between Payoneer customers are free.
- **Customers:** The majority of Payoneer's customers are freelancers, independent retail sellers, and contractors receiving payouts from corporates and online marketplaces. Payoneer's platform has over 4mn users including a number of Amazon sellers and Airbnb hosts.
- **Differentiation:** Payoneer offers instant domestic and international transfers between Payoneer accounts, and users can transfer funds to a local bank account. Payoneer also offers direct transfers to bank accounts across currencies, though payout to a bank account typically takes 2-5 days.

Stripe

- **Product:** Stripe offers a range of payment and billing solutions including domestic and cross-border payment processing, as well as billing systems with invoice management and payments that integrate into a company's existing ERP system. Stripe also offers specialized B2B solutions including disbursements (Stripe powers payments for Lyft, Instacart, and Postmates) and has partnered with other B2B providers, including Handshake, for supplier payments. Stripe also launched Stripe Issuing in July 2018, a new platform that allows companies to create and manage their own physical/virtual cards – which can help companies better manage employee spending (e.g. managing fuel purchases or a contractor's supply purchases).
- **Revenue model:** Stripe earns a fee on each payment processed. For Stripe Billing, the company offers a range of pricing options ranging from flat-rate to usage-based plans. In its new issuing business, Stripe will earn interchange on each payment and charge additional fees for printing and distributing physical cards.
- **Customers:** Stripe serves businesses of all sizes including a number of e-commerce platforms and marketplaces.
- **Differentiation:** Stripe benefits from a cloud-native offering, and the company believes its attractive pricing and focus on merchant needs differentiate it in the marketplace.

Tradeshift

- **Product:** Tradeshift offers multiple procure-to-pay solutions, AP automation, and spend management tools on its open API platform. The company's procure-to-pay solutions feature supplier onboarding, digital invoicing, payments through Tradeshift's network, and supply chain financing. For payments, Tradeshift offers a virtual card solution Tradeshift Go powered by American Express.
- **Revenue model:** Tradeshift charges an annual fee for its procure-to-pay solutions based on the volume of invoices a company processes. Customers typically sign a 3-year contract. Tradeshift does not charge suppliers to join its network, though it does offer customized invoicing solutions for an additional fee.
- **Customers:** Tradeshift's core procure-to-pay offerings are designed for enterprises with \$500mn+ revenue regardless of vertical. Enterprises currently on the platform include Apple, Nike, and DHL. Tradeshift also offers AP automation and spend management tools for companies that fall below the \$500mn threshold.
- **Differentiation:** Tradeshift primarily competes with Oracle, SAP Ariba, and Coupa, though Tradeshift is more global than most of its competitors and is one of only two companies compliant with China's tax law. This brings a number of enterprises to the platform to manage at least a portion of their supplier payments since Tradeshift's open API platform can be integrated with other AP automation solutions to cover a certain subset of suppliers. Tradeshift partners with financial services (HSBC and Santander), technology, BPO, and consulting companies.

Challenges in the adoption of B2B payment solutions

B2B payments remains a huge market opportunity, but it does face some structural challenges which could potentially hinder the adoption of tech-enabled solutions - making it difficult to identify winners early in the market's development.

- **The market is likely to remain fragmented for longer:** In contrast to the retail (B2C) and P2P payments markets where simple process flows and network effects have led to a consolidated group of winners in a short period of time, we think the B2B payments market is likely to remain fragmented for longer. Accounting solutions, internal processes, and ERP solutions differ from company to company, and the enterprise sales cycle is much longer – making it difficult for AP automation providers to expand exponentially and rapidly consolidate market share. We believe players which are able to build robust technology platforms, form key partnerships, customize offerings for clients, and integrate seamlessly with various accounting and payment systems are likely to survive in the medium term and emerge as winners in the long run.
- **Different systems used by buyers and suppliers generate friction:** A B2B payment follows a complex process and requires accounting reconciliation on both the buyer and supplier sides to close the loop. If the buyer wants to use AP automation solutions and e-payments, but its suppliers still rely on manual accounting, the supplier may still be paid by check. Since a part of the cost savings from AP automation come from electronic payments and automatic reconciliation, adopting AP automation will not be as financially lucrative for the buyer unless the supplier follows suit and accepts electronic payments. AP automation providers will need to ensure that their solutions do not hinder the reconciliation processes of a diverse set of suppliers.
- **Replacement costs can be high:** Smaller businesses, especially those using paper-based accounting systems, still prefer checks as they provide an easily verifiable trail for reconciliation, audits, and handling exceptions. On the other hand, larger businesses have already invested heavily in automated ERP and payables systems. Using a new AP automation solution requires businesses to completely shift their existing processes and reassign their AP headcount, which can be met by internal resistance as the internal “sunk costs” are high. Solutions that provide end-to-end services including accounting, pre-payment process management and payments, on a SaaS model will help businesses adopt AP automation without incurring high replacement costs.

