

November 19, 2014

MORGAN STANLEY BLUE PAPER



Wearable Devices

The 'Internet of Things' Becomes Personal

Ramping faster than even smartphones and tablets. Persistent identity is the “killer” feature that will ignite a long tail of industry use cases and augment existing mobile applications, such as sensor analytics and mobile payments. We model 154% unit CAGR in 2013-17, more than double industry estimates, with shipments reaching 248 million in 2017. Our bull case 1 billion unit forecast for 2020 is driven by upside in enterprise adoption, subsidies for consumers, and broader use cases.

Best-positioned companies include Apple, Samsung, Microsoft, and analytics companies; component suppliers AAC, Goertek, Quanta, and Zhen Ding; Invensense, Ambarella, Atmel, NXP Semiconductor, Freescale, Microchip, ARM, Imagination Tech, ASE, Maxim Integrated Products in semiconductors; Nike, Adidas, Under Armour in apparel; existing credit card value chain; Intime and Chow Tai Fook in China retail; Dexcom, Insulet, Abbott, Medtronic, Philips, UnitedHealth and CVS in healthcare; Legrand and Assa Abloy in industrials. **Potentially challenged are** Garmin, LG, and Sony; traditional watch brands Swatch Group, Casio, Citizen, and Seiko; Gemalto and eBay in payments; Hengdeli and Luk Fook in China retail; Osram in industrials.

What could limit wearables adoption? Wearables need to offer data accuracy, appealing design, ease of use and independence from smartphones. In addition, it may be harder than expected to change consumer behavior. Consumer adoption may also be constrained by device fatigue or limited willingness to share personal data.

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Key Takeaways

- Wearables will be the fastest ramping consumer technology product to date, addressing a broad range of industries and \$1.6T of global consumer/business spend.
- Persistent identity is the "killer" feature and sensor analytics and mobile payments are two "killer" apps, while more immersive first-person videogames and live event experiences could become another "killer" app for some wearables.

Morgan Stanley Wearables Model

- We expect wearable shipments to grow at a 154% CAGR from 6M in 2013 to 248M in 2017, more than double industry estimates
- Our 1B bull case forecast for 2020 is driven by upside in enterprise adoption, subsidies for consumers, and new use cases.
- Main gating factors include ease of use, need to pair the device with a smartphone, device fatigue, reluctance to change behavior or share personal data, and level of enterprise adoption.

AlphaWise Survey Data

- Our global AlphaWise consumer survey of 10,500 consumers in seven markets indicates 6% of respondents own wearables today.
- Survey points to a 70M (our base case) to 111M (bull case) unit opportunity next year.

Industry Sections	Key Conclusions	Evidence	Best-Positioned / Challenged
Computing	<ul style="list-style-type: none"> • Computing companies well positioned to capitalize on wearables growth • Cannibalization of other consumer electronic devices appears limited 	<ul style="list-style-type: none"> • Samsung leads in purchase intentions of current wearable products, and Apple leads among all CE brands • Cannibalization is low with watch and smartphone most at risk • Analytics is a big opportunity with Salesforce.com announcing Salesforce Wear program in June 2014 	<ul style="list-style-type: none"> • Best-Positioned: Apple, Samsung, Microsoft, Salesforce.com, IBM • Challenged: LG, Sony, Garmin
Supply Chain	<ul style="list-style-type: none"> • Wearables expand the addressable market for the smartphone supply chain • High-volume components (display, batteries, substrates, and acoustics) are key beneficiaries of wearable demand 	<ul style="list-style-type: none"> • Most of the component makers in the smartphone supply chain also engage in wearables • For example, our checks suggest the acoustic value content within the Apple Watch is almost the same as in the iPhone 	<ul style="list-style-type: none"> • Best-Positioned: Zhen Ding, AAC, GoerTek, Quanta
Semiconductors	<ul style="list-style-type: none"> • Wearables expand semiconductor TAM without significant cannibalization • Expect increased demand for low-power and near-range connectivity (Bluetooth Smart and NFC) • Integrating MEMS sensors, connectivity, and micro-controller technology is key to driving costs down, potentially driving consolidation 	<ul style="list-style-type: none"> • MEMS convert energy from one form to another with motion sensors accounting for two thirds of the market today • System-in-Package (SiP) allows for smaller, lighter form factors and could expand from fingerprint sensors to wearables in the future 	<ul style="list-style-type: none"> • Best-Positioned: Invensense, Ambarella, Atmel, NXP Semiconductor, Freescale Semiconductor, Microchip Technology, ARM Holdings, Imagination Technologies Group, ASE, Maxim Integrated Products

Traditional Watches	<ul style="list-style-type: none"> Wearables change how consumers view traditional watches Brands with low to mid-range prices are most at risk, especially those with a more masculine following Watch retailers in China (the biggest market) are currently indifferent but we see risks to those exposed to low- to mid-range watches 	<ul style="list-style-type: none"> Like other technology products, consumers could view wrist-based devices as having a life cycle vs. "one-off" purchases Wearables today have the most overlap with masculine-looking \$200-1,000 traditional watches Our survey shows low to mid-range traditional watches have higher exposure to young consumers who are more likely to consider wearables 	<ul style="list-style-type: none"> Challenged: Swatch Group, Casio, Citizen, Seiko, Hengdeli
Apparel	<ul style="list-style-type: none"> Wearables could accelerate an ongoing health and wellness trend Wearables create another avenue for brands to connect with consumers and generate demand We expect major brands to focus on partnerships with hardware manufacturers 	<ul style="list-style-type: none"> Athletic apparel and footwear has outpaced industry growth and we expect this to continue Past surveys found respondents that were athletically active or serious athletes spent more on athletic gear Nike will soon discontinue its Fuelband hardware and focus on its software, and other brands also have apps for 3rd-party mobile devices 	<ul style="list-style-type: none"> Best-Positioned: Nike, Adidas, Under Armour
Payments	<ul style="list-style-type: none"> Though it is still early days, Apple Pay is seeing strong adoption Apple Watch would make Pay even easier to use and could further increase adoption We expect Apple's competitors to implement similar systems on their wearables and other devices 	<ul style="list-style-type: none"> Apple Pay has broad support from networks, merchant acquirers and issuers, and is seeing high usage among a growing user base Apple will use biometric instead of fingerprint sensors on the Watch to verify the user (persistent identity) Competitors will likely adopt Apple's implementation after limited success in the past, which will be a positive for the payments industry 	<ul style="list-style-type: none"> Best-Positioned: networks (Visa, MasterCard, American Express, Discover), merchant acquirers (Vantiv, TSS, Heartland Payments, Evertec, Global Payments), issuers (Bank of America, JPMorgan, Citigroup, Capital One in the US), payment terminal manufacturers (Verifone, Ingenico) Challenged: trusted service managers (Gemalto), competing payment options (PayPal)
China Retail	<ul style="list-style-type: none"> The future of retail is about location, service, and technology Wearables represent technology solutions that can improve customer experience by providing more relevant information more effectively 	<ul style="list-style-type: none"> Intime is working with Alibaba and Baidu to equip its stores and malls with technology to improve customer experience and data analytics Jewelry retailer Chow Tai Fook is putting RFID chips in products to capture the pre-purchase decision-making process of its customers 	<ul style="list-style-type: none"> Best-Positioned: Intime and Chow Tai Fook Challenged: Luk Fook
Healthcare	<ul style="list-style-type: none"> Wearables could address healthcare system inefficiencies Healthcare is ripe for disruption due to regulation and technology changes Wearables could become a data hub and disrupt the current system 	<ul style="list-style-type: none"> In the US, \$765B in healthcare spend is wasted each year US healthcare reform is shifting the system from fee-for-service to value-based reimbursements We see opportunities in personal, portable, and persistent medical devices, managed care and pharmacies 	<ul style="list-style-type: none"> Best-Positioned: Dexcom, Insulet, Abbott, Medtronic, Philips, UnitedHealth Group, CVS Health
Industrials	<ul style="list-style-type: none"> Within home automation, wearables can be a catalyst because they offer something unique compared to smartphones and tablets Incumbents need to move fast as there are new competitors, though there is the chance of partnerships 	<ul style="list-style-type: none"> Companies are building smart home products: Philips' Hue lighting, Assa Abloy's connected locks, and Legrand has multiple offerings Persistent identity in wearables would be an improvement in automating smart homes Google acquired Nest, Dropcam, and Revolv, and Apple launched HomeKit to connect 3rd-party devices 	<ul style="list-style-type: none"> Best-Positioned: Legrand, Assa Abloy, Philips Challenged: Osram

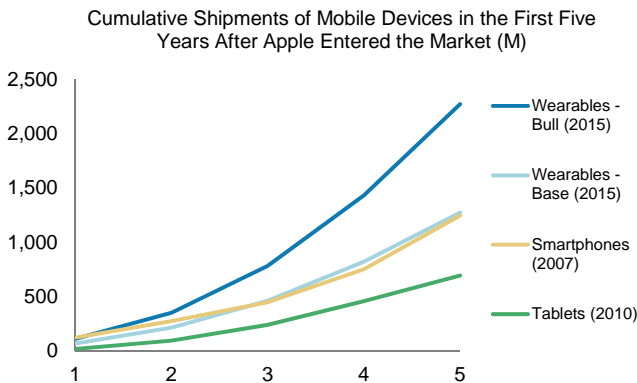
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Executive Summary

Greater impact than smartphones and tablets. Wearable devices will far surpass market expectations, and become the fastest ramping consumer technology device to date, in our view. In contrast to other consumer devices before it, like feature phones, which were disrupted by smartphones, and notebook computers, which were disrupted by tablets, wearables will have far-reaching impact by creating a new category *and* by disrupting or accelerating change within industries outside of technology.

Expect 154% CAGR between 2013 and 2017. Our wearables forecast is more than double industry estimates and is arguably still conservative. We expect wearable shipments to grow at a 154% CAGR from 6M in 2013 to 248M in 2017. Our 1B bull case forecast for 2020 incorporates our bullish view on enterprise adoption (in retail, manufacturing), subsidies for consumers (from insurance, employers), and new use cases (augmented reality).

Exhibit 1
Wearables to Become the Fastest-Ramping Technology Device



Source: IDC, Gartner, Company Data, Morgan Stanley Research

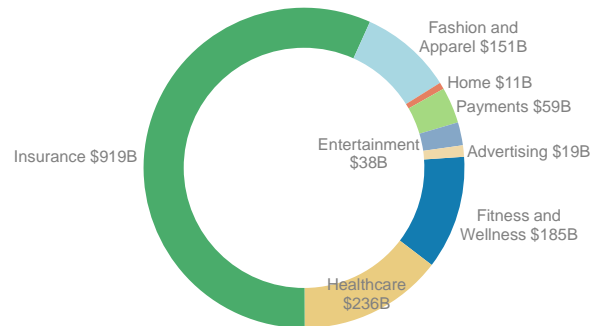
Three factors drive our bullish view:

- Increasing broadband penetration drives faster consumer technology ramp than previous devices.** Wearables should continue this trend in light of a lower starting price, lack of a monthly service contract, incremental use cases versus a smartphone (due to persistent identity), and potential for enterprise adoption.

Early use cases alone make up \$1.6T of global consumer/business spend. These include health and fitness, entertainment and gaming, home automation and

security, watches, payments, advertising, and insurance. Our base case forecast of 70M wearable shipments next year at a \$250 ASP assumes 1% penetration of this spending opportunity.

Exhibit 2
Wearables Address \$1.6T of Global Consumer and Business Spending

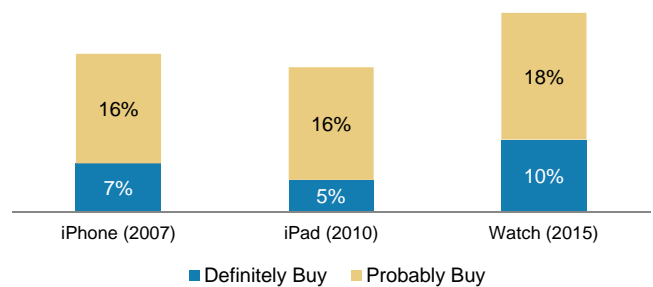


Source: ADT, AM Best, CDC, CRS, eMarketer, Euromonitor, IAB, MagnaGlobal, IBIS, LA Times, Nilson, NPD, RAND, SNL Financial, Statista, Morgan Stanley Research

- Our global AlphaWise consumer survey points to a 70M (our base case) to 111M (bull case) unit opportunity next year, well above IDC forecast of 42M, and corroborates our macro views of the opportunity.** Additionally, when we compare US purchase interest to early iPhone/smartphone and iPad/tablet demand, Watch/wearable demand is 1.3x higher.

Exhibit 3
Initial Apple Watch Purchase Intention in the US 1.3x Initial iPhone and iPad Demand

Survey Responses on Purchase Intention in the US for New Apple Product Categories



Source: AlphaWise, Morgan Stanley Research

What exactly are “wearables,” anyway?

Wearables specifically are mobile electronic devices that are worn on the body, or attached to or embedded in clothes and accessories. These mini computers and sensors can display, process, or gather information, and tend to have wireless communication capabilities. It is a logical extension of past computing cycles – from desktop computers to notebooks to more recently tablets and smartphones – as each device becomes more personal and portable.

What Will Drive This Next Tech Trend?

Persistent identity – the “killer feature.” While the market sees wearables as a way to shrink and mobilize computing beyond smartphones today, we see much more differentiated and disruptive use cases. The lesser-talked-about feature of Apple Watch is something we call “persistent identity.” When a user first puts on an Apple Watch, s/he is asked for a personal pin to confirm their identity. Sensors on the back of the Watch provide constant contact, allowing apps to know with a high degree of certainty who is controlling the device. Why does this matter? Because users can now streamline many day-to-day processes, like making payments, unlocking / starting cars, automating security and heat/air (HVAC) technologies at home, accessing office buildings and so on. Business value creation is even greater on the back of sensor analytics, examples of which we highlight below.

Two killer apps – sensor analytics and mobile payments:

Sensor analytics is an extension of the Internet of Things (IoT) computing cycle: Consider the following logical extension of having an IoT depot on your wrist:

- **Personal data collection:** A wearable device collects personal physical data – activity, health, and location – about a specific individual which can influence behavior and be used by industries to drive business value.
- **Behavior-based retail promotions:** A retailer can better understand how customers spend time in their stores and provide targeted coupons or information about product.
- **Customized auto insurance:** Auto insurance companies can determine premiums based on consumer behavior that influences their safety in an automobile.
- **Drug monitoring:** Pharmaceutical companies can improve prescription fill-rates and doctors can better monitor pill intake.

- **Factory process and efficiency monitoring:** Manufacturing companies can monitor employee efficiency and improve processes on the factory floor.
- **Credit card safety and efficiency:** Credit card issuers can reduce fraud while also increasing usage and customer satisfaction and volumes.

Payments become even more interesting on wearables.

Wearables can significantly reduce the time to complete a transaction by limiting the need to take a wallet or smartphone out of a user’s pocket and confirming a purchase with a pin or signature. We see this as an even more convenient experience versus the same technology on a smartphone. Importantly, ease of use leads to higher volumes, which means merchants, card networks, card issuers and payment platforms like Apple Pay potentially all win

What We Did

- We conducted AlphaWise surveys of 10,500 device consumers in seven countries (US, UK, Germany, France, China, Japan, and Brazil).
- We spoke to experts from many companies, including start-ups and private companies, semiconductor and component suppliers, consulting companies, enterprise and government CIOs, as well as leading consumer electronics vendors.
- We benchmarked five popular fitness trackers over several weeks to determine the strengths and weaknesses of the products in the market today.
- We analyzed past consumer electronics products, in particular initial product ramps. We combined this analysis with the data points above to arrive at our forecast of the size and growth of the wearables market.

Note: Because it appears to be the most advanced device of its kind today, we base some of our conclusions about the potential wearables market on the Apple Watch. Many of these market and consumer/device interface dynamics will apply no matter who makes the devices, provided they deliver the kinds of technologies we address here.

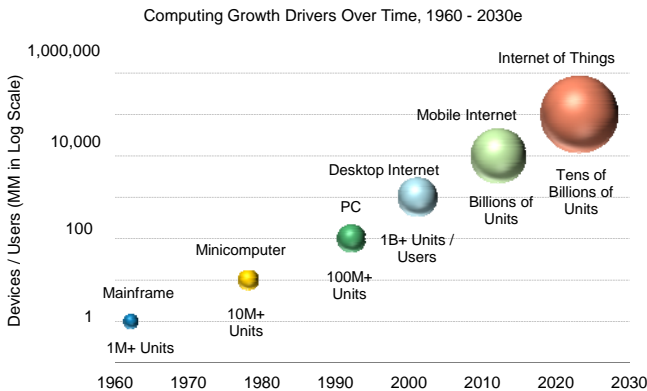
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The ‘Internet of Things’ Era: If You Build It, Will They Wear It?

The Internet of Things represents the next big computing cycle, after Mobile Internet. In our April 3, 2014, Blue Paper [The ‘Internet of Things’ Is Now: Connecting the Real Economy](#), we defined this computing cycle as the next generation of personal computing, whereby machines interact, potentially independently, with each other and with their environment. It is enabled on the hardware side by a combination of distributed computing power, sensors, actuators and wireless communication, and on the software side by applications and big data/analytics.

Exhibit 4

We Are Entering the Next Computing Cycle: Internet of Things



Source: Morgan Stanley Research

We focus in this Blue Paper on the “wearables” segment of the Internet of Things computing cycle. It is still “day 1” in the wearables market. While the idea of wearable computers and sensors has been around for a long time, we have seen only certain products gain traction in the last few years. The most well-known products in the market today are fitness trackers that can be worn on the wrist or clipped onto clothing, led by Fitbit (Tracker launched in 2008), Jawbone (Up in 2011), and Nike (Fuelband in 2012). Other notable introductions include Samsung Gear in late 2013, Google Glass, with a developer version launched in early 2013, and Oculus VR’s Rift, which was funded initially through Kickstarter in 2012 and acquired by Facebook in July 2014.