Catalog of public and private B2B payments and software companies

Exhibit 38: Public companies in the B2B payments market

Company	Ticker	Mkt cap (\$mn)	Business description	Key partnerships/Clients
Public Companies				
American Express	AXP	108,310	Global electronic payment network with credit, debit, and expense management products; financing solutions.	All major banks
Basware	BAS1V.HE	578	AP and AR process automation and working capital management solutions.	Nordea Bank, ING Bank, CGI, Fuji Xerox
Bottomline Technologies	EPAY	2,860	Business payment solutions including AP process automation, payments automation and cash management.	Fifth Third, NACHA, UXC Eclipse
Coupa Software	COUP	5,265	Complete suite of business spending services including procurement, expense management, AP automation and discounting.	Genpact, Wipro, PwC, Capgemini
Earthport	EPO.L	80	Cross border payments service across 50+ countries.	Payoneer, BofA, Bottomline, Ripple, TransferWise
FleetCor (Cambridge)	FLT	20,136	Cross-border payment and currency risk-management solutions.	Mastercard, Ripple
FleetCor (Comdata)	FLT	20,136	Domestic AP payments, reporting, and reconciliation.	Mastercard, Ripple
Mastercard	MA	223,909	Global electronic payments provider with credit, debit, and fast ACH capabilities.	All major banks
PayPal	PYPL	110,572	Global online payment provider.	Visa, Mastercard, Homedepot
SAP (Concur)	SAP	142,313	End-to-end expense management and AP process automation.	SAP, Visa, American Express, Mastercard
Square, Inc.	SQ	43,374	Payment processing, software tools (including disbursements), and financing solutions for SMBs.	Apple, Visa, Mastercard, eBay
Visa	V	337,682	World's largest electronic payments network facilitating credit and debit payments.	All major banks
WEX, Inc.	WEX	8,515	Electronic payment (virtual card) and corporate card solutions.	Visa, Mastercard
Worldpay (Paymetric)	WP	29,022	Integrated cross-border payments for large enterprises.	Visa, SAP, Toshiba, Lenovo
WU Business Solutions	WU	8,806	Cross-border payments across 200+ countries; FX hedging and risk management services.	Chrome River, Fiserv

Source: Company data, Goldman Sachs Global Investment Research

Exhibit 39: Private companies in the B2B payments market

Company	Year est.	Funding	Business description	Key partnerships/Clients
Private Companies				
Advanon	2014	\$13mn	Online invoice marketplace connecting SMEs with investors.	Deutsche Bank
Aria Systems	2002	\$142mn	Cloud-based enterprise billing platform that manages recurring payment streams.	Ntegra, Avalara
AvidExchange	2000	\$574mn	AP process and payment automation for mid-size companies.	Mastercard, Fifth Third
Bill.com	2006	\$259mn	Cloud-based accounts payable automation for small companies.	JP Morgan, QuickBooks, CPA.com
Billtrust	2001	\$104mn	AR solutions that manage the entire invoice-to-cash process.	FIS, Oracle, Flywire, QAD, Avidxchange
Boost Payment Solutions	2009	VC Funded	US acquirer exclusively focused on B2B payments.	Fifth Third, Mastercard
C2FO	2008	\$197.7mn	Online B2B marketplace for working capital.	White Oak, Tech Data, Tradeshift
Chrome River Technologies	2007	\$154mn	Expense management and invoice automation/management software for mid- to large-size companies.	Barclays, WU Business Solutions, BMO, US Bank, PwC
DivvyPay Inc.	2016	\$53mn	Automated platform that manages an organization's budget and expenses, controls spend by issuing secure physical and virtual cards.	WEX, Inc.
Enliven Software	2000	\$14mn	AP and AR process automation for small and mid-size companies.	Microsoft Dynamics, QuickBooks
GoCardless	2011	\$47mn	International payment network that facilitates recurring direct debit payments.	Sage, Salesforce, Zoho, QuickBooks
HighRadius	2006	\$50mn	Receivables platform that optimizes cash flow through automation of receivables and payments processes.	Citi, Tech Mahindra
Invoice2go	2002	\$50mn	AR solution offering digital invoice creation, management, and payment; expense management.	Microsoft, Stripe, Paypal
Kabbage	2008	\$1.6bn	Automated lending platform that provides small businesses loans of up to \$250k.	ING, Scotiabank, Stripe, TaxSlayer
Kickpay	2014	Seed round	Inventory financing for SMEs and start-ups.	
Mineral Tree	2010	\$18mn	AP automation for mid-market companies.	American Express, First Data, Western Union
Modulr Finance	2015	VC Funded	Platform providing real-time, end-to-end payment processing, collection, and reconciliation.	FCSA, Salary Finance, Infinity Contracts, Cardstream
Nvoicepay	2009	\$21mn	Domestic and international AP payment automation for enterprises.	Mastercard, Coupa, Inspyrus, Viewpoint
Optal	2000		AP automation solutions and optimization services to help customers lower transaction costs and earn rebates.	Allianz Worldwide Partners, Mastercard
Payoneer	2005	\$270mn	Global payments platform with multiple payout options (bank transfers, prepaid, wire, e-wallet) across 200+ countries.	eZ Cash, Upwork, Freelancer
PaySimple	2005	\$145.3mn	Cloud-based platform that provides accounts receivable solutions for small businesses.	Ontario Systems, Market Hardware, CheckAit
Stripe	2010	\$440mn	Provides a set of APIs and tools that instantly enable businesses to accept and manage online payments.	American Express, Visa, Alipay, Lyft, SurveyMonkey, Shopify
Taulia	2009	\$156.7mn	Working capital solutions using dynamic discounting and lending.	KPMG, Lavante, Infosys, Buyerquest
Tradeshift	2010	\$455mn	Global business network and technology platform that offers procurement, payables, and working capital solutions.	American Express, Intuit
TransferMate	2009	€51mn	Same-day, cross-border payments at real-time FX rates.	ING Bank, BT Sport, Allied Irish Bank
Traxpay	2009	\$19mn	Dynamic financing platform that enables banks to offers their customers supply chain financing/reverse factoring.	Mastercard, NORD/LB, IBM, KPMG, Commerzbank
Viewpost	2011	\$60mn	AP and AR process automation and payments using virtual cards.	VISA, Capital One, US Bank, BofA

Source: crunchbase, CB insights, Company data, Goldman Sachs Global Investment Research

Price targets and methodologies

Exhibit 40: Price targets and methodologies

Company Name	Ticker	Rating	Price 09/11/18	Price Targets	PT Methodology	Risks
American Express	AXP	Neutral	\$107.29	\$108	15X 2018/19E EPS	Upside: faster loan growth. Downside: competition, cobrand renewals
Coupa Software Inc.	COUP	Buy	\$78.02	\$81	50-50 blend of 10-year DCF and 14.5X 2019E EV/sales	Declining sales productivity, competition, and IT spending.
FleetCor Technologies, Inc.	FLT	Buy	\$217.61	\$245	20X 2019E EPS	M&A execution, fuel prices, client portfolio losses.
Intuit	INTU	Buy	\$224.72	\$230	50-50 blend of 10-year DCF and 35X CY19 EPS	Slowing user growth, worse-than-expected ARPU, competition
Mastercard, Inc.	MA	Buy*	\$211.67	\$260	33X 2019E EPS	Slowing macro trends, share losses and regulatory uncertainty
MoneyGram International, Inc	MGI	Neutral	\$5.81	\$7	70% fundamental value based on 5X 2019E EPS; 30% M&A value based on 15X 2019E EPS	Upside: better remittance volumes. Downside: contract losses.
PayPal Holdings	PYPL	Buy*	\$89.80	\$98	22X 2019E EV/EBITDA	Competition, transaction/operating margin pressure, security threats.
SAP	SAPG.DE	Buy*	€101.98	€122	25X 2019E EPS	Macro environment, lack of traction in S4HANA or cloud, M&A, management changes
Square Inc	SQ	Buy	\$89.39	\$68	16X 2019E EV/Sales	Uneven traction in the lending business, slower client growth, faster investment, weaker SMB trends.
The Western Union Company	WU	Sell	\$19.14	\$18.50	9.5X 2019E EPS	Reduced pricing pressure, stronger macro.
Visa, Inc.	V	Buy	\$144.08	\$160	28.5X CY19E EPS	Slower consumer spending, litigation and regulatory issues, and FX volatility.
WEX, Inc.	WEX	Buy	\$194.65	\$205	20X 2019E EPS	Lower fuel prices, higher credit and fraud loss rates, client portfolio losses.
Worldpay Inc.	WP	Buy	\$97.20	\$102	20X 2019E EPS	Slower e-commerce growth, larger decline in brick-and-mortar retail sales, inability to exceed synergy targets.