Exhibit 5

Samsung Gear Is the Most Popular Wearable Today



Source: Company data, Morgan Stanley Research

Exhibit 6

Fitbit Flex Is One of Many Fitness Trackers in the Market



Source: Company data, Morgan Stanley Research

Exhibit 7

Google Glass Is a Voice Controlled Computing Device with Some Functionality of Smartphones



Source: Company data, Morgan Stanley Research

Exhibit 8

Oculus VR, Now Owned by Facebook, Makes the Rift, a Virtual Reality Headset with an Immersive 3D Experience



Source: Company data, Morgan Stanley Research

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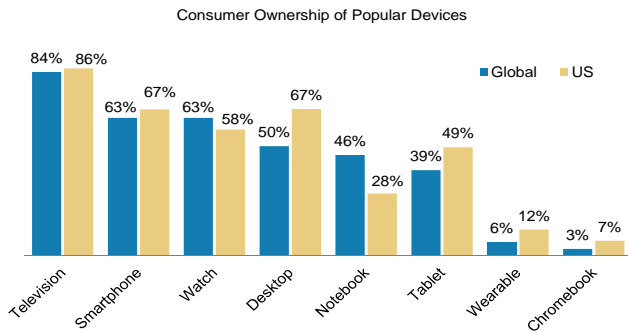
Current Vendors and Share

First, we size the existing market, rank the brands, and examine the current use cases. We estimate only 6M wearables were shipped globally in 2013 vs. over 300M PCs and over 1B smartphones. Shipments should increase significantly to 25M in 2014 mainly due to Samsung entering the market with its Gear line in September 2013 and quickly becoming the top vendor. All the major brands focus on health tracking though some offer other functions similar to smartphones.

Wearable ownership is still very low today. Our proprietary AlphaWise survey indicates 6% of respondents own wearables. We surveyed 9,000 consumers in the US, UK, Germany, France, Japan and Brazil in August 2014. We surveyed another 1,500 consumers in China but the data is only used for select analyses. For emerging markets, we consider the responses to reflect the most affluent 7-15% of the population. In the US, wearable ownership is much higher at 12%. We think this is partially because most wearable start-ups are based in the US.

Interestingly, traditional watch ownership is quite high at 63%, in line with smartphones. Tablet ownership is also high at 39%, close to notebooks and desktops already just over four years after the iPad launched. In contrast, Chromebook ownership is still very low at 3%, though in the US ownership is higher at 7%.

Exhibit 9
6% of Consumers Own Wearables Today



Source: AlphaWise Survey August 2014, Morgan Stanley Research

alphawise Evidence

Core Questions for Evidence Research

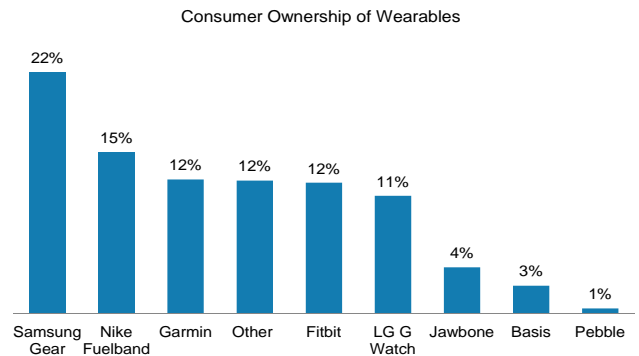
- What is the market size (installed base, shipments) of wearable devices?
- What is the purchase intention by brand and timing?
- What are the key features and functions consumer want?

What Gives Us Confidence

- In July-August 2014, we conducted an online survey of 10,500 consumers in 7 countries. The survey sample is representative of the 18+ population by gender, age, geography and income in France, Germany, Japan, UK and US. Respondents in Brazil are a national sample of online consumers from the A, B & C socio-economic classes, and in China, online consumers from 14 Tier 1&2 cities with above-average education and income. At 1,500 sample size, conclusions based on the total sample of each country have a maximum margin of error of +/- 2.2% at 95% confidence level.

Samsung Gear is the leading brand in the wearable market with 22% ownership share. The market is fragmented with five vendors each having 11-15% share, which is what we would expect for such a nascent market.

Exhibit 10
Samsung Leads the Wearables Market, but There Are Many Vendors Vying for Second

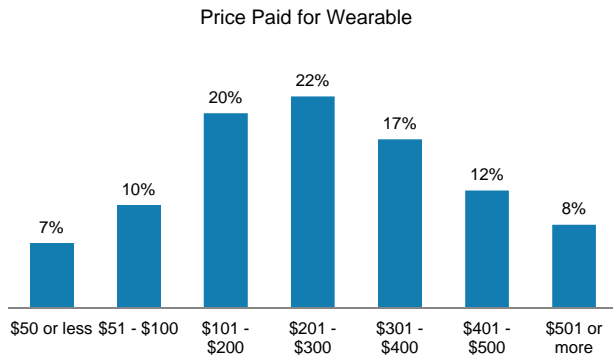


Source: AlphaWise Survey August 2014, Morgan Stanley Research

Consumers on average spent \$269 and have owned their wearable for 9.4 months. Pricing for the most popular devices tends to be around \$100, like the Nike, Jawbone and Fitbit products, or around \$250 and above, like the Samsung, LG and Basis (acquired by Intel) products. Garmin's devices have a wide range of price points. Unsurprisingly, the wearable installed base is relatively young compared to smartphones at over two years and PCs over four years, based on our estimates.

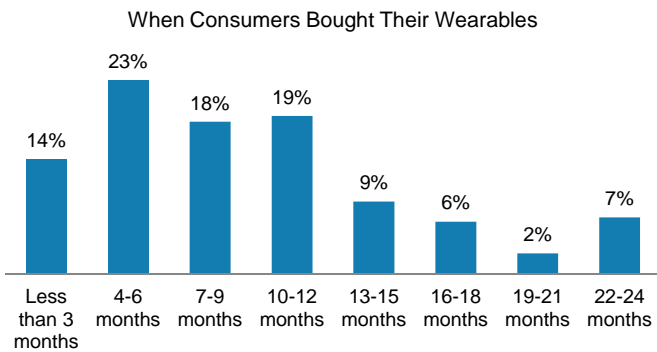
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Exhibit 11
Consumers Spent on Average \$269 on Their Wearable



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Exhibit 12
Average Wearable Age Is 9.4 Months

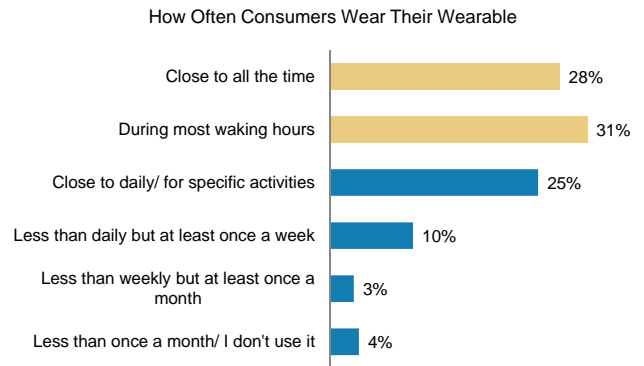


Source: AlphaWise Survey August 2014, Morgan Stanley Research

Usage and Use Cases

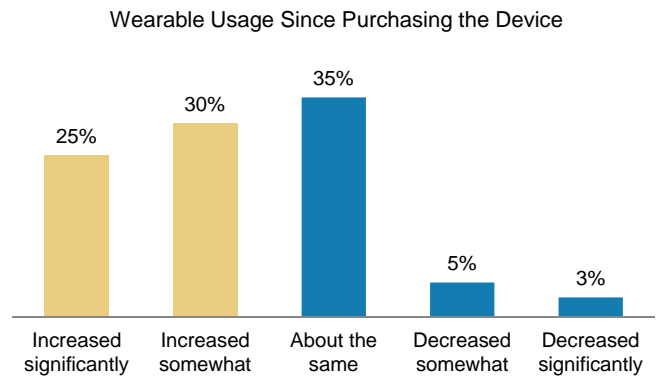
The survey results refute the notion that wearable usage is not sustainable. In fact, wearable owners really like their devices. Nearly 6 in 10 respondents wear their devices either all the time or during most waking hours. Another quarter wear their devices frequently for specific activities. More encouragingly, nearly 6 in 10 respondents have increased their usage since buying their devices, and over one-third have maintained their usage.

Exhibit 13
59% of Respondents Use Their Device Almost All the Time



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Exhibit 14
56% of Respondents Have *Increased* Usage since Buying Their Devices



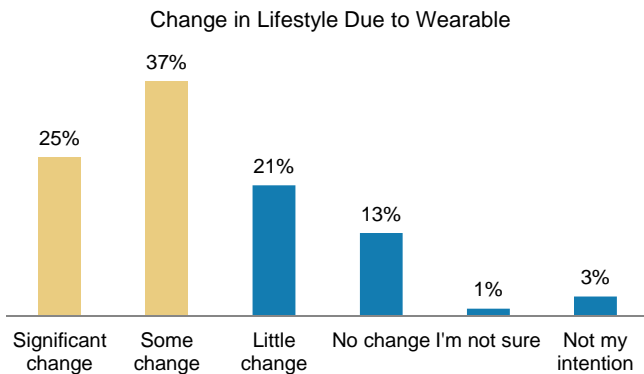
Source: AlphaWise Survey August 2014, Morgan Stanley Research

Wearables are changing users' lifestyles. The sustainability of the usage can be explained by the fact that the devices are creating a real change in lifestyle and integrating into the users' behavior. This is similar to the change in society and culture we have seen due to smartphone adoption since the iPhone launch in 2007.

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Exhibit 15

62% of Respondents Made Significant or at Least Some Change to Their Lifestyles

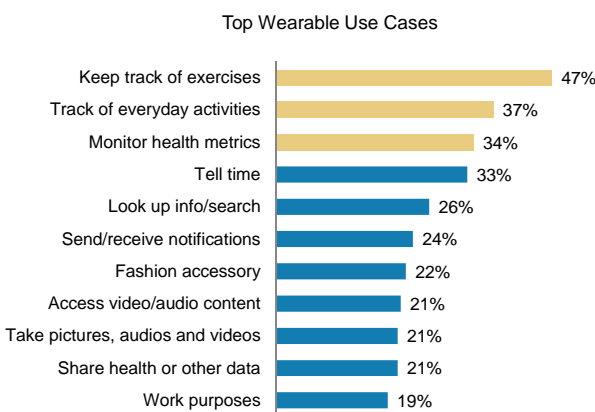


Source: AlphaWise Survey August 2014, Morgan Stanley Research

Not surprisingly, health monitoring is the most popular use case. The other use cases are roughly equally popular. However, as a group, information access (i.e., tell time, search for directions) is next, followed by communications (i.e., send a text), and work usage is the least popular. We think enterprises will likely adopt wearables over time and it is a driver of the bull case in our market model. We explore this potential in a section below.

Exhibit 16

Health Monitoring Is the Most Popular Use Case and Work Usage Is the Least Popular



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Early adopters likely behave differently from the majority. While the level of usage and sustainable change in behavior among early wearable adopters is encouraging, we think wearables need to expand their use cases, and improve their hardware, software, and services in order to gain mainstream traction. In the following section, we analyze the strengths and weaknesses of current wearables and then discuss what future devices need to do to succeed.

Fitness Tracker Trial

We simultaneously tried five of the most popular fitness trackers in the market today to get a sense of the strengths and weaknesses of each device. We tried the Basis Carbon Steel, Fitbit Flex, Garmin Vivofit, Jawbone UP and Nike+ FuelBand. According to our survey, these five companies account for 46% of the wearables installed base today.

We group our review into three categories: price, form, and functionality. Every device has its strengths and weakness, but overall we see a lot of room for improvement, which is not surprising for such a new market. See chart below for a summary of the key metrics.

Price: Most fitness trackers on the market today are quite affordable. With the exception of the Basis Carbon Steel (\$199) and certain versions of the Nike+ FuelBand, all of the fitness trackers we tried cost between \$80 and \$100. For comparison, Apple’s smallest iPod today, the Shuffle, costs \$49. The iPod Nano is \$149 and iPod Touch starts at \$199. Major electronics vendors have recently launched smartwatches priced at a premium to fitness trackers. Samsung’s products, including the Gear 2 at \$299 and Gear Live at \$199, have been most popular, followed by LG’s G Watch which costs \$229 and Google’s Moto 360 which costs \$249. Apple’s Watch starts at \$349 but we suspect average prices could go higher once they are revealed.

Form: None of the fitness trackers we tested has perfected the balance between fashion and comfort. A wearable is by definition a very personal device, and an expression of the user’s style, so a successful mass-marketed product needs to be attractive enough for us to want to wear, regardless of the functionality. Vendors have to balance aesthetics, comfort, and functionality. Often, we see devices sacrifice one of these criteria for the sake of another, and rarely can we get the perfect mix. Interestingly, the vast majority if not all of the fitness devices on the market are androgynous in design yet the opposite is true for most fashion accessories.

Interestingly, we are still dealing with the same challenges 14 years later. In June 2000, the *New York Times* interviewed Swatch’s then president and current CEO Nick Hayek about the company’s upcoming Swatch Talk, which is a watch with phone capabilities. Hayek said, “I can’t expect people to buy monsters. First, you must do a nice-looking watch, and then we can talk about the function.”

Back to the present, crowdfunding campaigns reveal that early adopters prefer to wear their devices on their wrists.

7 out of the 10 most popular crowdfunded campaigns are for the development of wrist-based devices. It is no surprise that all the fitness trackers we tested are designed for the wrist though the Fitbit has other devices that can be clipped onto clothing. All of them have a rubbery and, in some cases, plastic texture.

Some product-specific observations on *form*:

- The Jawbone UP had the best balance of fashion and comfort out of the five, in our opinion. It has a sleek rubber body. The ends taper a little and have a shiny metallic finish.
- The Fitbit Flex's initially bright smooth surface begins to look worn after a month or so of daily use. However, users can take the tracker out of the band and replace the latter with a new one.
- The Garmin Vivofit looks similar to the Flex except for the clear plastic display on the tracker. While the display allows users to check their activities and progress against goals, it also makes the band much more obtrusive and the device a lot more noticeable when worn.
- The Nike+ FuelBand has a simple rubber wristband with a display made of 120 LED lights built into the band. It comes in bright neon colors in addition to black and metallic, allowing for more differentiation among users.
- The Basis Carbon Steel clearly favors functionality over "wearability." It is the thickest and heaviest (~44 grams) fitness tracker out of the five. The watch face could scratch easily, and the black rubber straps encounter the same aging issues as the other trackers
- While we did not try this device, we note that Adidas launched the miCoach in October 2013. It has built-in GPS, a heart-rate monitor, Bluetooth 4.0, music capabilities, and a color touchscreen. Initial feedback indicates that battery life has been disappointing for the price point (\$380).







Functionality: Products need to broaden use cases in order to gain mass adoption. In order to have sustained engagement for mass adopters, future wearables must increase the number of use cases so they continue to interact with users, and add insight and value to their lives.

Most products we tested break the two-second rule. Users will become frustrated and are likely to give up if a machine takes more than two seconds to compute an operation and return control to the user, according to a paper by IBM psychologist Robert B. Miller in 1968. Today we simply call it ease-of-use or user experience (UX). Ideally, this means it should not take more than two or three steps for users to find what they need on a device, in our view. It is even more important for wearables since users are often trying to access something on the device while on the go, and there is very limited screen real estate and input methods (maybe voice and some touch commands, and very few buttons).

Some product-specific observations on *functionality*:

- Both the Basis Carbon Steel and Nike+ FuelBand violate the two-second rule. The Basis usually takes a few minutes to sync with the smartphone, and during this time, users cannot close out of the Basis app. The FuelBand only has the 120 LED light display, and it can take a while to scroll through all the metrics (steps, calories, battery life, etc.) to get to what the user wants.
- The Fitbit Flex, Jawbone UP, Garmin Vivofit, and Nike+ FuelBand cannot automatically detect the activities being performed. For example, the user has to press a button before going to sleep and reawaken the band when he wakes up. These bands cannot automatically detect and place the user's body movement into an activity category, and requires the user to classify the activities (e.g. gym) after synchronizing with a smartphone or computer. Some devices, like the Fitbit, do not have the option to tag workouts in its official app, although there are third-party apps that do that.
- The FuelBand only provides the length of time the user was asleep, but does not offer details like length of REM sleep, or how many times the user woke up at night.
- While the Basis has the largest form factor, it also has the best functionality. It is the most automated out of the five we tested. For example, the display lights up when the user flicks his wrist towards him or herself. The device knows whether the user is walking, running, or cycling, or when the user goes to bed and wakes up. It also gives detailed activity breakdowns without the need for tagging.
- We also note that Adidas miCoach and MyFitnessPal (a calorie counting service) have recently announced a joint initiative, which allows data to be automatically exported from the device so consumers can compare calories consumed versus burned.

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	Fitbit Flex	Basis Carbon Steel	Nike+ FuelBand SE	Garmin Vivofit	Jawbone UP	Adidas Fit Smart	Adidas Smart Run
							
Release Date (US)	Early May 2013	January 3, 2014	November 27, 2013 (Likely to be Discontinued)	March 1, 2014	November 6, 2011 to March 2014 (Replaced by UP 24)	July 9, 2014	November 1, 2013
Price	\$99.95	\$199	\$99-\$149	\$129.99	\$79.99	\$199.90	\$400.00
Hardware							
Colors	10 colors with customizable bands	1 color (black) with customizable straps	7 colors	6 colors with customizable bands	7 colors	Black & White	1 color
Display	5 white LED indicator lights	Monochrome backlit LCD display	20 red/green LEDs and 100 white LEDs	Dual-color non-backlit LCD display	Dual multi-color LEDs	17x11 LED matrix	1.45" LCD, 184 x 184 px touch screen
Weight	20 grams	44 grams	30 grams	25.5 grams	20 grams	~47/50 grams (small/large)	80.5 grams
Connectivity	Bluetooth 4.0; sync via charging cradle	Bluetooth 2.0; sync via charging cradle	Bluetooth 4.0; sync via built-in USB 2.0	Bluetooth 4.0	Sync via 3.5 mm headphone jack	Bluetooth 4.0	Bluetooth 4.0, WLAN
Battery Life	5 days	4 days	4 days	1 year	10 days	5 days, 1hr workout/day	4 hours (training mode w/ music), 8 hours (marathon mode w/o music)
Charging Time	3 hours	3 hours	1 hour	Battery needs to be replaced	1 hour 20 minutes	~3 hours	4 hours
Storage	Up to 7 days of detailed, minute-by-minute data, or past 30 days without minute-by-minute details	Up to 7 days of data if worn 24/7	Up to 3 months	Up to 3 weeks of 24/7 activity data, or up to 2 weeks if the heart rate monitor is used 1 hour per day	Up to 9 months of movement and sleep data	Up to 10 hours of workout data	4GB (3GB dedicated to music)
Software							
Applications	Steps, distance, caloric burn, caloric intake (manual), water intake (manual), active minutes, achievement alert, sleep quality	Date, time, steps, caloric burn, active minutes, resting heart rate, auto-detects running, walking, bicycling, and sleeping, sleep quality	Time, steps, active caloric burn, Hours Won (time user has been active for 5 consecutive min), NikeFuel points (proprietary fitness tracking unit), achievement alert	Date, time, steps, distance, caloric burn, sleep quality	Steps, distance, active caloric burn, caloric intake (manual), water intake (manual), active minutes, sleep quality, power nap alarm, daily fitness advice in app	Time, pace, distance, stride, caloric burn, visual coaching guidance for workout intensity, wireless syncing with miCoach Train & Run app	GPS, step, pace, distance, stride, caloric burn, time, continuous heart rate, audio and visual coaching, Bluetooth MP3 player, wifi syncing
Social Features	Yes	No	Yes	Yes	Yes	Yes	Yes
Compatibility	<ul style="list-style-type: none"> • iPhone 4S and newer • iPod Touch 5th Generation and newer • iPad 	<ul style="list-style-type: none"> • iPhone 4 and newer • iPod Touch 5th Generation and newer • Android 4.1.2 and newer (unofficially supported) 	<ul style="list-style-type: none"> • iPhone 4S and newer • iPod Touch 5th Generation and newer • Android 4.3 and newer 	<ul style="list-style-type: none"> • iPhone 4S and newer • iPod Touch 5th Generation and newer • iPad • Android 4.3 and newer 	<ul style="list-style-type: none"> • iPhone 3GS and newer • iPod Touch 4th Generation and newer • iPad 2 and newer • Android 4.0 and newer 	<ul style="list-style-type: none"> • iPhone 4S and newer • iPod Touch 5th Generation and newer • iPad 2 and newer • Android 4.0 and newer 	<ul style="list-style-type: none"> • iPhone 4S and newer • iPod Touch 5th Generation and newer • iPad 2 and newer • Android 4.0 and newer
Other Features							
Time Display	No	Yes	Yes	Yes	No	Yes	Yes
Silent Alarm	Yes	No	No	No	Yes	No	No
Idle Alert	Yes (vibration)	No	Yes (display)	Yes (display)	Yes (vibration)	No	No
Goal Setting	Yes	Yes	Yes	Yes (tailored)	Yes	Yes	Yes
Water Resistant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Summary							
Strengths	Best mix of form and function, most user-friendly, fastest sync	Most functionality and automation	"Gamification" of activities and best for competing with friends	Best display, most accurate distance count, ability to create usable goals, longest battery life	Best form factor, most accurate step count, best smartphone app	Light, streamlined features for longer battery life, coaching function, syncs well with app for goal setting	Continuous heart-rate monitoring, audio/visual coaching, Bluetooth MP3 player
Weaknesses	Band can be hard to clasp, tracker and clasp are detachable making it easy to lose	Relatively heavy, bigger form factor, slow sync	Least functionality and inefficient scroll screen	Average design, display not backlit	Inconvenient sync, no display to gauge performance on device	Limited features, given price point, no GPS functions	Short battery life, only connects to miCoach, slow to get GPS signal, only wireless sync, priced at higher end of spectrum
Rating Out of 5							
Amazon.com	3.7	3.2	2.9	3.4	2.9	Not Rated	3.5
PCmag.com	4.0	4.5	3.5	3.5	3.5	Not Rated	Not Rated
Engadget.com	4.5	4.0	4.0	3.0	2.6	2.0	4.0
Average Out of 5	4.1	3.9	3.5	3.3	3.0	2.0	3.8

Note 1: In April 2014, Nike discontinued manufacturing of the FuelBand because it believes the company's future lies in software rather than hardware.

Note 2: Jawbone stopped manufacturing the Jawbone UP after the release of Jawbone UP24 in March 2014.

Source: Amazon.com, PCmag.com, Engadget.com, Cnet.com, Pocket-lint.com, Morgan Stanley Research

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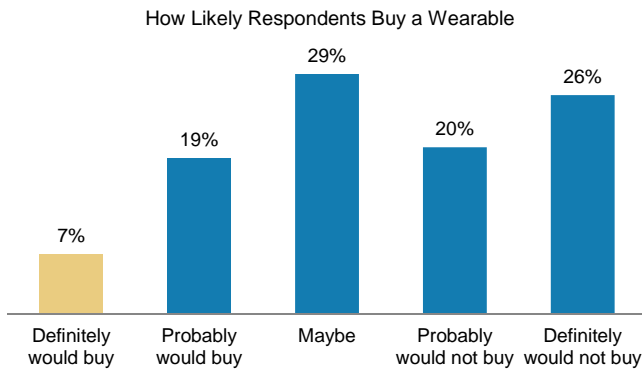
Wearable Market Outlook

Purchase Intention for Current Vendors

Wearables are gaining traction. Seven percent of all respondents said they would “definitely” buy wearables, and another 19% said “probably.” Among current wearable owners, those numbers jump up to 30% and 44%. Only 2% of current owners said they “definitely” would not buy another wearable.

Exhibit 17

7% of All Respondents Would “Definitely” Buy Wearables, Slightly Higher than 6% Ownership



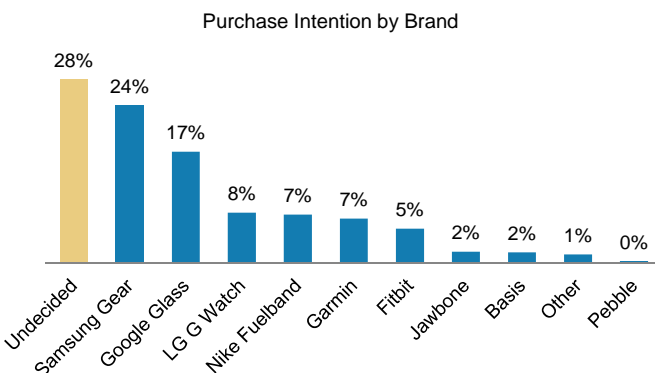
Source: AlphaWise Survey August 2014, Morgan Stanley Research

Samsung Gear remains the most popular device.

Consistent with ownership data, purchase intention data suggest Samsung Gear remains the most popular wearable. However, the top response is actually “undecided,” which means a lot of market share is up for grabs in our view. While Google Glass is the second most popular device, we believe its \$1,500 price point, over 10x as expensive as some of the other devices on the list, would prevent it from realizing its purchase intention share of 17%.

Exhibit 18

Samsung Gear Lead All Brands in Purchase Intention but Many Consumers Are Undecided



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Comfort is the top priority. As we learned in our product trial above, comfort is an important criterion since the owner will most likely wear the device almost all the time. Beyond comfort, the quality of the ecosystem is also important, represented by “ease of syncing with other devices” and “quality of its apps on other devices” in the responses below.

Exhibit 19

Comfort of Device Is the Top Purchasing Criterion



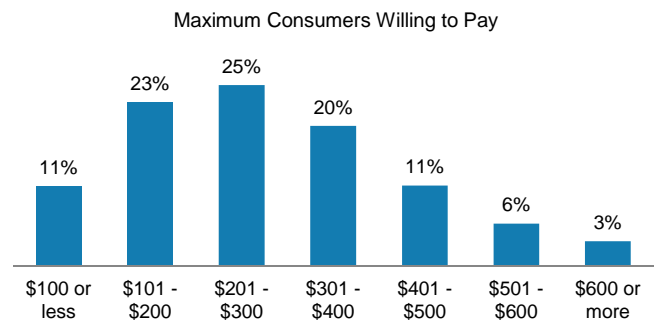
Source: AlphaWise Survey August 2014, Morgan Stanley Research

Consumers ready to invest in wearables now.

Respondents were willing to spend \$281 on average on their next wearable devices, slightly more than the \$269 current owners spent on their devices. Two-third of purchasers also plan to buy in the next year, with another 18% waiting to see what new products come to market. We believe these are very encouraging signs for a new product category, and suggest we may be near the inflection point of mass adoption.

Exhibit 20

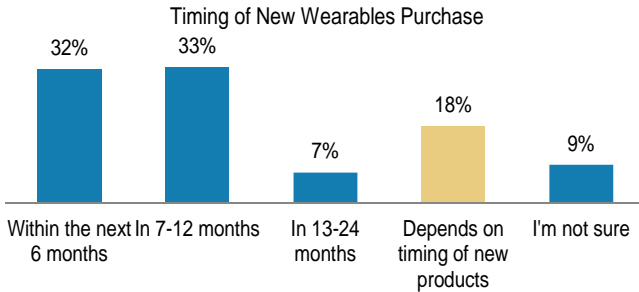
Consumers Willing to Spend \$281 on Average for New Wearables



Source: AlphaWise Survey August 2014, Morgan Stanley Research

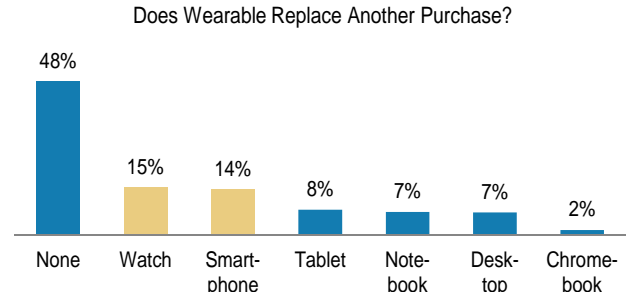
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Exhibit 21
2/3 of Purchasers Plan to Buy in the Next Year and Another 18% Are Waiting for New Products



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Exhibit 22
Watch and Smartphones Are Most Likely to Be Cannibalized by Wearable Purchases



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Watch and smartphone budgets are most at risk. Nearly half of consumers do not believe their wearable purchase will replace another device. However, 15% think it will replace their watch spending and another 14% think it will replace their smartphone spending.

Case Study: Disney's Adoption of Internet of Things and Wearables

Wearables are much more than fitness trackers. While fitness trackers have become more popular recently and it is one of the first use cases in the wearables market, we see much broader application in the future. For example, we discuss future mobile payments and augmented reality use cases below. However, Disney (covered by Ben Swinburne) has already implemented a whole ecosystem for its theme parks that brings together wearables, sensors and software, all aspects of the Internet of Things. In this section, we examine the company's new MagicBand and MyMagic+ offerings.

Exhibit 23
Disney's MyMagic+ Experience includes the MagicBand, which Visitors Wear on Their Wrists



Source: Company Data, Morgan Stanley Research

MyMagic+ helps customers create a customized Disney resort experience. It includes the MagicBand, which customers wear during their stay, and FastPass+, which allows customers to reserve access to some rides over the Internet before they even leave home and skip the lines when they arrive at the attractions.

MagicBands make the users' lives much easier while at Disney resorts. Customers that stay at Disney Resort hotels will receive MagicBands, which are colorful bracelets made of plastic and rubber, and come customized with the users' names on them. Teardowns show that the MagicBand uses RFID for its wireless connectivity. The bands allow users to unlock doors in Disney Resort hotels, enter Disney parks, check in at FastPass+ entrances, connect Disney PhotoPass images to their accounts, charge food and merchandise purchases to their Disney Resort hotel rooms. The bands also have location tracking abilities so users can sit down at tables after purchasing their food and wait for it to be delivered.

Disney is optimistic about MyMagic+. Customer reviews online indicate the bands do improve the resort experience though early reviews from last year noted there were some bugs to be worked out. Disney just finished rolling out the MyMagic+ experience at Walt Disney World in the June 2014 quarter. Management said that about half of the guests use MagicBands currently, and 90% of them rated the experience as excellent or very good. Disney expects the system to increase customer spending, and said that it contributed to earnings in the September quarter.

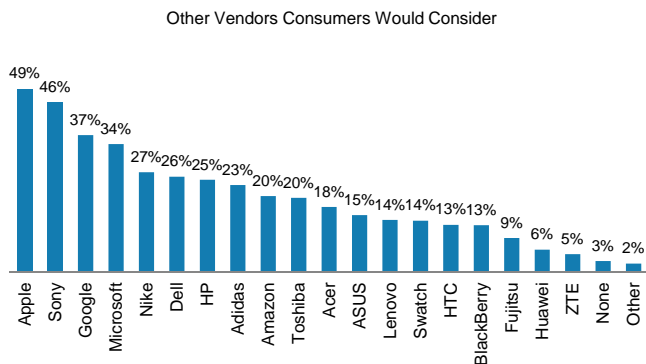
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Potential New Entrants

It is not too late for major brands to enter the wearables market. So far, we have seen a mix of established companies and startups launch wearables. Although many of the well-known technology or fashion brands have yet to participate, respondents are willing to consider many of them. In particular, Apple (49% of respondents) and Sony (46%) rank the highest. Three of the top four are technology platform players: Apple iOS, Google Android and Microsoft Windows. This is followed by apparel companies: Nike and Adidas. Interestingly, traditional consumer electronics companies that are focused on hardware, and Swatch, the only watch brand on the list, did not rank very high.

There are some regional differences to brand consideration. In general, a brand tends to get more consideration in the country it is based, or where it already has high market or mind share. For example, respondents in Japan are more willing to consider Fujitsu. In China, respondents are more willing to consider local brands Huawei and Lenovo. Interestingly, respondents in China are even more willing to consider Apple than those in other countries but much less willing to consider Swatch. In the US, Apple, Google, Nike and Microsoft screened better than in other countries. Surprisingly, Adidas did not screen better in Germany than other countries.

Exhibit 24
Consumers Willing to Consider Existing Technology Giants for Wearables



Source: AlphaWise Survey August 2014, Morgan Stanley Research

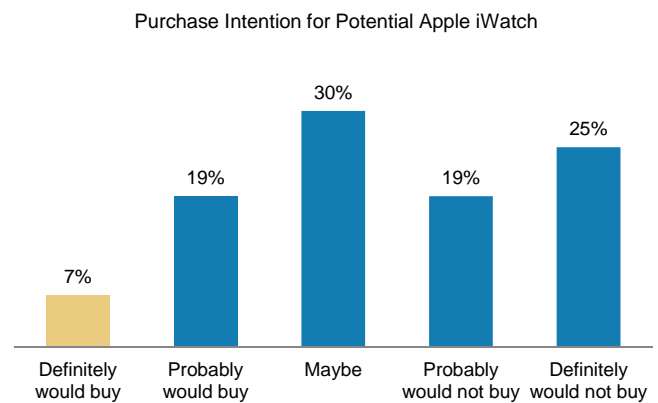
There is strong interest in an Apple wearable. We conducted our survey just ahead of Apple’s Watch announcement in September. In general, our description below is in line with Apple’s announcement though the actual Watch does not have GPS but does emphasize mobile payments. Seven percent of all respondents would “definitely” purchase the hypothetical device we described below, and another 19% “probably” would purchase it. The purchase

intention share is similar to all existing devices combined as we discussed above.

Our hypothetical specifications and features of Apple’s wearable (used in the survey before the official Watch announcement):

- 1-2” OLED touch screen worn on the wrist
- Has communication capabilities through voice control (similar to Siri) and apps
- Has GPS to record location
- Has Bluetooth and NFC to connect to iPhone and other sensors (such as iBeacon)
- Has access to Apple’s App Store to purchase additional applications
- Records activities: steps taken, distance walked and ran, certain exercises and sports, sleep length and quality
- Records health metrics: calories burned, body temperature, blood pressure
- Addition features: has an app on the iPhone that aggregates and analyzes the data, and records and potentially share achievements with other apps, family, friends, doctors or companies if you choose to

Exhibit 25
Purchase Intentions for Apple Watch Match All Brands Currently in the Market



Source: AlphaWise Survey August 2014, Morgan Stanley Research

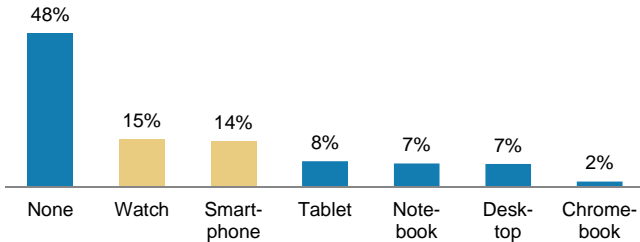
Larger screen iPhones may lower cannibalization risk. We believe Apple’s recently announced iPhone 6 with 4.7” screen and 6 Plus with 5.5” screen, both significantly bigger than the prior generations with 4” screens could lower the Watch’s cannibalization risk to iPhones. However, the new iPhones may increase cannibalization of the smaller iPad, which has a 7.9” screen.

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Exhibit 26

Watch and Smartphones Still Most Likely to be Cannibalized by Apple Wearable Purchase

Does Wearable Replace Another Purchase?

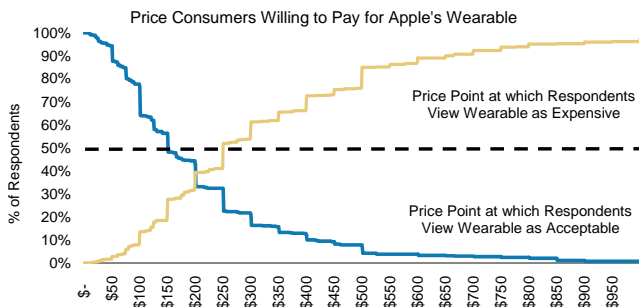


Source: AlphaWise Survey August 2014, Morgan Stanley Research

Consumers would like to pay up to \$250 for Apple’s wearable, according to our survey. While that would be the ideal price for consumers, we believe Apple can push the pricing higher. For comparison, we believe Apple can price higher than Samsung’s Gear 2, which cost \$299, especially as the Watch incorporates more features, such as mobile payments with NFC, smart home connectivity with HomeKit, and third party health monitoring connectivity with HealthKit. In addition, Apple can offer a larger iPhone, iPad, and Mac installed base, iCloud and other internet services, and an iBeacon Bluetooth network. As our survey indicated, consumers look for a strong ecosystem as part of their purchasing criteria. To offset the higher actual price point, we count respondents that say they will “definitely” purchase Apple’s Watch and only consider a small portion of those that say they will “probably” purchase in our market sizing.