* On Americas Conviction List

Source: Factset, Goldman Sachs Global Investment Research

Disclosure Appendix

Reg AC

We, James Schneider, Ph.D., Julia McCrimlisk, Bill Schultz, Jesse Hulsing, Ryan M. Nash, CFA, Richard Ramsden, Mohammed Moawalla and Heath P. Terry, CFA, hereby certify that all of the views expressed in this report accurately reflect our personal views about the subject company or companies and its or their securities. We also certify that no part of our compensation was, is or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

Unless otherwise stated, the individuals listed on the cover page of this report are analysts in Goldman Sachs' Global Investment Research division.

GS Factor Profile

The Goldman Sachs Factor Profile provides investment context for a stock by comparing key attributes to the market (i.e. our coverage universe) and its sector peers. The four key attributes depicted are: Growth, Financial Returns, Multiple (e.g. valuation) and Integrated (a composite of Growth, Financial Returns and Multiple). Growth, Financial Returns and Multiple are calculated by using normalized ranks for specific metrics for each stock. The normalized ranks for the metrics are then averaged and converted into percentiles for the relevant attribute. The precise calculation of each metric may vary depending on the fiscal year, industry and region, but the standard approach is as follows:

Growth is based on a stock's forward-looking sales growth, EBITDA growth and EPS growth (for financial stocks, only EPS and sales growth), with a higher percentile indicating a higher growth company. **Financial Returns** is based on a stock's forward-looking ROE, ROCE and CROCI (for financial stocks, only ROE), with a higher percentile indicating a company with higher financial returns. **Multiple** is based on a stock's forward-looking P/E, P/B, price/dividend (P/D), EV/EBITDA, EV/FCF and EV/Debt Adjusted Cash Flow (DACF) (for financial stocks, only P/E, P/B and P/D), with a higher percentile indicating a stock trading at a higher multiple. The **Integrated** percentile is calculated as the average of the Growth percentile, Financial Returns percentile and (100% - Multiple percentile).

Financial Returns and Multiple use the Goldman Sachs analyst forecasts at the fiscal year-end at least three quarters in the future. Growth uses inputs for the fiscal year at least seven quarters in the future compared with the year at least three quarters in the future (on a per-share basis for all metrics).

For a more detailed description of how we calculate the GS Factor Profile, please contact your GS representative.

M&A Rank

Across our global coverage, we examine stocks using an M&A framework, considering both qualitative factors and quantitative factors (which may vary across sectors and regions) to incorporate the potential that certain companies could be acquired. We then assign a M&A rank as a means of scoring companies under our rated coverage from 1 to 3, with 1 representing high (30%-50%) probability of the company becoming an acquisition target, 2 representing medium (15%-30%) probability and 3 representing low (0%-15%) probability. For companies ranked 1 or 2, in line with our standard departmental guidelines we incorporate an M&A component into our target price. M&A rank of 3 is considered immaterial and therefore does not factor into our price target, and may or may not be discussed in research.

Quantum

Quantum is Goldman Sachs' proprietary database providing access to detailed financial statement histories, forecasts and ratios. It can be used for in-depth analysis of a single company, or to make comparisons between companies in different sectors and markets.

GS SUSTAIN

GS SUSTAIN is a global investment strategy focused on the generation of long-term alpha through identifying high quality industry leaders. The GS SUSTAIN 50 list includes leaders we believe to be well positioned to deliver long-term outperformance through superior returns on capital, sustainable competitive advantage and effective management of ESG risks vs. global industry peers. Candidates are selected largely on a combination of quantifiable analysis of these three aspects of corporate performance.