Exhibit 27

Consumers Would Like to Pay between \$150 and \$250 for Apple’s Wearable



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Future Use Cases

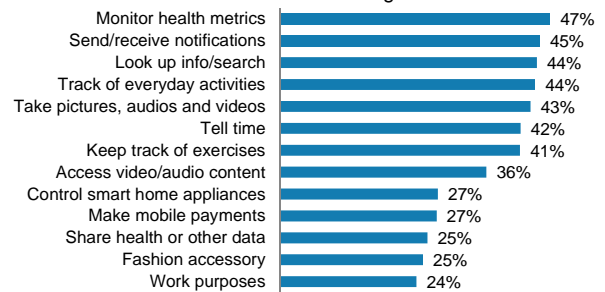
Buyers today want to monitor their health and fitness but there are many future use cases. The top use cases for respondents considering buying wearables are health and

activity monitoring, followed by communications and search. In contrast, the top reason for respondents that do not want to buy wearables is lack of usefulness. Not surprisingly, price is always a consideration. We believe wearable demand could increase significantly, as brands broaden the use case from primarily health tracking to other areas such as mobile payments, smart homes, work purposes, etc.

Exhibit 28

Health and Activity Monitoring the Top Use Case, though Communication and Search also Important

Reasons for Purchasing Wearable

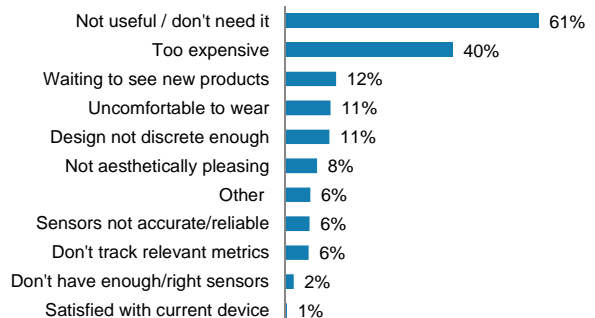


Source: AlphaWise Survey August 2014, Morgan Stanley Research

Exhibit 29

Relevant Use Case and Price by Far the Top Reasons for Not Buying Wearables

Reasons for NOT Purchasing Wearable



Source: AlphaWise Survey August 2014, Morgan Stanley Research

As the market develops, we believe there will be many new use cases consumers cannot even imagine today.

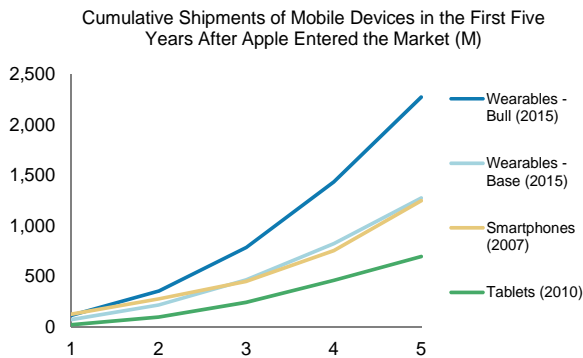
The wearables market is already shifting from dedicated, single-purpose devices, mainly fitness trackers, to general computing, multi-purpose devices, also known as smartwatches. Samsung Gear’s rise since its launch in September 2013 signifies that. Apple is releasing a software development kit (SDK) for the Watch to third-party developers. CEO Tim Cook recently said that based on the first few days post the SDK announcement, “there will a lot of stuff [apps] available for it [the Watch].”

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Morgan Stanley Wearables Model: Base Case

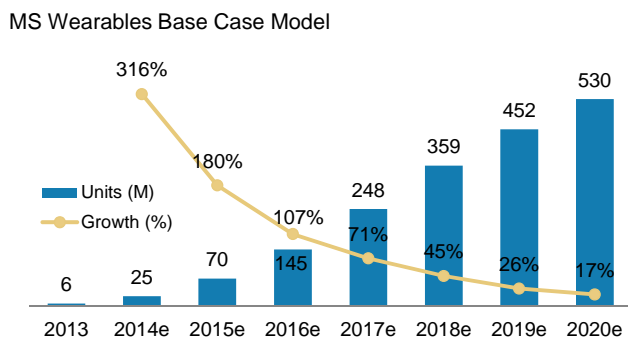
Wearables will be the fastest ramping consumer technology product to date. We model 494M cumulative wearable shipments by 2017, the third year post the launch of Apple Watch, as compared to 240M tablets and 448M smartphones three years after the iPad and iPhone introduction. We expect wearable shipments to grow at a 154% CAGR from 6M in 2013 to 248M in 2017. See the appendix for our model.

Exhibit 30
Wearables to Become the Fastest Ramping Technology Device



Source: IDC, Gartner, Company Data, Morgan Stanley Research

Exhibit 31
Wearables Model: Base Case Units and Growth



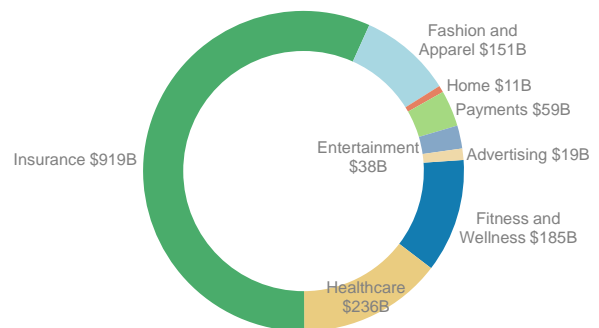
Source: IDC, Morgan Stanley Research

Wearables mark the beginning of an even bigger change in behavior and culture than smartphones and tablets and represent an entirely new product category. In the chart below, we examine the key characteristics of technology products. Wearables are a completely new product category that is trying to incorporate sensors and computing on an

individual's body. Smartphones and tablets were replacing technology devices that came roughly 20 and 30 years before them (feature phones and personal computers). In fact, the only other totally new categories in the list below are televisions and feature phones.

We believe consumer behavior will change over time and there will be a long period of value creation for the wearables industry. The television ecosystem includes content providers, distribution networks and device makers that took decades to develop. This led to a change in consumer behavior as people incorporated TV watching into their lifestyles. Similarly, feature phones needed wireless networks and handset vendors. The ability to reach people wherever they were changed how people communicated and lived. In the long term, we see an ecosystem for wearable devices (Internet of Things), including smart homes, offices, malls, cars, hotels, stadiums, etc. As wearables become more useful and integral to people's lives, they likely will lead to significant change in behavior beyond our initial estimated \$1.6T addressable market, which centers on fitness and health, insurance, fashion, payments, entertainment, residential security and automation, and advertising. People will be able to quantify their lives, and companies will tailor their products and services based on that data.

Exhibit 32
Wearables Address \$1.6T of Global Consumer and Business Spending



Source: ADT, AM Best, CDC, CRS, eMarketer, Euromonitor, IAB, MagnaGlobal, IBIS, LA Times, Nilson, NPD, RAND, SNL Financial, Statista, Morgan Stanley Research

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Exhibit 33

Key Characteristics of Past Consumer Electronics Products that Determined the Speed of the Initial Sales Ramp

Product	Enabling Connectivity Technology	Category Replaced	Consumer/ Enterprise	Per Household/ Personal	Requires New Monthly Subscription?	Flagship Product			
						Year Introduced	Mobile (5) to Static (1) Score	Price, Adjusted for Inflation	Peak Year Shipments (in mln units)
Wearables	Smartphone or Wi-Fi/Cellular	New category	Both	Personal	Optional	2015	5	\$349	
Tablets	Wi-Fi/Cellular	Netbooks	Both	Personal	Optional	2010	4	\$545	232*
Netbooks	Wi-Fi	Notebook	Both	Per household	Optional	2008	3.5	\$385	39
Smartphones	Wi-Fi/Cellular	Feature Phones	Both	Personal	Yes	2007	4.5	\$575	1219*
E-Readers	Wi-Fi/Cellular	Print	Consumer	Personal	No	2007	4	\$460	26
MP3 Players	Initially PCs then Wi-Fi	Cassette players	Consumer	Personal	No	2001	4.5	\$535	200
Feature Phones	Cellular	New category	Consumer	Personal	Yes	1996	4.5	\$1,515	1290
DVD Players	Television	VCR	Consumer	Per Household	Optional	1996	1.5	\$1,055	130
Notebooks	Wi-Fi	Desktop	Both	Per Household	Optional	1985	3	\$4,200	211
Microwave	Electricity	Oven	Consumer	Per Household	No	1967	1	\$3,530	NA
Television	Cable	New category	Consumer	Per Household	Optional	1946	1	\$4,885	252

* - Unit shipments to date.

Source: Company Data, IDC, iSuppli, Morgan Stanley Research

Low prices increase demand. Fitness trackers today cost only \$100 and Apple Watch, which will come in at the high end of the price range, starts at \$349. That is 30% lower than the cost of the first iPad, which started at \$499 (average price \$650) and already surprised the market as it was half as much as the rumored \$1,000 price point. In fact, the Watch will be cheaper than the first iPod – and arguably the first mass market wearable – at \$399, which debuted 13 years ago. Over time, average selling prices could fall further. Xiaomi, a China-based consumer electronics brand known for its smartphones, announced the Mi Band, a health tracker, for RMB79 or about US\$13.

Our 2013 and 2014 estimates are based on vendor shipments and ownership share. Our analysts forecast about 1M shipments each for Fitbit, Jawbone, Nike, and Samsung in 2013. Based on ownership share from our AlphaWise survey, it implies a total market of 6M units, which is in line with IDC estimates. We estimate 25M shipments in 2014 using a similar methodology. We model shipment growth for the top brands but assume lower market shares due to new entrants. New products yet to be launched are major variables that could change our forecasts.

We forecast 2015 shipments using purchase intention from the survey and taking into account Apple's entrance. We estimate 68% growth in demand in 2015 for existing wearable vendors based on purchase intentions from our AlphaWise survey. We asked respondents whether they would purchase a hypothetical Apple device and “definitely buy” responses implied 30M demand in all countries we surveyed, though we excluded China to be conservative due to the aspirational nature of responses in the country in past surveys. We also discount another 2M units for cannibalization as some respondents chose Apple Watch *instead* of their prior choice when the Watch was introduced. So in total, we estimate 70M unit demand in 2015.

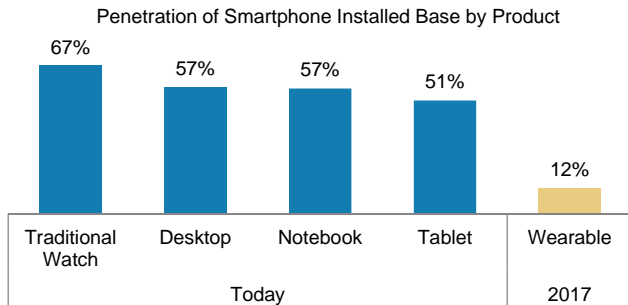
Wearables adoption could be limited to smartphone installed base in the near term. As we discuss in the Computing industry section below, wearables have to balance the tradeoff between adding more sensors and connectivity with limited space and battery power, even more so than smartphones and tablets. In the near term, wearables likely will not have cellular connectivity. Wi-Fi alone is likely not enough for such a mobile device, requiring pairing with smartphone for full functionality.

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Therefore, we consider the smartphone installed base when forecasting wearables adoption. By 2017, we estimate wearables installed base of 393M units, or 12% penetration of broadband users and of smartphone users. Wearables in the US will reach 36% smartphone installed base penetration in 2017 by our forecast, which is the highest among the regions we forecast.

For comparison, our AlphaWise survey indicated 67% of smartphone owners also owned watches, 57% owned desktops and/or notebooks, and 51% owned tablets. Therefore, we believe our wearables model is conservative based on smartphone installed base penetration.

Exhibit 34
Our Model Assumes a Conservative Wearables Penetration Rate of the Smartphone Installed Base



Source: AlphaWise Survey August 2014, Morgan Stanley Research

In the case of Apple, we think our company and industry models could be conservative too. Apple is poised to become the market leader by shipments in 2015 with 43% share in our wearables model so we look at our assumptions for the company in more detail.

Just over 12 months after the iPhone launch, shipments penetrated roughly 7% of the Apple user base. The iPad achieved 14% penetration one year after launch. Since then, the company's user base has grown significantly due to the iPhone, especially as Apple introduced lower price points in recent years. Although the 30M Watch shipments we forecast for the first 12 months could be the fastest product ramp for Apple, we actually assume a lower user base penetration than the iPad.

Apple says the Watch is compatible with iPhone 5 or newer generations and there was an installed base of over 200M such devices. The company made the statement in early September but our estimate suggests it is likely a June quarter-end number. We estimate that number will grow to 315M by the end of this year. Therefore, the 30M Watch shipments only account for 10% of the *compatible* installed base. Of the over 500M Apple user base, Watch will only account for 6%.

Exhibit 35

We Assume 10% Watch Penetration of Apple's Compatible User Base, in Between iPhone and iPad

New Product	Apple Installed Base at Launch	Initial 12 Months Shipments	New Product Penetration Rate
iPhone	87	6	7%
iPad	135	20	14%
Watch	315	30	10%

Note: iPhone penetration based on first five quarters of iPhone shipments (launched with a few days left in C2Q07) over trailing 2-year iPod shipments. iPad penetration based on pro-rated estimate of Apple's reported account numbers. Watch penetration based on estimate of trailing 2.5-year shipments of compatible iPhones (5 and newer generations). We estimate the Watch accounts for 6% of Apple's over 500M user base today.
Source: AlphaWise Survey August 2014, Morgan Stanley Research

Actual shipments of other newly launched Apple products suggest our surveys could be conservative. We conducted AlphaWise surveys ahead of the iPhone and iPad launches. In the first eight quarters, actual iPhone shipments were 5% below our initial estimate. However, actual iPad shipments beat our estimate by over 300%.

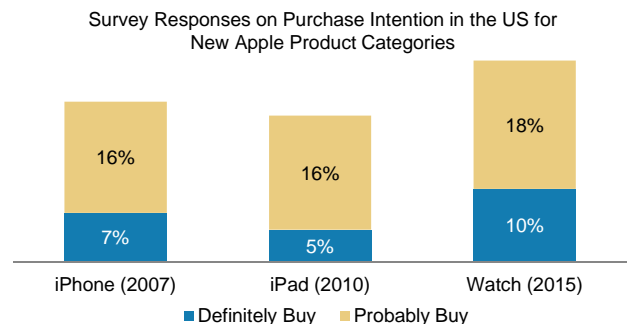
We see several reasons for the significant upside the iPad saw compared to the iPhone:

- The addressable market was not limited by carrier exclusivity, contract break-up fees, and monthly subscriber fees.
- There was a more robust ecosystem with the App Store.
- The use cases of mobile computing and iOS were clearer as many users were already familiar with the iPhone ecosystem.
- The global brand awareness of Apple and the iPhone were much higher.

Therefore, as the Watch builds on Apple's existing brand, user base and ecosystem, we believe there could be upside compared to the purchase intentions expressed in the survey.

Exhibit 36

Past Surveys Suggest Apple Watch Purchase Intention in the US Is Reasonable and Likely Conservative



Note: Purchase intention for the Watch in all countries excluding China is 7% "definitely buy" and 19% "probably buy" and including China, it is 9% and 23%
Source: AlphaWise Survey August 2014, Morgan Stanley Research

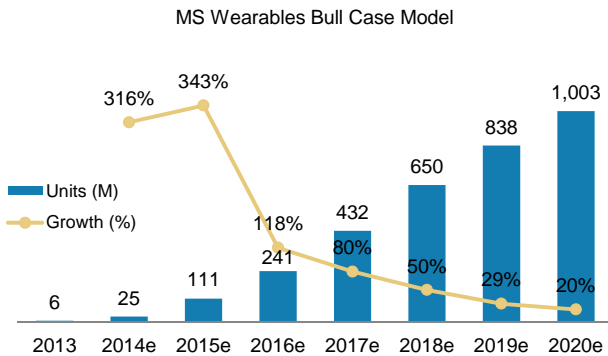
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Enterprise Adoption and Subsidies Drive Our Bull Case Forecast

We estimate 111M wearable shipments in 2015 and 1B units in 2020 in the bull case. We assume 111% growth next year from existing wearable brands. This includes all respondents that said they “definitely” would purchase products and 25% of respondents that said they “probably” will purchase products to be conservative. We make the same adjustments for respondents who “definitely” or “probably” would purchase Apple’s Watch, and for the cannibalization resulting from respondents that chose Apple over their prior wearable selection. In six years, with smartphone shipments likely over 2B units, we think it is possible for wearables to reach about 50% of smartphone shipments, provided some of the drivers we describe above play out.

Exhibit 37

Wearables Model: Bull Case Units and Growth



Source: IDC, Morgan Stanley Research

We see two major drivers of our bull case forecast – enterprise adoption and subsidies.

Enterprise Adoption

So far most of the attention has been drawn to consumer applications, but wearables also apply to enterprise environments. We see the consumer wearables market taking off with fitness devices in the last couple of years, and with the introduction of more general purpose computing devices like the Apple Watch and Samsung Gear going forward. As shown in the survey, “work” is the least popular wearables use case today (24%). However, the benefits of improving efficiencies in enterprise could be significant. In the long term, users could have multiple wearables – one for personal and one for work use or one for fitness and one for every day wear. Companies may purchase or subsidize wearables for the majority of their employees, which increases the likelihood of multiple devices per person.

Several of the wearables companies and enterprise CIOs we spoke to point out the significant potential in the enterprise market. While consumers may be fickle about fashion and social norms, they do not apply to the enterprise market in the same way. For example, doctors, police officers, mechanics, etc. may prefer function over fashion and choose to wear large head-mounted displays though there has been some consumer backlash for Google Glass. We see a large long-term opportunity to change how workers perform their jobs, but this market is even more nascent than the consumer market. There is not an ecosystem of apps, similar to some of the growing pains tablets are experiencing in the enterprise today. That said, we’ve already heard anecdotal evidence of enterprise applications being developed in partnership with Apple.

Augmented reality could be a key technology for the enterprise, especially for head-mounted devices.

Augmented reality integrates virtual information with the real world on a display and allows users to interact with both worlds at the same time. In the bullets below, we look at a series of enterprise use cases to show the wide range of applications. See the following chart for a comprehensive list of potential consumer and enterprise use cases.

- **The use of augmented reality on “smart helmets” could decrease the number of mistakes made** when operating a device for the first time – “training for first time operations.” For instance, below are pictures of an industrial-grade connected helmet from the DAQRI project.

Exhibit 38

What an Industrial Wearable Could Look Like



Source: DAQRI website

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Exhibit 39

The View on the Display: Connected Helmets Help Operators Perform Their Jobs



Source: DAQRI website

- **The Internet of Things has not connected all the sensors in industrial applications yet.** Another example would be a connected helmet logging data from devices in the real world.

Exhibit 40

Connected Helmets Help Log Data from the Real World, such as Gauges Not Connected to the Internet of Things



Source: DAQRI website

- **SAP is working with Vuzix**, another augmented reality helmet company, to increase device efficiencies, such as making sure an operator picks the correct part from a warehouse, increasing safety in forklift operations, retrieving inventory information from its database, etc.
- **EasyJet is testing Epson and Vuzix smartglasses** to optimize maintenance activities and therefore reduce delays. The technology allows a remote engineering team to access the user's view, helping it to solve the issue in real time. Currently pilots and engineers on board have to send pictures to the Operations Control Centre and find a solution over the phone. EasyJet states that 7 out of 1000 flights are affected by technical issues, 100 flights per year are delayed at least one day and lighting issues hit an average of 1 plane per day, requiring several days to be solved. Each delay overnight costs the company around \$25,500.
- **Mitsubishi deploys Metaio software on Epson's Moverio smartglasses** for its air conditioner service technicians. A YouTube video streamed in front of the worker guides him in the procedure by overlaying virtual arrows, circles and screwdrivers on the physical object.
- **Augmedix is a software company working with Google Glass** to offer easy access to electronic health records for the healthcare sector.
- **Apple's recent partnership with IBM may have more to do with analyzing data collected from sensors** in the Internet of Things computing cycle than just increasing iPad's enterprise penetration in the mobile computing cycle, in our view. We also believe IBM brings deep industry expertise in key verticals that have shown early interest in wearables including retail, manufacturing, banking, and healthcare.

List of Consumer and Enterprise Use Cases

Consumer Use Cases	Scenarios		
<p>Entertainment Controller-free gaming; virtual reality 3-D gaming, TV, and concerts</p>	<ul style="list-style-type: none"> • More immersive first-person videogames experience • Every member of the audience at a sporting event, concert, etc. can have the view of the best seat in the house 		
<p>Communication Send text, audio, video or images; communication for the disabled, deaf, blind, and speech impaired</p>	<ul style="list-style-type: none"> • Send a message without taking out a smartphone • Assist the blind with reading 		
<p>Home Automation Security (e.g. electronic keys), HVAC (heating, ventilation and air conditioning) control</p>	<ul style="list-style-type: none"> • The garage door automatically opens and the house awakes from energy-saving mode to the user's preset HVAC preferences as he approaches the house 		
<p>Health and Fitness Measure vital signs, fitness metrics, and mood; early detection of health threats and personal emergency response system; temperature control; physical therapy</p>	<ul style="list-style-type: none"> • Wearable detects overexertion and alerts the user to stop/slow his workout • As the user's body temperature rises, his shirt begins to cool down 		
<p>Navigation Turn-by-turn outdoor and indoor navigation</p>	<ul style="list-style-type: none"> • Wearable has location detection and directs the user to the store he is looking for in the mall • Outdoor or indoor sensors automatically communicate with wearable to alert user to nearby points of interest 		
<p>Shopping Virtual "in-store" shopping experience online; mobile advertising; mobile payment</p>	<ul style="list-style-type: none"> • Relevant coupons show up on the wearable as the user pass by a store he frequents • Avoid long lines by getting in line virtually via the wearable 		
<p>Pets and Kids Health and fitness monitoring; geo-fencing; communication</p>	<ul style="list-style-type: none"> • Track the fitness of pets or kids, and potentially reduce visits to the vets or doctors • Remote monitoring lets the user know the location, mood, etc. of his kids and pets at all times 		

Commercial Use Cases	Functions		
<p>Healthcare Surgery assistance, mobile patient medical records, more accurate patient diagnosis, assistance for the disabled, cost-minimization for insurers</p>	<ul style="list-style-type: none"> • Help doctors access patient or other relevant information as they perform surgery • Receive alerts to take medication and refill prescriptions 		
<p>Retail Inventory tracking, more efficient customer service, targeted product recommendations</p>	<ul style="list-style-type: none"> • Store associates are notified when a product needs to be restocked • Notifies shopper if an item is on sale 		
<p>Transportation Electronic fare cards, transportation companies aiming to increase efficiency and personalize customer service</p>	<ul style="list-style-type: none"> • A user can carry all his fare cards on one device and swipe to pay • Flight attendant knows the names and preferences of passengers 		
<p>Tourism Augmented reality improves the experience of tourists, allows for real-time language translation</p>	<ul style="list-style-type: none"> • Wearable gives user additional information on artifacts in a museum • Wearable translates a sign in a foreign language 		
Industrial Use Cases	Functions		
<p>Training, Repair, and Inspection Real-time instructions and assistance while in the field</p>	<ul style="list-style-type: none"> • Wearable provides step-by-step prompts for the user to carry out a repair • Provide detailed, personal training to employees 		
<p>Law Enforcement, Public Safety, and Military Record point-of-view perspective while in the field, environmental sensor to detect hazardous materials, biometric monitors to track health</p>	<ul style="list-style-type: none"> • Wearable includes heat sensors and provides crucial building blueprint and other information to firefighters • Tracks vital signs and point-of-view of police officers in the field 		
<p>Agriculture Crop scouting, remote equipment maintenance, animal handling and identification</p>	<ul style="list-style-type: none"> • Tracks livestock's location and health • Wearable allow user to interact with sensors in the field 		

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Companies Could Subsidize Wearables

Subsidies from employers and other companies that want consumer data could further accelerate adoption.

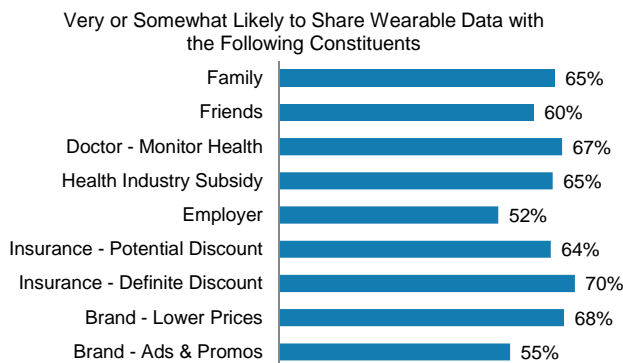
There are many existing corporate programs that reward employees for exercising, and we believe health insurers, like car insurers, could adopt the lower-prices-for-data model. We see many subsidy models. For example, Google and Facebook monetize the data of their users. Amazon charges \$15-20 more for its Kindle e-reader or Kindle Fire tablet if consumers do not want any advertisements.

Health monitoring could see even higher adoption than auto insurance. Usage-based auto insurance tends to attract those who are lower-risk drivers since only safe drivers benefit from discounted premiums. However, health insurance could potentially offer incentives to all types of customers since both healthy and ill customers could benefit. For example, wearables can remind users to take their medication, or detect when they have higher risk of a heart attack.

Respondents are willing to share wearable data with many parties. Given the right incentives, the majority of wearable users are willing to share their data with family, friends, healthcare providers, employers and wearable brands, in addition to their insurers.

Exhibit 41

Consumers Are Willing to Disclose Wearable Data Given the Right Motivation



Source: AlphaWise Survey August 2014, Morgan Stanley Research

The healthcare industry is already running pilots with wearables. A company we spoke to that makes monitoring devices for seniors sees a few reasons healthcare companies are interested. Hospitals cannot bill Medicare for the same treatment twice so they are incentivized to monitor patients post visits. In addition, the company saw 50% conversion in one of their pilots from hospital paid health

monitoring to privately paid post the hospital's program as users wanted to continue to monitor their health. In another pilot with an insurance company, where its highest cost policyholders were provided with monitoring and call center service, the insurance company saw a 2.5x return on investment as health advice and engagement with the patients lowered insurance payouts. Pharmaceutical companies are also running pilots where monitoring devices help make sure patients take their medication, and run better trial programs for drugs in development. These devices are also marketed as differentiated value-added services by the pharmaceutical companies for off-patent drugs. Another company we spoke with that makes head mounted wearables also started discussions with a large US insurance company recently.

Those who start collecting data earlier have a first mover advantage. One of the companies we spoke to saw its pilots increase 10x in size but they are still relatively small, totaling tens of thousands of people. The company believes we have yet to hit an inflection point. However, if some health insurers improve their risk management and offer lower pricing as they gather more data and learn to analyze it, then those that do not will be at a disadvantage. So we believe it only takes a few early adopters to drive industry wide adoption of these technologies and programs.

Policyholders are also incentivized, if not for their health then for the premium savings. In the examples above, policyholders receive better care because of the monitoring devices. However, often that is not enough of an incentive. In 2014, the average annual health insurance premium for an individual is \$3,252 in the US. Assuming a policyholder is offered a 10% discount on his premium for joining a health-tracking program, close to what auto insurance companies offer, he would save \$325 a year.

In fact, even employers may be incentivized to pay for a fitness program. Oil company BP offered employees discounts on their health insurance if they exercised. The company tracked employees' activities through Fitbit bracelets. One 260-pound employee walked over one million steps over several months and, including dietary changes, lost 70 pounds and 10 pant sizes, according to Bloomberg. These changes lowered the employee's blood pressure and cholesterol levels to within normal ranges, "significantly" lowering BP's risks of covering treatments for heart problems and other medical issues. See the Healthcare section for more details.

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Case Study: Car Insurers Exchange Policy Discounts for Driving Data

We believe the healthcare industry is highly incentivized to subsidize some wearables in exchange for health data that could maximize revenue and/or lower costs. Our conversations with wearable makers indicate certain insurance companies, hospitals, and pharmaceutical companies are currently conducting pilot programs, and these programs are increasing in size and frequency.

There is a lot of precedence for this subsidy model. Most notably, wireless carriers subsidizing smartphones helped drive adoption, and today smartphone penetration is higher than PC penetration globally. However, the most relevant case study may be car insurance companies.

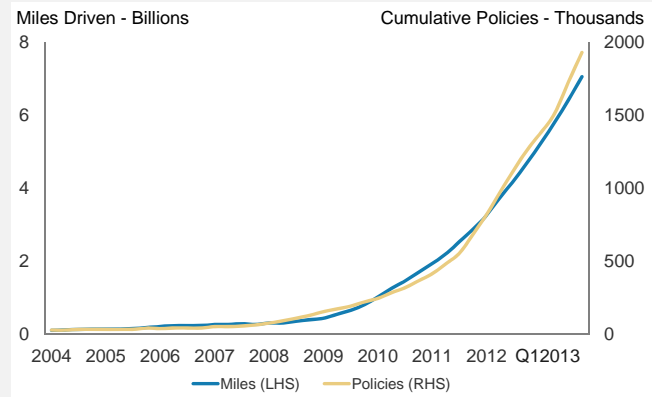
Progressive is the US telematics market leader through its Snapshot offering, part of the company's usage-based insurance (UBI) system, which has been developed since the mid-1990s (covered by Kai Pan). It is a voluntary on-board telematics device that monitors mileage, changes in speed/direction, and time of day. Progressive analyses the data and awards a discount (up to 30%) to consumers who drive less, more safely and during safer times of the day.

Big Data drives predictive power. Over six years, Progressive has accumulated 10 billion miles worth of driving data (100+ terabytes). The data enable the company not only to price consumers to the optimal level, but also to price new policies with the same characteristics to an optimal level. Progressive uses many different rating variables to price policies, but believes driving behaviour (Snapshot data) is ~2x more predictive in determining consumer profitability than the next most relevant variable.

Snapshot is driving growth and consumer retention. At its annual analyst meeting in May 2014, Progressive reported that Snapshot had more than \$2 billion in premiums (10%+ of total premiums) and had grown by +30% year to date (surpassing \$1 billion in annual premiums in 2012). Consumers who enroll in Snapshot have an 11% greater policy life expectancy and those who receive a discount have a 19% longer policy life expectancy.

Other insurance companies around the world are adopting this business model though penetration is still low. While more than 80 insurers worldwide offer telematics-based products (with more coming on-stream all the time), we estimate penetration is no greater than 1% in most markets – roughly 3 million policies globally. Italy is the most advanced telematics insurance market, with 19 of its top 20 insurers participating and a penetration rate of over 3.5%. In the UK, Admiral estimates that, despite rapid growth for the market overall, telematics sales represent only around 2.5% of new business sales by volume, but nearly 6-7% by value given the higher premium size of the target market. In the US, 10 of the top 25 insurers participate in telematics-led

Exhibit 42
Progressive Snapshot Has Seen Strong Adoption: 2M+ Policies in Force and 10B+ Miles Driven

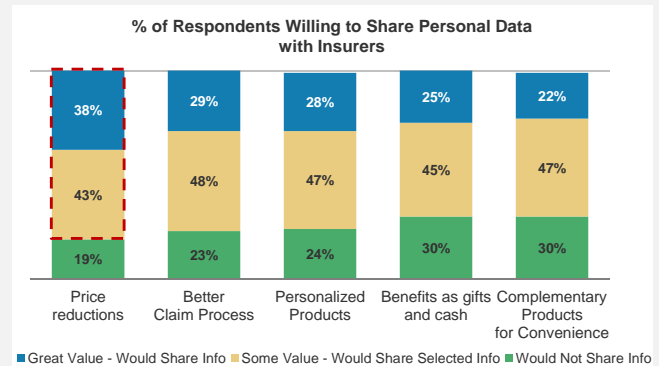


Source: Progressive 2013 Investor Day Presentation

motor insurance, while in Japan, many automakers are installing telematics equipment in new vehicles, and interest among Japanese insurers is rising.

Usage-based programs are gaining traction. A Morgan Stanley and Boston Consulting Group survey of global consumers indicated 81% of respondents would share at least some additional information with insurers if they were able to obtain price reductions.

Exhibit 43
81% of Respondents Would Exchange Personal Data with Insurers for Price Reductions



Source: Morgan Stanley/BCG Global Consumer Survey 2014; BCG e-intensity index, Morgan Stanley Research
Question: For each of the benefits, please indicate how likely you would be to share personal information to obtain it: I see great value in this benefit and would share personal information to receive it; I see some value in this benefit and would share selected personal information to receive it; I would not share any personal information to receive it.

Imagine a World Where...

Without having to measure your blood pressure, the doctor says, "your blood pressure has been a little high recently, have you been taking your medication?" There was no need to wait for the doctor to read through your medical history from a folder. By the time he walks in, he has already received your medical records, which are online, and analyzed the data on his computer. In fact, he pulled up some relevant information for discussion on his smartglasses.

You tell the doctor that you have been taking your medication. In fact, your smartwatch has been sending you reminders to do so at the right time. You just finished your current prescription, and a notification on the device asks you whether you would like to refill. You click "yes" and a message is sent to your local pharmacy.

Later in the day, you go to pick up your prescription. There is no need to dig through your purse or pockets to find your credit card. You simply pay with your smartwatch by scanning it at the register.

Your health insurer then receives a confirmation that you have filled your prescription. It is one of many inputs that are used to judge how responsible you are with your health, which all help the insurer determine whether you receive a discount on your premium next year.

Your medication is one that is subsidized by the pharmaceutical company, so it also received a confirmation. The company combine this with health data that you have been sending periodically in order to analyze and improve its products.

While grocery shopping that evening, you receive a new notification on your smartwatch. The store has a partnership with your health insurance company. The system senses that you walked by the fruit section, and offers you a discount on fruits as an incentive to eat healthy foods and reduce the risk of heart attacks.

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Risks to Wearables Adoption

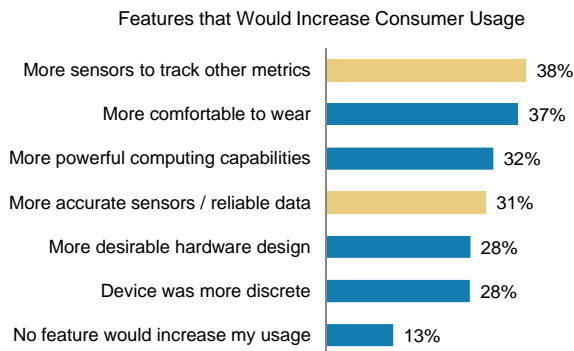
While we believe the wearables market is poised to hit an inflection point, there are still many challenges to be addressed. In our discussions with industry experts, we found several key technological issues companies are working on. Many have yet to find the “killer app” or build a compelling ecosystem that would convince consumers that they need to wear the devices consistently and interact with them frequently. Below we address key gating factors that may limit wearables adoption.

Accuracy and power are key technological hurdles that can limit consumer and enterprise adoption, according to our conversations with industry experts. Users will stop using the devices and enterprises will not adopt the technology if data is not accurate. Yet, medical grade sensors are expensive, usually take up too much real estate and/or power in a mobile device, and potentially are overkill for this purpose. Battery life is an even bigger limitation on wearables compared to smartphones or tablets. The accuracy of sensors is often a trade off with battery life. In addition, it is a hassle if users have to take off their wearables often to charge them, just like how many people used to (and still do) bring their phone charger with them during the day to charge their smartphones. Wearables can leverage many of the sensors developed over the years for smartphones, but some new sensors still need to improve their accuracy and power usage. See the Semiconductors section for further discussion.

Our survey respondents indicated increases in quantity (38%) and quality/accuracy (31%) of sensors would boost their usage. They also view comfort of the device (37%) as critical to increasing usage.

Exhibit 44

Quantity and Quality of Sensors, and Comfort of the Wearable Key to Increasing Usage



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Another commonly cited challenge with wearables today is aesthetics and design. When the device is so personal and often displayed on the body, it becomes a fashion statement. This means the attractiveness of the device is very important, probably more than any other computing device that came before, and design has to stand on its own regardless of the capabilities and usefulness of the internal technology. Tory Burch recently launched a set of bracelets and a pendant that can hold the Fitbit Flex. The Nex Band takes a modular approach so users can change the sensors they wear at any time, and they even commissioned jewelry designers to improve the design of their beta products. We believe this insight is the main reason Apple hired several key executives from the fashion industry, including former Burberry CEO Angela Ahrendts, former Yves Saint Laurent CEO Paul Deneve, former LVMH Tag Heuer VP of Sales Patrick Pruniaux, and two former Nike designers.