Disclosures

Coverage group(s) of stocks by primary analyst(s)

James Schneider, Ph.D.: America-IT Consulting and Outsourcing, America-Transaction Processors. Jesse Hulsing: America-Emerging Software. Ryan M. Nash, CFA: America-Consumer Finance, America-Regional Banks. Richard Ramsden: America-Large Banks. Mohammed Moawalla: Europe-IT Services, Europe-Software. Heath P. Terry, CFA: America-Internet.

America-Consumer Finance: Alliance Data Systems Corp., Ally Financial Inc., American Express Co., Capital One Financial Corp., Discover Financial Services, Santander Consumer USA Holdings, Synchrony Financial.

America-Emerging Software: Alteryx Inc., Appian Corp., Apptio Inc., Avalara Inc., Benefitfocus Inc., Blackline Inc., Ceridian HCM Holdings, Cornerstone OnDemand Inc., Coupa Software Inc., Guidewire Software Inc., Hortonworks Inc., HubSpot Inc., Intuit Inc., New Relic Inc., ServiceNow Inc., Shopify Inc., Splunk Inc., Tableau Software, Talend SA, Teradata Corp., Ultimate Software Group, Veeva Systems Inc., Zendesk Inc., Zuora Inc..

America-IT Consulting and Outsourcing: Accenture Plc, Black Knight Inc., CGI Group, CGI Group, Cognizant Technology Solutions, DXC Technology Co., Fidelity National Information Services, Fiserv Inc., International Business Machines, Sabre Corp..

America-Internet: Amazon.com Inc., Blue Apron Holdings, Booking Holdings Inc., CarGurus Inc., Criteo SA, eBay Inc., Etsy Inc., Expedia Group, GrubHub Inc., LendingClub Corp., Netflix Inc., Pandora Media Inc., PayPal Holdings, Redfin Corp., Snap Inc., Spotify Technology S.A., TripAdvisor Inc., Trivago N.V., Twitter Inc., Zillow Group.

America-Large Banks: Bank of America Corp., Citigroup Inc., J.P. Morgan Chase & Co., Morgan Stanley & Co., PNC Financial Services, U.S. Bancorp, Wells Fargo & Co..

America-Regional Banks: Bank of N.T. Butterfield & Son Ltd., BankUnited Inc., BB&T Corp., Cadence Bancorporation, Citizens Financial Group, Comerica Inc., Fifth Third Bancorp, First Hawaiian Inc., First Horizon National Corp., First Republic Bank, Huntington Bancshares Inc., KeyCorp, M&T Bank Corp., Regions Financial Corp., Signature Bank, SunTrust Banks Inc., Synovus Financial Corp., Zions Bancorporation.

America-Transaction Processors: Automatic Data Processing Inc., Euronet Worldwide Inc., Evertec Inc., EVO Payments Inc., First Data Corp., FleetCor Technologies Inc., Global Payments Inc., GreenSky Inc., MasterCard Inc., MoneyGram International Inc., Paychex Inc., Square Inc., Total System Services Inc., Visa Inc., Western Union Co., WEX Inc., Worldpay Inc., Worldpay Inc..

Europe-IT Services: Atos, Capgemini, Evry AS, Indra, Wirecard, Worldline.

Europe-Software: Aveva, Dassault Systemes, Hexagon AB, Micro Focus, Sage Group, SAP, SAP, Simcorp A/S, Software AG, Temenos.

Company-specific regulatory disclosures

Compendium report: please see disclosures at <http://www.gs.com/research/hedge.html>. Disclosures applicable to the companies included in this compendium can be found in the latest relevant published research

Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global Equity coverage universe

	Rating Distribution			Investment Banking Relationships		
	Buy	Hold	Sell	Buy	Hold	Sell
Global	35%	53%	12%	63%	56%	51%

As of July 1, 2018, Goldman Sachs Global Investment Research had investment ratings on 2,851 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by the FINRA Rules. See 'Ratings, Coverage groups and views and related definitions' below. The Investment Banking Relationships chart reflects the percentage of subject companies within each rating category for whom Goldman Sachs has provided investment banking services within the previous twelve months.

Price target and rating history chart(s)

Compendium report: please see disclosures at <http://www.gs.com/research/hedge.html>. Disclosures applicable to the companies included in this compendium can be found in the latest relevant published research

Regulatory disclosures

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; for equity securities, market making and/or specialist role. Goldman Sachs trades or may trade as a principal in debt securities (or in related derivatives) of issuers discussed in this report.