Exhibit 45

The Nex Band Has Modular Sensors that Users Can Add or Remove



Source: Nex Band by Mighty Cast

In addition to accuracy and design, wearables must be easy to use to see broad adoption. Given the portable form factor, we see screen real estate as increasingly more valuable and scarce, therefore requiring input paradigm evolution to make devices easy to use. In the early mainframe era, compute jobs were entered into the system using punch cards. Minicomputers relied on a keyboard as the primary input method, while the mouse was popularized with the adoption of the PC. Touch became the primary input paradigm in smartphones, which enabled the introduction of a virtual keyboard that effectively doubled the amount of real estate available on a handset device. We see voice as the logical input mechanism in wearables given the small form factor, which makes touch less user friendly, but see a need for improvements in voice recognition technology. We note

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that Apple introduced the Digital Crown as an input device for Apple Watch to address the challenge of the scarce screen real estate. Wearables must also be context-aware, meaning they might know your location, activity level, whether you're with a friend or family member, etc., in order to offer the right notifications or interface at the right moment. This helps create a sense that the device is easy to use, relevant, and important to the user.

Some devices require a companion smartphone. Many smartwatches on the market today, including the forthcoming Apple Watch, require pairing with a compatible smartphone for full functionality. While the category benefits from low price, high potential volume (one device per person vs. PCs shared across households), lack of a required carrier contract, and new functionality, the smartphone pairing requirement could hold back demand near-term. While not perfect parallels, the original iPod required a Mac and demand increased 150% the second year when it became compatible with Microsoft Windows. The original iPhone required both a carrier contract and syncing directly to a computer, the latter of which is no longer required due to iCloud. Apple has shipped 2.8x more iPhones to date post the iCloud launch in late 2011 than in the 4.5 years before.

Behavioral change is hard. Insurance companies, healthcare providers, and even fitness clubs must adjust their business models, learn to analyze new datasets coming from fitness trackers, and then offer incentives to customers in order to drive long-term behavior changes. Fitness tracking is one of several "killer apps" enabled by wearables. However, without sustainable change, demand and interest in wearables could wane before the ecosystem has a chance to develop and enable even more functionality within health monitoring and outside of it.

Consumers may get device fatigue. In addition to limited enterprise adoption, we believe another reason tablet adoption may be slowing is consumer fatigue. Before 2007, most consumers owned two screens – TVs and PCs – and they were often shared within a household. Since 2007, consumers own up to four screens – TVs, PCs, tablets and smartphones – and they may soon own five or more including wearables. Consumers may experience some technology fatigue with the number of devices, and some wallet fatigue with the spend required to keep all their devices up to date.

Willingness to share personal data is critical to wearables ecosystem. While Apple has made it clear it does not plan to store user data relating to payments, health, etc., that would not be the case with all companies in this space, we believe. In order for the ecosystem and many business models (ad-based, subsidies, etc.) to work, consumers have to be comfortable with sharing their personal data. Most consumer-facing online properties, such as Google or Facebook, already exchange services for personal data so consumers may be getting used to this model. In fact, our survey indicated that the majority of respondents are willing to share data for the right incentives.

Wearables are causing a Big Data problem. Companies in the wearables market are figuring out how to collect the data but have not yet figured out what to do with the data. Devices in the market today do not offer a compelling and easy way for most consumers to digest all the information. For example, should the user increase or decrease calorie intake? What is the optimal time for the user to exercise? Software and user interfaces are always important and often overlooked by hardware companies. There is a tremendous opportunity for software innovation to present the data and partnerships with healthcare experts to interpret the data. Through our conversations, we believe the healthcare industry, especially insurance companies, are already looking at the potential of wearables, and they may play a significant role in driving the mass adoption of these devices. One of the companies we spoke to, Numera, believes there needs to be standardization so data gathered by different devices can be analyzed together.

MORGAN STANLEY BLUE PAPER

Wearable Devices
Computing

November 19, 2014
Wearable Devices

Computing

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How will wearable adoption affect traditional computing companies?

Computing companies are well positioned to create significant value in the wearable market. Consumers want to consider wearables from their PC, tablet, and/or smartphone brands. These companies should leverage their computing installed bases while quickly trying to improve their fashion sensibilities, potentially through new hires and partnerships. Wearable cannibalization of other computing will be a risk, but it looks relatively limited, according to our survey.

Which brands are best positioned or most challenged?

Apple and Samsung best positioned with large smartphone and tablet installed bases. Apple is arguably the closest computing company to having a good balance between technology and fashion. Samsung is the dominant Android device maker.

In contrast, Garmin could be relegated to being a niche player, as it does not have a strong ecosystem. While LG and Sony can leverage the Android ecosystem, they are also challenged due to competition from Samsung and their track records in the mobile computing cycle.

- Best positioned: Apple, Samsung, Microsoft, Salesforce.com, IBM
- Challenged: LG, Sony, Garmin

Leveraging Existing Ecosystems

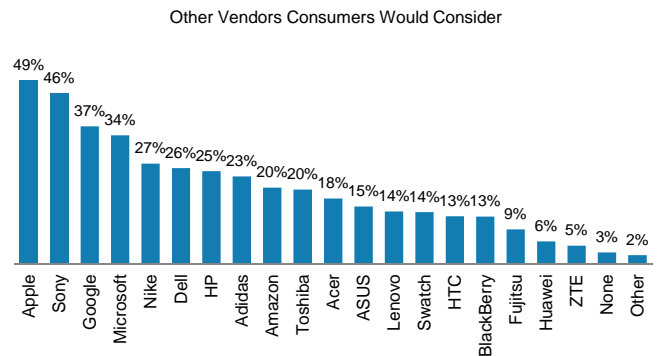
Computing device companies have to play to their strengths. Most of these companies have existing installed bases in PCs, tablets, and/or smartphones products. They have years of experience with software platform and application development, cloud services development, leveraging relationships with third-party developers, managing fast product cycles driven in large part by Moore's Law, managing complex hardware supply chains, and leveraging existing installed bases in other consumer electronics.

However, computing companies need to learn about style. Successful wearable devices need to have a good balance between technology and fashion. For technology companies, their strength is the former. Historically, they tend to prize utility and uniformity over taste and variety. Encouragingly, these companies realize their weaknesses and are taking action. Apple has hired several senior executives from Burberry, Tag Heuer, Yves Saint Laurent, Gap, and Nike. Google is collaborating with Fossil and Luxottica.

The good news for computing brands is that consumers want to consider them for wearables. Among vendors not in the wearables market today, respondents in the survey ranked most computing companies – and importantly three of the four are platform companies – ahead of apparel or watch companies when asked which brands they would consider when purchasing wearables.

Exhibit 46

Consumers Willing to Consider Existing Technology Giants for Wearables

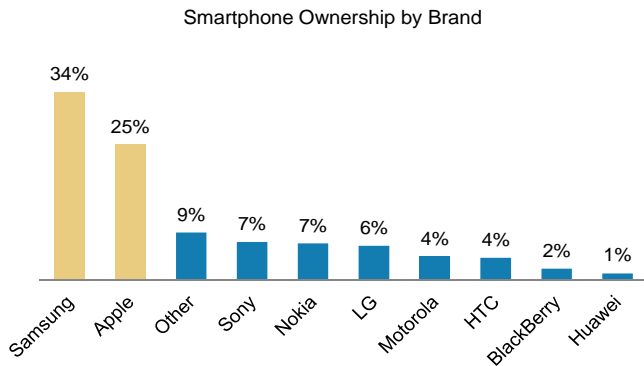


Source: AlphaWise Survey August 2014, Morgan Stanley Research

Apple and Samsung stand to benefit the most from large mobile computing installed bases. In our survey, Apple and Samsung are the top two in terms of smartphone and tablet ownership share, and together account for 59% and 57% of the installed bases. Since many wearables, at least in the near term, will be tethered to smartphones, this is a major advantage.

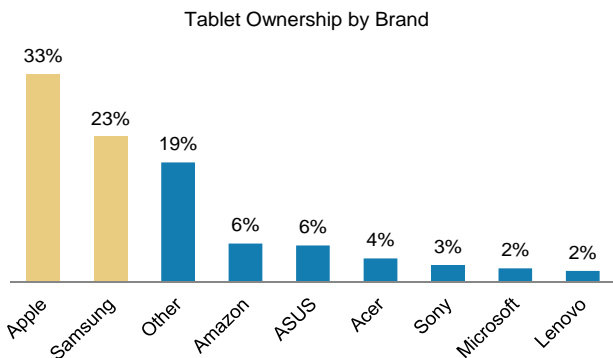
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Exhibit 47
Samsung and Apple Dominate the Smartphone Space with 59% Unit Share



Source: AlphaWise Survey August 2014, Morgan Stanley Research

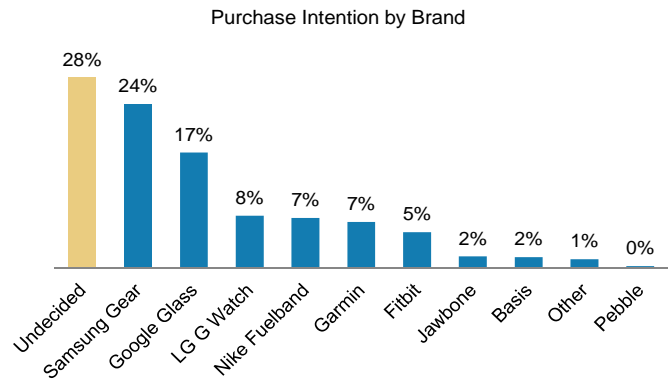
Exhibit 48
Apple and Samsung Reverse Their Positions in the Tablet Market but Have Similar Total Unit Share



Source: AlphaWise Survey August 2014, Morgan Stanley Research

They are best-positioned for the wearables market. Given Samsung's market share in mobile computing, it is no surprise the company has the highest wearables market share today at 22%, and leads all brands in terms of purchase intention at 24%. As shown above, Apple also ranks first among vendors that respondents would consider that are not in the wearables market today.

Exhibit 49
Samsung Gear Leads All Brands in Purchase Intention but Many Consumers Are Undecided



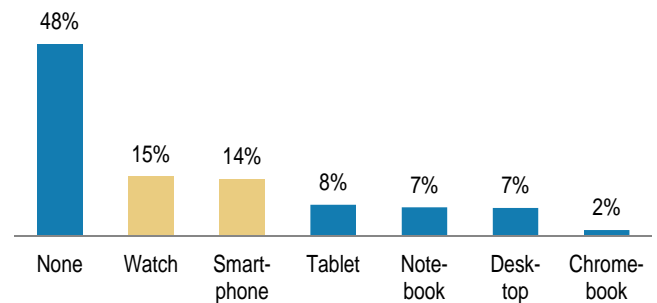
Source: AlphaWise Survey August 2014, Morgan Stanley Research

Smartphone Cannibalization

Cannibalization impact from wearables is small. Our AlphaWise survey in May 2012, about two years after the iPad launched, indicated 41% of tablet shipments delayed or eliminated PC purchases. In our new survey, nearly half of consumers do *not* believe their wearable purchase will replace another device and only 14% think it will replace their smartphone spending.

Exhibit 50
Watch and Smartphones are Most Likely to Be Cannibalized by Wearable Purchases

Does Wearable Replace Another Purchase?



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Consumers may get device fatigue. As we noted in the model section above, a potential risk to wearable adoption is consumer fatigue. Before 2007, most consumers owned two screens – TVs and PCs – and they were often shared within a household. Since 2007, consumers own up to four screens – TVs, PCs, tablets, and smartphones – and they may soon own five or more if wearables are included. Consumers may experience some technology fatigue with the number of devices. They may also experience wallet fatigue with the spend required to keep all their devices up to date, which could lead to lengthening of refresh cycles for other devices, such as smartphones, tablets, and PCs. This in effect could cannibalize shipments even though the installed bases of these devices may not decline and actually continue to grow over time.

Apple

Among wearable companies, Apple is arguably the closest to having a good balance between technology and the arts, which is a broad term referring to important qualities outside of science and engineering, such as taste and style. The company's co-founder and ex-CEO Steve Jobs highlighted this in 2010 when he introduced the iPad for the first time: "We've always tried to be at the intersection of technology and liberal arts... to be able to get the best of both, to make extremely advanced products from a technology point of view... but also have them be intuitive, easy to use, fun to use, so that they really fit the users." This balance becomes even more important as we move from mobile computing to wearables in the Internet of Things computing cycle.

Apple Watch suggests the company understands the unique challenges of wearables. Though there are still a lot of details left to be filled in before the Watch launches in early 2015, Apple is obviously trying to create new interfaces, new forms of communication, new hardware and sensors, and new software and applications, leveraging but not copying what it developed for iPhones and iPads. Here is a list of key points on the Watch:

- Multiple versions from the beginning, unlike past new category launches: (1) two watch face sizes (height of 38mm and 42mm), (2) three finishes (stainless steel Watch, aluminum Watch Sport and 18-karat gold Watch Edition), and (3) six different bands.
- Digital Crown provides a new way to navigate and interact with the device.
- Force-sensitive Retina display can differentiate between a press and a tap, adding another input method

- New haptic feedback engine allows the device to give the wearer a discrete tap, a new way to receive alerts and notifications.
- New sensors measure heart rate and new application tracks activities.
- New custom-designed system-on-chip called S-1 integrates many silicon components onto one module.
- New inductive charging ability that also leverages Apple's magnetic charger technology from its notebooks.
- New Digital Touch application allows users to communicate through sketches, taps, or even by sending their heartbeats or conversing through walkie-talkie mode.
- Mobile payments with Apple Pay, which verifies the wearer's identity through the Watch's biometric sensors.

Exhibit 51

Apple Watch



Source: Company Data

The company can leverage a large iPhone installed base at launch. Apple Watch works with iPhone 5 or later generations, and we estimate there will be 315M compatible iPhones by the end of this year. Apple has trained all these users on its iOS software. They have stored all their photos, videos, and other data with Apple, and have invested in applications in the App Store. The 30M Watches we expect to ship in the first 12 months only account for 10% of this compatible installed base, lower than the initial penetration of iPad into Apple's user base. We assume 60M Watch shipments in our bull case.

Closed Systems: Advantage or Vulnerability?

Closed systems tend to win in the early stages of new markets. Some of the most successful technology innovations have occurred when a single company had full

control of all aspects of product development (hardware, software, services, and ecosystem – the “walled garden”). The closed approach is often required in the early stages of a new product category, given the lack of standards, high risks and uncertainties around market adoption, and the rapid rate of innovation/iteration.

Apple is the most well-known example of the closed approach. Apple favors closed systems in which it maintains control of key technologies. Except for a period in the mid-1990s when it licensed its operating system, Apple has designed, developed, and integrated much of the hardware, software, and services in all its devices during the PC and mobile Internet computing cycles.

However, as markets mature, standards are set, and prices fall, open systems gain traction on some metrics.

Linux and Intel dominate the server market. Microsoft and Intel dominate the PC market. Google and Samsung have been very successful so far in the smartphone and tablet markets. It is important to note that in past computing cycles, open systems tended to help participants gain unit share. However, not everyone participating in open systems wins in terms of revenue and profitability. For example, we estimate Apple has double-digit operating margins in its Mac business while Dell and HP's PC businesses have low-single digit margins. Apple still makes the majority of smartphone profits despite having mid-teens unit share. Apple and Samsung collect most of the profits in the smartphone market. This suggests consumers still place a premium on high quality, better design, ease of use, strong security, and better customer support, though not all consumers can or will pay that premium.

Wearables will test the closed vs. open systems theory.

At first blush, it is easy to think history is about to repeat itself. Apple will disrupt the market with its Watch and quickly become the market share leader before others catch up and Apple will be content to be the premium brand with high profit margins but lower unit share. However, as devices become extremely personal, more consumers may be willing to pay for a better experience. Comfort is the top purchase criterion for wearables in our survey, ahead of price. Even in the smartphone market, some Android users are switching to iPhones, despite the higher price. Our AlphaWise survey indicated Apple would gain share from Samsung and other Android vendors with larger screen iPhones.

CEO Tim Cook has said Apple is becoming more open in some ways. The company has worked with car companies to integrate CarPlay, and is currently working with healthcare

and smart home companies on HealthKit and HomeKit. Apple also announced a partnership with IBM to develop native iOS applications and cloud services, and to sell and support the devices in the enterprise. We believe both companies could extend the collaboration to opportunities in developing applications, data analytics, and device sales/support in the Internet of Things cycle and wearables. These partnerships could help Apple create better third-party ecosystems and give it an edge over less organized consortia of open system players going forward.

The Watch is likely just the start of a portfolio of wearable products. CEO Tim Cook recently said, “The next chapter for us is about personal devices, about something that's even more personal than what we had before. And I think the watch is a great place to start that.” Wearables today are at just the beginning of a long computing cycle, and Apple is aiming to take its prominent share, as it did in the prior PC and mobile computing cycles.

Samsung

Samsung leads the nascent smartwatch market, with 17% share since it started shipping in 4Q13. The company has been able to achieve relative success in the market due to (1) early market entry, (2) strong brand and distribution network, and (3) vertical integration, which shortens time-to-market for new products and quick upgrade cycles. However, we are still skeptical on whether wearables can become a long-term earnings driver for the company.

Samsung entered the wearables market in September 2013 with the release of Galaxy Gear. The product was disappointing due to (1) limited application compatibility, (2) poor design and wrist band quality, (3) high price, and (4) lack of a stand-alone music player. In 2014, the company released five additional Gear devices with improved features/design and hoped to dominate the market ahead of launches from competitors such as Apple.

Gear 2, Gear 2 Neo, and Gear Fit were released in April 2014, seven months after the launch of Galaxy Gear. The biggest physical difference between Gear 2 and its predecessor is the wrist band. With a camera and an infrared (IR) blaster now placed at the top edge of the watch, the wrist bands are detachable and replaceable. Gear 2 and Gear 2 Neo are also equipped with (1) an open software development kit (SDK), (2) a new Tizen OS instead of Android, (3) a stand-alone music player, (4) a heart rate monitor, and (5) an IR blaster that allows the user to control his or her television using the Gear 2.

Exhibit 52

Samsung Galaxy Gear (Left) and Gear 2 (Right)

Source: Company Data

Gear Fit is a hybrid between a smartwatch and a fitness band, and the device was recognized as “The Best Mobile Device” at Mobile World Congress 2014. Gear Fit has an eye-catching design, with a 1.84” curved Super AMOLED display, which allows for a snug and comfortable fit on the wrist. The device monitors the user’s activities, such as steps taken and calories burned, to provide personalized fitness coaching. When paired with a Galaxy smartphone, Gear Fit can also receive simplified instant notifications on emails, text messages, calls and calendar items.

Exhibit 53

Samsung Gear Fit

Source: Company Data

Gear Live, released in June 2014, is powered by Android Wear instead of Samsung’s own Tizen OS. The design and specifications are almost identical to Gear 2, but the device weighs 10g less and comes without a camera, IR blaster, or stand-alone music player. However, unlike the previous Gear models, Gear Live is compatible with Android smartphones running Android 4.3 (Jelly Bean) or later.

Samsung unveiled the Gear S in August 2014, a few days ahead of its Note 4 event at IFA Berlin 2014. Gear S is the most advanced Samsung smartwatch yet, and the biggest improvement is 3G and Wi-Fi connectivity, in addition to

Bluetooth, which means it can function as a stand-alone smartwatch without syncing to a smartphone. It also features a 2” curved AMOLED display and a number of useful apps such as music player, a turn-by-turn pedestrian navigation application (HERE), and *The Financial Times* news application (FastFT). The device shipped in October 2014.

Exhibit 54

Samsung’s First Stand-Alone Smartwatch Gear S

Source: Company Data

Initial demand for Samsung’s wearables has been slow, despite the company’s consistent roll-out of Gear devices. We believe 0.8M Galaxy Gear smartwatches were shipped in 2013, and shipments are tracking poorly so far this year. At the Galaxy Note 4 presale in Korea, Gear Fit was given away to early buyers as part of a sales promotion, which suggests overall demand for Samsung wearables remains low.

We think Samsung’s biggest weakness is in software.

Tizen is an open source Linux-based operating system developed by Samsung and Intel, and it is used to power the majority of Samsung’s wearable devices. The company is trying to reduce its dependence on Google’s Android platform, but user reviews are mixed for Tizen though it is relatively new. Another weakness of Samsung wearables is compatibility with smartphones. When Galaxy Gear was introduced last year, it could only be paired with Galaxy Note 3. A month after release, compatibility was extended to three other Galaxy devices. Although device compatibility has improved significantly for later models such as Gear 2, Gear 2 Neo, and Gear Fit, it is still limited to 17 Galaxy devices. Gear Live, which features Android Wear, can be paired with Android 4.3 or later devices.

LG

LG entered the wearables market with the release of G Watch in June 2014. G Watch, jointly developed by LG and Google, was featured as one of the two first Android Wear-based smartwatches, along with Samsung’s Gear Live. The G

Watch has been a disappointment due to (1) unpopular design, (2) lack of auto brightness control, and (3) short battery life.

Exhibit 55

LG's First Smartwatch G Watch

Source: Company Data

The company unveiled the updated G Watch R in August, only two months after the release of the previous model and around when Samsung announced Gear S. G Watch R features a 1.3" circular OLED screen with a higher resolution, and will compete directly with Motorola's Moto 360, which also features a round face. Major improvements from the previous model include (1) better design, (2) heart rate monitor, and (3) better screen. The bulky size and short battery life are still areas for improvement. The device will go on sale in 4Q14.

Both LG smartwatches use Android Wear. As such, device compatibility is not an issue for the company and users are generally more satisfied with the features in comparison to Samsung's Tizen. The "OK Google" feature allows the user to do a number of tasks using voice control, including sending texts.

Exhibit 56

LG's Updated G Watch R

Source: Company Data

We believe LG does not have a strong position in the wearables market and will not gain significant market share in comparison to major players such as Samsung and Apple. Aside from the design, LG smartwatches are not differentiated from other Android vendors and the value proposition is not clear. There is no "killer app" (i.e., Apple Pay for Watch). As such, it is likely to be a small player in the Android ecosystem, and thus repeating what we saw in the smartphone and tablet markets.

Sony

Sony's two product lines are SmartWatch and SmartBand. Both are Android platform-based and focus on design and high definition audio. Sony made its wearables debut in 2012 with SmartWatch, rolling out annual upgrades with SmartWatch 2 in October 2013 and SmartWatch 3 due out late November 2014. The newest SmartWatch 3 has a 1.6" LCD display, can be paired with smartphones running Android 4.3 or later via Android Wear, and can record activities using the Lifelog application. Other features include Bluetooth 4.0 and NFC connectivity, an acceleration sensor, compass, GPS, and gyro sensor. It has a 1.2GHz quad-core ARM A7 CPU and 512MB RAM. It has the ability for stand-alone music and video playback, and has 4GB of storage capacity.

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Exhibit 57

Comparison of Sony's SmartWatch Line

	SmartWatch MN2	SmarWatch2 SW2	SmartWatch3 SWR50
			
Release Date	April, 2012	Oct, 2013	Nov, 2014 (Japan)
Price	9,480 yen	14,000 yen	25,000 yen
Colors	Band 5-color	Band 5-color	Band 4-color
Display	1.3", 128x128, OLED	1.6", 220x176	1.6", 320x320
Weight	15.5g	23.5g	38g
Dimensions	36x36x8mm	42x41x9mm	51x36x10mm
Connectivity	Bluetooth 3.0	Bluetooth 3.0, NFC	Bluetooth4.0
Battery/ Life	3-4 days	3-4 days	420mAh
Charging Time	2 hour	1 hour	1 hour
Applications	Android 2.3 and later	Android 4.0 and later	Android 4.3 and later

Source: Company Data, Morgan Stanley Research

Sony plans to launch SmartBand Talk with a 1.4" curved e-ink display. It will also offer hands-free voice communication via Bluetooth 3.0 connection to a smartphone running Android 4.4 or later. Other features include a 32-bit ARM Cortex-M4 CPU, and built-in accelerometer and barometer. In addition, Sony showcased the SmartEyeglass at IFA Berlin 2014, and plans to launch it later in 2014.

Exhibit 58

Sony SmartBand Talk



Source: Company Data

Success in mobile is important for Sony. The company believes the wearables market is still in its infancy, searching for a longer-term product road map. Sony sells wearables via Sony Mobile Communications, so they are in the same segment as Sony's smartphone Xperia. Having exited PC operations, the company's mobile business comprises smartphones, tablets, and wearables. Sony is working on completely overhauling the mobile business, which was once

a prioritized growth area but is now in need of restructuring. Sony has announced a roughly 15% cut to mobile business headcount of 7,100, excluding 1,400 of manufacturing department staff, but additional fixed-cost cuts could be needed.

Sony sees wearables as smartphone peripheral devices, and therefore not a priority today. Our understanding is that wearables are not a big short-term product development priority for Sony. Excluding Sony's device business rooted in CMOS sensors, we think the company's overall growth driver will shift from electronics to games and entertainment.

Garmin

Leveraging legacy strength in high-end fitness watches.

Garmin's strength has typically been in the \$300+ fitness watch market. The serious fitness enthusiasts and athletes who buy watches at this end of the market are buying Garmin for the advanced analytics and high-end features they offer, such as oxygen meters, recovery time calculators, heart rate monitors, GPS, barometers, altimeters, and run monitors (pace, vertical lift) to improve running dynamics. While the software functionality for social interaction is relatively recent, Garmin has mobile apps that allow users to share and track their data over time. Garmin is hoping to leverage its strong analytics, market position, and brand at the high end of the market to move into the more generic fitness band market.

Exhibit 59

Garmin Forerunner 620



Source: Company Data

Within fitness bands, Garmin lacks the brand recognition of the competitors mentioned above.

Garmin's product in the general fitness band market has been the Vivofit and more recently the Vivosmart. The Vivofit saw strong sales early in the year, particularly with the Fitbit recall and the view that Nike was exiting the market. Customers liked the one-year battery life and the basic display on the device since some competing devices have to be tethered to a phone to

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retrieve information. The recently introduced Vivosmart include new features, such as basic integration with your smart device – allowing the user to read texts and emails – and vibration alerts. So far, there is little market data about overall receptivity. While Garmin's products appear to be strong, especially since its experience in fitness watches helps it build accurate products and analytics capabilities, the market is crowded, and brands like Nike, Fitbit, and Jawbone tend to have more recognition, making it hard for Garmin to gain significant share, in our view.

Exhibit 60

Garmin Vivosmart



Source: Company Data

The company needs to make further investments in software and brand in order to gain share in wearables.

Garmin's Connect application is a continuation of the software it uses for its high-end devices, and is more focused on goal setting for workouts (e.g., training planning). While Connect allows users to view and share activities from their Garmin devices, further investment will be needed in software (e.g., social, weight loss tracking, diet monitoring) in order to keep up with features other fitness bands have today. As more and more competitors enter the market, these software features will increasingly be the differentiator, particularly for Garmin, which is not coming from a brand leadership position. However, even with further investments in software, and without additional investments in brand, Garmin is in a difficult position from which to grow share and participate meaningfully in the general wearables market going forward.

Microsoft and Nokia

Microsoft is a vendor to watch in the wearables space, given the large installed base of Windows-based devices, a strong software portfolio, and the recent push into hardware.

While Samsung/Android and Apple have received more attention for their wearables efforts thus far, Microsoft is not standing still. With over 90% share of the 1.3B desktop and notebook installed base, Microsoft's Windows has a large ecosystem and strong brand name recognition, particularly notable since consumers prefer wearables from computing device platforms. According to our survey data, 34% of consumers would consider a Microsoft watch—even though Microsoft had not spoken publicly about its smartwatch efforts at the time of our survey and has a low share in other mobile devices.

Wearables align with Microsoft's strategy. The company is focused on delivering productivity and platform services in mobile and/or cloud-first work and home environments. A move into wearables would certainly support this. Microsoft has some hardware manufacturing expertise through its Xbox, Surface, and now Nokia businesses, which it could leverage into other hardware categories.

The Microsoft Band leverages Microsoft's strength in software. Microsoft recently announced a new fitness band, available on October 30, 2014, for \$199. The band would have sensors that track a user's fitness level and would integrate with its new Microsoft Health platform, available across Windows, Android, and iOS. The Microsoft Band has advanced sensor technology to measure heart rate, calorie count and other biometrics. In addition, the band will show text, emails, and other relevant information while providing access to its virtual assistant technology, Cortana.

The larger goal for Microsoft is to be the central repository for the world's fitness data, regardless of the platform or device – and Microsoft Health is a key component of that strategy. Microsoft developed partners across the health ecosystem, including Jawbone, RunKeeper, and MapMyFitness, and plans to partner with more in the future. Microsoft is also licensing its 10 sensor modules to developers to build additional software and hardware from its technology. Microsoft's Intelligence Engine, which powers Microsoft Health, is a self-learning engine, which will get richer over time through greater data collection and better user insights.

Microsoft Band will complement its Xbox / Kinect gaming system, as a way to better track biometrics as consumers interact with fitness-oriented games. Microsoft may also position the band for the enterprise space – leveraging its relationship with the enterprise to bundle the band with cloud-based software aimed at cutting healthcare costs.

Exhibit 61

The Microsoft Band

Source: Company Data

Microsoft has multiple avenues to capitalize on wearables through its broad software portfolio. As the leader in productivity software with its Office apps, Microsoft has focused on extending its leadership into mobile-friendly apps that span across consumer and enterprise and across different platforms. The release of Office on iOS earlier this year well illustrates these shifts. Some more examples specific to wearables:

- Microsoft recently released a version of OneNote for Android Wear watches, which allows users to take notes on their smartwatches and sync with their OneNote application on their smartphones.
- Microsoft offers an online platform called HealthVault, which stores and maintains health and fitness information. This tool is used by both individuals and healthcare professionals (as a Personal Health system). The growing collection of health and fitness data through wearable devices makes HealthVault increasingly relevant as a platform for managing and analyzing this data.
- Microsoft's venture with General Electric, Caradigm, brings to market an enterprise-oriented health intelligence platform. The aim is to give healthcare providers a better platform for managing and analyzing healthcare data. The greater capture of health data supports the need for analytical tools, like Caradigm, to make sense of and act on the data.

Microsoft looks well-positioned for the enterprise opportunity. With Microsoft's strong presence in the

enterprise through Windows and Office, a Windows-based wearable device may have some traction if enterprise adoption picks up steam. Microsoft's device could be appealing to enterprises that are looking for integration with enterprise applications, systems management tools, and enterprise-oriented security features. While iOS and Android devices are becoming more pervasive in enterprises (as are tools to manage and secure them), the integration with enterprise apps and tools remains a key differentiator for Microsoft relative to Samsung, Apple, and others.

Salesforce.com

Salesforce.com is positioning itself for wearables in the enterprise. Salesforce.com has aggressively focused on the idea of aggregating data from multiple points onto its platform to drive sales, customer service, and marketing applications. This focus has recently expanded to include data from wearables.

In June 2014, Salesforce launched its Salesforce Wear program, which helps enterprises develop apps to connect with customers via wearables. With Salesforce Wear for connected devices, enterprises can deliver more tailored customer experiences, more contextually aware sales processes, and faster customer service. Also in June 2014, the company announced a partnership with Philips to build applications on the Salesforce.com platform to collect data from Philips' medical devices, which could provide better holistic care for patients. The Salesforce Wear initiative also includes support for Android Wear, ARM, Fitbit, Pebble, Samsung, and other devices to accelerate the adoption of wearables in the enterprise.

IBM

IBM could benefit from analytics demand from the significant amounts of data generated by wearables, in our view. It has a competitive business analytics portfolio that generates \$16B in high-margin revenue that is growing 8%. The company has invested \$24B to build its Big Data and analytics capabilities through organic investments and over 30 acquisitions. IBM's recently announced partnership with Apple to build enterprise-grade mobile applications for iOS is likely to extend to Apple Watch, where we see meaningful synergies given IBM's strong presence in the enterprise market and business analytics capabilities.

Wearable Devices

Component Supply Chain

Component Supply Chain

Jasmine Lu
Grace Chen
Sharon Shih

Who are the main beneficiaries as the wearables take off? Who faces challenges should wearables cannibalize smartphone and watch markets?

Wearables do expand the addressable market for the smartphone supply chain, though their revenue contribution is still small. Most of the component makers in the smartphone supply chain also engage in wearables. If wearables take off, the incumbents should benefit from expanding addressable markets. However, we believe wearables have limited impact to current incumbents as both unit volume and value of wearable components remain small, compared to other consumer electronics.

High-volume components including display, batteries, substrates, and acoustics are key beneficiaries of wearable demand, and to a lesser extent camera modules, as many wearable devices so far do not have cameras. Exposure to the wearables supply chains of Apple and Samsung could give certain suppliers an edge, as our survey suggests, giving them an early lead in this market.

- **Best-positioned:** Zhen Ding (FPC), AAC (acoustic, haptics), GoerTek (acoustics), Quanta (assembly)

Printed Circuit Boards (PCBs)

Wearables are not a key driver yet but flexible PCBs (FPCs) would benefit the most. FPCs best fit the requirements given the compact design, slim and light form factor, and flexibility needed in smartwatches or glasses. We estimate FPCs account for 44-45% of total PCB value in wearables, higher than the 37-38% contribution in smartphone PCB value. High-density interconnect (HDI) PCB design is less complicated since there is less computing power in wearable devices. We see Zhen Ding as a major beneficiary should wearables take off in 2015-16 due to its superior FPC production capability and scale, full-range PCB product offerings, and solid execution.

Display

Wearables make a limited contribution to the display supply chain. Due to the small display area on wearables, we estimate the value of the display would range from \$3-27, depending on resolution and form factors (i.e., flexible or not). Therefore, the revenue contribution to major panel makers is

limited (less than 3%). Among suppliers, LG Display could be an early beneficiary thanks to its collaboration with Apple.

Camera Modules

Suppliers would be challenged if wearables take off. We believe the wearable devices will change the camera module supply chain, as not every wearable will adopt cameras due to privacy issues. Many of the devices announced so far, including Apple Watch, do not have cameras. The most popular fitness bands in the market, including Fitbit, Nike Fuelband, and Jawbone Up, do not have cameras. Only one of the five current Samsung Gear variants has a camera (Gear 2). Therefore, the camera module supply chain, including Largan (lens), Sunny Optical (camera module), etc. will see less benefit from wearables.

Acoustics

Companies could benefit from an increase in value content. Our checks suggest the acoustic value content within the Apple Watch, which is equipped with a speaker box and microphone, is almost the same as in the iPhone (i.e., \$3-4). We expect acoustic suppliers to benefit should wearables gain traction, especially the incumbents, including AAC and GoerTek. Both are aggressively increasing exposure in the wearables segment. We believe AAC is an initial supplier for the Apple Watch, while GoerTek will likely be added as a second source.

Haptics

Apple Watch could lead the trend for haptics adoption. Management highlighted several use cases for haptics during the Apple Watch introduction in September. Haptic technology allows the device to give the wearer tactile feedback, similar to a tap or a vibration. Apple said its implementation, called Taptic Engine, in the Watch feels like a tap on the wrist, and is a “discrete” and “nuanced” experience compared to other notification methods. Leveraging its mechanical know-how in linear vibrators, strong design capacity, and full automation process, AAC should secure dominant share as the haptics supplier in iPhone 6 and 6 Plus, and Apple Watch. In fact, our checks suggest AAC is the majority supplier for the first batch of Apple Watches. Since the design of haptics in the Watch is more complicated than in the iPhone, we believe the second source for haptics in the iPhone, Jinlong Electronics, might not have started supplying Apple for the Watch. The opportunity for haptics suppliers also lies in the mass adoption

of the technology in other wearables, assuming Apple starts an industry trend with the Apple Watch.

Battery

This is likely the key bottleneck for improving wearable functionality, including wireless communication, due to limited technology improvement in the past decades. This is no surprise since smartphones, tablets, and other mobile devices still suffer from limited battery capacity. Given the highly concentrated nature of the battery cell supply chain, we believe battery cell suppliers including LG Chem and Samsung SDI will benefit the most from wearables, especially since the two have led in flexible battery design in smartwatches.

Assembly

Wearables are the new growth engine for ODMs, as many brands are investing resources in developing wearables to capture the opportunity in the Internet of Things era. We believe Quanta should outgrow peers in the wearable market given its superior customer mix. We expect Quanta to be the dominant final product assembler for Apple Watch, given the former's long experience with Apple in MacBook and iMac assembly, as well as its R&D capability.