The following are additional required disclosures: **Ownership and material conflicts of interest:** Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst's area of coverage.

Analyst compensation: Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. **Analyst as officer or director:** Goldman Sachs policy generally prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director or advisor of any company in the analyst's area of coverage. **Non-U.S. Analysts:** Non-U.S. analysts may not be associated persons of Goldman Sachs & Co. LLC and therefore may not be subject to FINRA Rule 2241 or FINRA Rule 2242 restrictions on communications with subject company, public appearances and trading securities held by the analysts.

Distribution of ratings: See the distribution of ratings disclosure above. **Price chart:** See the price chart, with changes of ratings and price targets in prior periods, above, or, if electronic format or if with respect to multiple companies which are the subject of this report, on the Goldman Sachs website at <http://www.gs.com/research/hedge.html>.

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. **Australia:** Goldman Sachs Australia Pty Ltd and its affiliates are not authorised deposit-taking institutions (as that term is defined in the Banking Act 1959 (Cth)) in Australia and do not provide banking services, nor carry on a banking business, in Australia. This research, and any access to it, is intended only for "wholesale clients" within the meaning of the Australian Corporations Act, unless otherwise agreed by Goldman Sachs. In producing research reports, members of the Global Investment Research Division of Goldman Sachs Australia may attend site visits and other meetings hosted by the companies and other entities which are the subject of its research reports. In some instances the costs of such site visits or meetings may be met in part or in whole by the issuers concerned if Goldman Sachs Australia considers it is appropriate and reasonable in the specific circumstances relating to the site visit or meeting. To the extent that the contents of this document contains any financial product advice, it is general advice only and has been prepared by Goldman Sachs without taking into account a client's objectives, financial situation or needs. A client should, before acting on any such advice, consider the appropriateness of the advice having regard to the client's own objectives, financial situation and needs.

Brazil: Disclosure information in relation to CVM Instruction 483 is available at <http://www.gs.com/worldwide/brazil/area/gir/index.html>. Where applicable, the Brazil-registered analyst primarily responsible for the content of this research report, as defined in Article 16 of CVM Instruction 483, is the first author named at the beginning of this report, unless indicated otherwise at the end of the text. **Canada:** Goldman Sachs Canada Inc. is an affiliate of The Goldman Sachs Group Inc. and therefore is included in the company specific disclosures relating to Goldman Sachs (as defined above).

Goldman Sachs Canada Inc. has approved of, and agreed to take responsibility for, this research report in Canada if and to the extent that Goldman Sachs Canada Inc. disseminates this research report to its clients. **Hong Kong:** Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C.

India: Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited, Research Analyst - SEBI Registration Number INH000001493, 951-A, Rational House, Appasaheb Marathe Marg, Prabhadevi, Mumbai 400 025, India, Corporate Identity Number U74140MH2006FTC160634, Phone +91 22 6616 9000, Fax +91 22 6616 9001. Goldman Sachs may beneficially own 1% or more of the securities (as such term is defined in clause 2 (h) the Indian Securities Contracts (Regulation) Act, 1956) of the subject company or companies referred to in this research report. **Japan:** See below. **Korea:** Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. **New Zealand:** Goldman Sachs New Zealand Limited and its affiliates are neither "registered banks" nor "deposit takers" (as defined in the Reserve Bank of New Zealand Act 1989) in New Zealand. This research, and any access to it, is intended for "wholesale clients" (as defined in the Financial Advisers Act 2008) unless otherwise agreed by Goldman Sachs. **Russia:** Research reports distributed in the Russian Federation are not advertising as defined in the Russian legislation, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian legislation on appraisal activity. **Singapore:** Further information on the covered companies referred to in this research may be obtained from Goldman Sachs (Singapore) Pte. (Company Number: 198602165W). **Taiwan:** This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk.

Investment results are the responsibility of the individual investor. **United Kingdom:** Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Conduct Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs

International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.

European Union: Disclosure information in relation to Article 4 (1) (d) and Article 6 (2) of the European Commission Directive 2003/125/EC is available at <http://www.gs.com/disclosures/europeanpolicy.html> which states the European Policy for Managing Conflicts of Interest in Connection with Investment Research.

Japan: Goldman Sachs Japan Co., Ltd. is a Financial Instrument Dealer registered with the Kanto Financial Bureau under registration number Kinsho 69, and a member of Japan Securities Dealers Association, Financial Futures Association of Japan and Type II Financial Instruments Firms Association. Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Ratings, coverage groups and views and related definitions

Buy (B), Neutral (N), Sell (S) -Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock's total return potential relative to its coverage. Any stock not assigned as a Buy or a Sell on an Investment List with an active rating (i.e., a stock that is not Rating Suspended, Not Rated, Coverage Suspended or Not Covered), is deemed Neutral. Each regional Investment Review Committee manages various regional Investment Lists to a global guideline of 25%-35% of stocks as Buy and 10%-15% of stocks as Sell; however, the distribution of Buys and Sells in any particular analyst's coverage group may vary as determined by the regional Investment Review Committee. Additionally, each Investment Review Committee manages Regional Conviction lists, which represent investment recommendations focused on the size of the total return potential and/or the likelihood of the realization of the return across their respective areas of coverage. The addition or removal of stocks from such Conviction lists do not represent a change in the analysts' investment rating for such stocks.

Total return potential represents the upside or downside differential between the current share price and the price target, including all paid or anticipated dividends, expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The total return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

Coverage groups and views: A list of all stocks in each coverage group is available by primary analyst, stock and coverage group at <http://www.gs.com/research/hedge.html>. The analyst assigns one of the following coverage views which represents the analyst's investment outlook on the coverage group relative to the group's historical fundamentals and/or valuation. **Attractive (A).** The investment outlook over the following 12 months is favorable relative to the coverage group's historical fundamentals and/or valuation. **Neutral (N).** The investment outlook over the following 12 months is neutral relative to the coverage group's historical fundamentals and/or valuation. **Cautious (C).** The investment outlook over the following 12 months is unfavorable relative to the coverage group's historical fundamentals and/or valuation.

Not Rated (NR). The investment rating and target price have been removed pursuant to Goldman Sachs policy when Goldman Sachs is acting in an advisory capacity in a merger or strategic transaction involving this company and in certain other circumstances. **Rating Suspended (RS).** Goldman Sachs Research has suspended the investment rating and price target for this stock, because there is not a sufficient fundamental basis for determining, or there are legal, regulatory or policy constraints around publishing, an investment rating or target. The previous investment rating and price target, if any, are no longer in effect for this stock and should not be relied upon. **Coverage Suspended (CS).** Goldman Sachs has suspended coverage of this company. **Not Covered (NC).** Goldman Sachs does not cover this company. **Not Available or Not Applicable (NA).** The information is not available for display or is not applicable. **Not Meaningful (NM).** The information is not meaningful and is therefore excluded.

Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs on a global basis. Analysts based in Goldman Sachs offices around the world produce equity research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy. This research is disseminated in Australia by Goldman Sachs Australia Pty Ltd (ABN 21 006 797 897); in Brazil by Goldman Sachs do Brasil Corretora de Títulos e Valores Mobiliários S.A.; Ombudsman Goldman Sachs Brazil: 0800 727 5764 and / or ouvidoriagoldmansachs@gs.com. Available Weekdays (except holidays), from 9am to 6pm. Ouvidoria Goldman Sachs Brasil: 0800 727 5764 e/ou ouvidoriagoldmansachs@gs.com. Horário de funcionamento: segunda-feira à sexta-feira (exceto feriados), das 9h às 18h; in Canada by either Goldman Sachs Canada Inc. or Goldman Sachs & Co. LLC; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs New Zealand Limited; in Russia by OOO Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman Sachs & Co. LLC. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom and European Union.

European Union: Goldman Sachs International authorised by the Prudential Regulation Authority and regulated by the Financial Conduct Authority and the Prudential Regulation Authority, has approved this research in connection with its distribution in the European Union and United Kingdom; Goldman Sachs AG and Goldman Sachs International Zweigniederlassung Frankfurt, regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht, may also distribute research in Germany.

General disclosures

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. The information, opinions, estimates and forecasts contained herein are as of the date hereof and are subject to change without prior notification. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst's judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by our Global Investment Research Division. Goldman Sachs & Co. LLC, the United States broker dealer, is a member of SIPC (<http://www.sipc.org>).

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and principal trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, principal trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.

The analysts named in this report may have from time to time discussed with our clients, including Goldman Sachs salespersons and traders, or may discuss in this report, trading strategies that reference catalysts or events that may have a near-term impact on the market price of the equity securities discussed in this report, which impact may be directionally counter to the analyst's published price target expectations for such stocks. Any such trading strategies are distinct from and do not affect the analyst's fundamental equity rating for such stocks, which rating reflects a stock's return potential relative to its coverage group as described herein.

We and our affiliates, officers, directors, and employees, excluding equity and credit analysts, will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives, if any, referred to in this research.

The views attributed to third party presenters at Goldman Sachs arranged conferences, including individuals from other parts of Goldman Sachs, do not necessarily reflect those of Global Investment Research and are not an official view of Goldman Sachs.

Any third party referenced herein, including any salespeople, traders and other professionals or members of their household, may have positions in the products mentioned that are inconsistent with the views expressed by analysts named in this report.

This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors. Investors should review current options disclosure documents which are available from Goldman Sachs sales representatives or at <http://www.theocc.com/about/publications/character-risks.jsp>. Transaction costs may be significant in option strategies calling for multiple purchase and sales of options such as spreads. Supporting documentation will be supplied upon request.

Differing Levels of Service provided by Global Investment Research: The level and types of services provided to you by the Global Investment Research division of GS may vary as compared to that provided to internal and other external clients of GS, depending on various factors including your individual preferences as to the frequency and manner of receiving communication, your risk profile and investment focus and perspective (e.g., marketwide, sector specific, long term, short term), the size and scope of your overall client relationship with GS, and legal and regulatory constraints. As an example, certain clients may request to receive notifications when research on specific securities is published, and certain clients may request that specific data underlying analysts' fundamental analysis available on our internal client websites be delivered to them electronically through data feeds or otherwise. No change to an analyst's fundamental research views (e.g., ratings, price targets, or material changes to earnings estimates for equity securities), will be communicated to any client prior to inclusion of such information in a research report broadly disseminated through electronic publication to our internal client websites or through other means, as necessary, to all clients who are entitled to receive such reports.

All research reports are disseminated and available to all clients simultaneously through electronic publication to our internal client websites. Not all research content is redistributed to our clients or available to third-party aggregators, nor is Goldman Sachs responsible for the redistribution of our research by third party aggregators. For research, models or other data related to one or more securities, markets or asset classes (including related services) that may be available to you, please contact your GS representative or go to <http://360.gs.com>.

Disclosure information is also available at <http://www.gs.com/research/hedge.html> or from Research Compliance, 200 West Street, New York, NY 10282.

© 2018 Goldman Sachs.

No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.

Mindcraft: Our Thematic Deep Dives

Innovation & Disruption

Extended Reality



Drones



Factory of the Future



Blockchain



Precision Farming



eSports



Space



AI Hardware



The Store of the Future



Insights & Policy

Rethinking Mobility



Banking on Technology



The Genome Revolution



Why Technology is not a bubble



Top of Mind



Making Cents



US Infrastructure



Healthcare's Holy Grail



Trade Policy

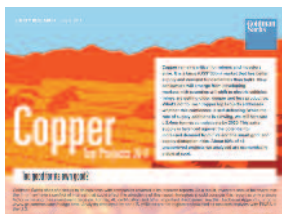


Commodity Corner

Top Projects 2018



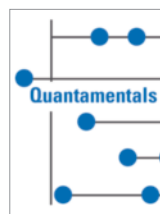
Copper Top Projects



Oil: Age of Restraint



Quantamentals



Music's Return to Growth



Bear Necessities



The Low Carbon Economy

NextGen Power



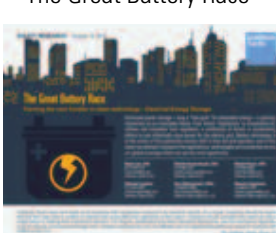
IMO 2020: Global Shipping



Power Shift 2.0



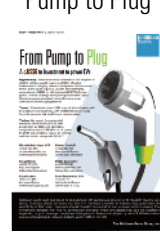
The Great Battery Race



More Lean, More Green



Pump to Plug



Americas Lodging: 2018 Hospitality Handbook



Rising Asia

Apple Suppliers' Dilemma



The Asia Stock Collection



Mapping China's Credit - Vol.2



China AI



GS SUSTAIN

The PM's Guide To The ESG Revolution



37 GS SUSTAIN GEMS



Capex Upturn

Capex Tracker



... and more in **The Mindcraft Library**