Apple is expected to be the leader in the wearable market after the Watch launches, based on our estimates. Below we conducted a sensitivity analysis on Apple Watch's impact to Quanta's net profit in 2015. We assume a blended ASP of US\$200 for Quanta (roughly Apple's cost of goods for Watch) and gross margin for Quanta of 3.5%, resulting in an

operating margin of 1.5%, slightly below the company's average. We believe these estimates are conservative, given potential yield rate issues with new products. We expect Apple Watch to contribute 19% of Quanta's total sales in 2015e and 10% of net profit in 2015e, based on the base case volume of 30M units, ASP of US\$200, and a C1Q15 launch.

Exhibit 62

Apple Watch Base Case: 19% of Quanta's 2015e Sales

Impact on Quanta's net income in 2015e					
Quanta's Apple Watch shipments (mn units)					
ASP (US\$)	10.0	20.0	30.0	40.0	50.0
100	2%	3%	5%	7%	8%
150	3%	5%	8%	10%	13%
200	3%	7%	10%	13%	17%
250	4%	8%	13%	17%	21%
300	5%	10%	15%	20%	25%

Source: Morgan Stanley Research Estimates

Exhibit 63

Apple Watch Base Case: 10% of Quanta's 2015e Net Profit

Impact on Quanta's sales in 2015e					
Quanta's Apple Watch shipments (mn units)					
ASP (US\$)	10.0	20.0	30.0	40.0	50.0
100	3%	6%	9%	13%	16%
150	5%	9%	14%	19%	24%
200	6%	13%	19%	25%	32%
250	8%	16%	24%	32%	40%
300	9%	19%	28%	38%	47%

Source: Morgan Stanley Research Estimates

Wearable Devices
Semiconductors

Semiconductors

François Meunier
Joseph Moore
Craig Hettenbach
Bill Lu

How will wearables impact the semiconductor industry?

We expect wearables to increase the semiconductor industry's total addressable market. Sensor content should grow, driven by sensor analytics and the need for persistent and pervasive identity. Assuming wearables become complementary instead of substitute devices for smartphones or other mobile devices, demand should increase for low-power and near-range connectivity, like Bluetooth Smart and near-field communications (NFC).

Integrating MEMS (micro-electro-mechanical systems) sensors, connectivity devices, and micro-controller technology is the key. The company is the exclusive supplier to GoPro, and it should benefit from the growth of wearables in new product categories like drones and new end markets like in professional environments. Providing systems-level solutions to ease development activities would be critical as well. Examples include Intel's Edison platform and Broadcom's WICED.

New packaging technologies like System-in-Package driven by reduced cost and sizes.

- **Best-positioned:** Invensense, Ambarella, Atmel, NXP Semiconductor, Freescale, Microchip, ARM, Imagination Tech, ASE, Maxim Integrated Products

Top Picks

Our top pick in sensors is Invensense. Secular growth in motion interfaces, location-based social applications, and optical image stabilization should drive demand for MEMS in consumer electronics and enable Invensense to outperform diversified analog players. Invensense has a strong customer base with leading smartphone OEMs and has been gaining share due to its differentiated technology that permits greater sensor integration and smaller form factors than competitors.

We also like Ambarella for its exposure to wearable cameras. The company is the exclusive supplier to GoPro, and should benefit from the growth of wearables in new product categories like drones and new end markets like in professional use.

In US microcontrollers, wearables have the most impact for Atmel. We think the adoption of wearables will likely move the needle for Atmel's growth more than it would for some of its larger peers (Atmel is 1/3 the size of Freescale and 3/4 the size of Microchip). Furthermore, we have written that

companies with building blocks for wearables and 32-bit microcontrollers (MCUs) could trade with consolidation premiums (Microchip and ON Semiconductor bid for Atmel in 2008). Atmel's integrated products provide customers a turnkey wearable solution, helping to simplify their processes and accelerate time-to-market.

We see wearables as an incremental growth driver for NXP Semiconductors. NXP has a leadership position (~50% market share) in NFC controllers and Secure Element as well as strong expertise in software (Java card operating system) and payment-related IP. As a result, we view the company as a key beneficiary of mobile payments adoption in wearables. Notably, the upcoming Apple Watch includes NXP's NFC controller and Secure Element chip for payments. See the Payment section for more details.

In Europe, we would highlight ARM, the market leader in semiconductor IP for microcontrollers, and Imagination because of its MIPS business (it is the main supplier to Microchip).

In Asia, we highlight ASE as the beneficiary of the new System-in-Package technology, which enables smaller and lighter form factors critical in wearables.

Integration Is the Key

Integration drives costs down and penetration up. Not many companies have all the building blocks today (i.e., MEMS/sensors, microcontrollers/microprocessors, and connectivity). There are a few exceptions, such as STMicroelectronics and Freescale, but they are not the strongest in every area. To drive unit costs down further, wearables might require more integration, which we believe could happen in several ways.

- **Connectivity companies adding microcontroller capabilities.** There are several suppliers of microcontroller IP, including ARM, Imagination, and Cambridge Consultants. ARM has taken market share (now above 20%), but we believe it might need to launch even cheaper/simpler alternatives as some devices can work well enough with a simpler microcontroller design such as the one available from Cambridge Consultants.
- **Microcontrollers add connectivity capabilities.** This would be a more complicated strategy because connectivity is not easy to integrate. Conceivably, microcontroller companies could use connectivity IP from CEVA or Imagination. Atmel, through its SmartConnect family of products, has an early lead in integrating MCUs with wireless technologies such as ZigBee.

Could wearables drive consolidation in the semiconductor space? Licensing microcontroller or connectivity IP is relatively easy but does not give full control. Hypothetically, wearables could drive a small wave of consolidation for companies looking to take control of all the wearables building blocks. Microchip approached CSR recently, and Atmel bought Newport Media for its Bluetooth capabilities.

We believe that wearables could boost an otherwise slow-growing microcontroller market. The radio frequency (RF) and connectivity features central to wearables should further propel growth in the 32-bit space. This is a market where 8-bit MCUs could still flourish, despite the performance advantages of 16- and 32-bit MCUs. The 8-bit MCUs are smaller, cheaper, and can meet the demands of many designers. In addition, the low power consumption of 8-bit offers an advantage over higher bit MCUs. ARM has introduced the Cortex M0 and M0+ 32-bit processors to compete in this space at low price points, but ARM is not necessarily the cheapest solution despite its large ecosystem.

Microcontrollers perform an array of functions and are commonly used in a wide range of markets, such as automotive, industrial, consumer, compute, and communications. With the introduction of the Internet Protocol version 6 (IPv6), almost every device can be assigned an IP address, giving it the ability to communicate with other devices. These connected processors and microcontrollers perform one or more of the following functions: sense, measure, control, and communicate – both ways. Furthermore, adding connectivity capabilities enables easy access to these devices.

Bluetooth

Bluetooth SMART is the standard of choice for wearables.

We know that both Android Gear and Apple Watch will use Bluetooth SMART. The iPhone has Bluetooth 4.0 and thus compatible with Bluetooth SMART, which we believe is the technology of choice for connecting wearable accessories to smartphones and tablets. Companies that would benefit from the rise of Bluetooth SMART include CSR, Dialog Semiconductor, Nordic Semiconductor, STMicroelectronics, and Texas Instruments.

Bluetooth SMART was introduced as Wibree by Nokia in 2006. Nokia already had the vision that any object could be connected to a smartphone. Unfortunately for Nokia, Apple and Google took over the smartphone market and apps ecosystem. Wibree was merged into the Bluetooth standard in 2010 and has been known as Bluetooth SMART since 2011.

The beauty of Bluetooth SMART is 1) its compatibility with any smartphone / tablet from the start and 2) a lower cost / lower power usage than WiFi. Potentially as small as 6 sq mm on a 28nm process, Bluetooth SMART is a smaller, simpler, and cheaper chip than a full Bluetooth chip. It can run on a small battery for a year or two. While other connectivity standards are equally power-efficient (like ANT, for instance, which has been used for PC mice and keyboards), they require a dongle to be installed on a PC.

Bluetooth SMART is expanding beyond wearables with a mesh topology option that is similar to Zigbee. Every Bluetooth SMART node becomes a new node for the network, extending its range. Consequently, Bluetooth SMART could also be used for connected light bulbs instead of Zigbee, without the need of a hub. Any smartphone could take control of the light bulbs.

Exhibit 64

Bluetooth SMART – Competitive Landscape

	CSR	Dialog	Nordic	STMicroelectronics	Texas Instruments
Strengths	Historical leader in the Bluetooth market	6mm2 chip at 55nm	Market leader in connectivity chips for keyboards and mice	Potential combo chip with MEMS and MCU	Strong marketing push
	Potential synergies with apps processors SOCs		Strong marketing push	Good early market share in fitness	Strong support to start-ups
	Next generation product has an ARM processor Bluetooth MESH	ARM Cortex M0 processor on-board	ARM Cortex M0 processor on-board		Potential synergies with apps processors SOCs (OMAP) Biggest promoter of Zigbee
Weaknesses	Marketing push late on Texas Instruments	unproven in the market yet	legacy revenues (proprietary 2.4GHz, ANT) at risk	Only introduced a single chip in August 2013	8051 microprocessors not as scaleable as ARM Cortex M0
	Current generation chip on 85nm	not approved by Bluetooth SIG yet	No SOC synergy		Recent track record in Bluetooth and Connectivity
	Proprietary 16 bits microcontroller	Protocol Stack licensed from 180nm chip 3rd party			180nm chip

Source: Company Data, Morgan Stanley Research

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Micro-Electro-Mechanical Systems

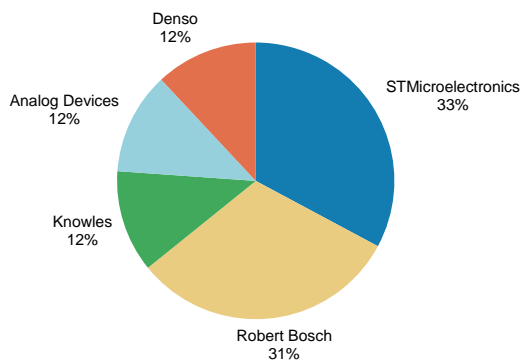
The MEMS opportunity is large in sensors, larger still in actuators and energy harvesting. The growth in the smartphone market has led to significant miniaturization and cost reduction for key sensing components such as accelerometers and gyroscopes, which now cost around US\$1. Today this is a US\$4bn market, according to Gartner (vs. \$300bn for the overall semiconductors market), with the bulk of volumes and revenues coming from smartphones. Among the companies we cover, our top pick is the market leader, STMicroelectronics. Invensense has a number of design wins in the area of combo MEMS sensors with gyroscope and accelerometer functionalities and should benefit, too.

- **A greater ability to interact with the outside world.** Honeywell has introduced a MEMS-based vacuum pump, and STMicroelectronics is working on piezo-based actuators.

Our top picks in the MEMS arena include STMicroelectronics and Invensense.

Exhibit 65

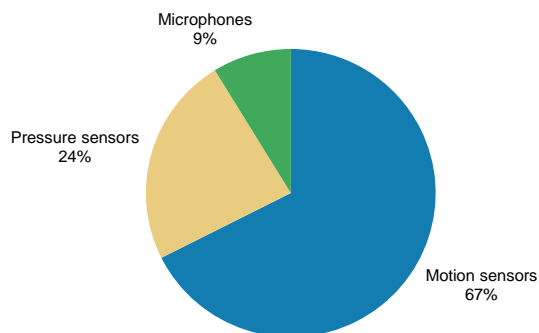
Connectivity MEMS Market Share (2012)



Source: Morgan Stanley Research

Exhibit 66

Breakout of Main Types of MEMS Sensors (2012)



Source: Gartner

We believe that the MEMS market will evolve in two ways:

- **More types of sensing devices**, for instance, through the downsizing of analytical instruments such as mass spectrometers (equivalent to an electronic nose that can detect molecules).

What are MEMS?

These miniaturized systems of mechanical and electro-mechanical elements, such as microsensors and microactuators, convert energy from one form to another. For instance, a microsensor converts a mechanical signal into an electrical one.

Accelerometers measure linear acceleration and tilt angle. Single and multi-axis accelerometers detect the combined magnitude and direction of linear, rotational, and gravitational acceleration. A common application for an accelerometer is changing a mobile device screen from a portrait to a landscape orientation.

Gyroscopes measure the angular rate of rotational movement about one or more axes. Gyroscopes can measure complex motion accurately in free space, tracking the position and rotation of a moving object. Unlike accelerometers and compasses, gyroscopes do not suffer from errors due to external environmental factors like gravitational and magnetic fields. This fact makes gyroscopes ideal for advanced motion sensing applications in consumer devices, such as full gesture recognition, movement detection, and motion simulation in video-gaming applications where elevation or floor-specific location is important.

Packaging Technologies

New packaging technologies like System-in-Package (SiP) will become more popular, in our view. In the wearable era, smaller form factors and lighter weight will become increasingly important, which should lead to growing demand for SiP assembly technology. Apple has already adopted SiP technology in the iPhone 6 and 6 Plus fingerprint sensor, and we expect to see more SiP-type assembly used in different applications of higher-end phones, portable devices, and wearables in the coming years. Our top pick in this space is ASE.

Cost-efficient way to reduced size and weight. We believe SiP enables form factors to have smaller size and lighter weight with limited cost addition. There are many ways to save weight/size of mobile devices, including more power-efficient displays, batteries, etc. However, these technologies are not necessarily available today, and thus we believe the use of SiP will be one easy way for wearables to save weight. For example, our analysis shows that Apple likely saved 50% or more on package size by using SiP in the fingerprint sensor

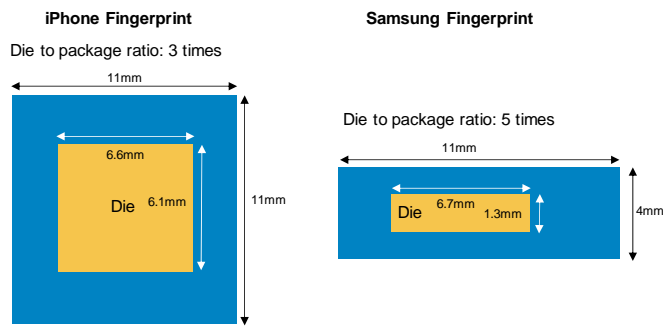
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and eliminating the substrate while the added cost is merely US\$0.50 to US\$1.00.

The semiconductor that Apple is using is 40mm², and the total package size is 121 mm². In Samsung's solution, which uses a more traditional package/substrate, the die size is 8.7mm², and the total package size is 44 mm². Apple's die size is 4.6x larger than Samsung's, and yet Apple's total packaged module size is only 2.8x larger than Samsung's. By eliminating the substrate and using ASE's SiP technology, we believe Apple likely saved 50% or more on size. If Samsung and others ever decide to move to an Apple-type solution, we believe they would also have to think about changing the manufacturing flow to reduce package size.

Exhibit 67

Fingerprint Sensors: Apple vs. Samsung



Source: Gartner

From a cost perspective, we estimate that Apple's solution is roughly US\$10-12 while the Samsung solution is \$3-4. The easy conclusion is that Apple is paying 3x as much as Samsung. However, not all of the additional costs are related to the tighter form factor. Apple is using more expensive materials like sapphire. We estimate that the form factor and SiP by themselves only added US\$0.50 to US\$1.00 to the cost.

Exhibit 68

Apple Fingerprint Cost Breakdown

Apple Touch ID BOM	\$
Sensor	5.8
Wafer cost	1.9
RDL	0.3
IC package	0.9
AuthenTec GM	50%
Sapphire	2.0
Stainless steel	0.3
FPCB	0.5
Others (passive, plastic)	0.9
EMS	0.5
Total cost	10.0

Source: Company Data, Morgan Stanley Research

Exhibit 69

Samsung Fingerprint Cost Breakdown

Samsung Natural ID BOM	\$
Sensor	1.8
Wafer cost	0.6
IC package	0.3
Validity GM	5.0%
Substrate	0.3
Plastic bottom	0.2
FPCB	0.3
Others	0.3
EMS	0.1
Total cost	3.0

Source: Company Data, Morgan Stanley Research

We see future opportunities outside of the fingerprint sensor.

We believe SiP would be attractive to other applications such as camera and acoustic modules and wearables.

- Camera modules:** We could see adoption of SiP in 2015 with high-end smartphones, before the technology trickles down to the low end. Higher-megapixel sensors and image stabilization make the modules thicker, while consumers want increasingly thinner phones. Going to more advanced packages and assemblies to reduce thickness will likely become more prevalent.
- Wearables:** While the market is still new, it is clear that form factor improvements will be the key. For example, Google Glass is roughly twice the weight of traditional glasses, and the Oculus VR is an order of magnitude heavier. In the smartwatch segment, Samsung's Gear is 11mm thick, and Apple Watch should be about the same thickness. While this is not too different from some traditional watches today, many smartwatches have less than desirable battery lives. We believe smartwatch vendors will aim to reduce the thickness of the watch, or fit in larger batteries while maintaining similar thickness.

Teardown Analysis

As the following teardown recap shows, the semiconductor content in the wearable market consists mostly of motion sensors, low-power MCUs (or AP), and connectivity devices like Bluetooth or Wi-Fi.

The wearable fitness devices like Fitbit and Samsung Gear 2 use a low-power MCU and motion sensors to track health activity and indicators. The battery power of these devices is still poor at about a day. It would be interesting to see the battery power numbers for the Apple Watch.

While fitness and watch type applications are popular, we believe wearable cameras could see secular growth as well, driven by increasing surveillance demand in professional use, such as by police/first responders, the military, etc.

Exhibit 70

Semiconductor Content in Popular Wearable Devices

Technology	Company	Product Number
Google Glass		
Applications Processor	Texas Instruments	OMAP 4430
Wi-Fi Transceiver	Broadcom	BCM4330
GPS Transceiver	CSR	GSD4E Sirf
Audio Codec	Texas Instruments	TWL6041B
Power Management	Texas Instruments	TWL6030B1
Oculus Rift		
MCU	ST Microelectronics	STM32L100RB
MEMS Sensor (Six-Axis Gyro+Acc)	Invensense	MP65
USB 2.0 Controller	Cypress Semiconductor	CY7C65632
HDMI	Toshiba	358779XBG
Inverter	Texas Instruments	SEM TI 39 CF5I
LED Driver	STMicroelectronics	STP16CPC26
GoPro Hero 3		
Bluetooth 4.0 controller	Qualcomm	AR6233GEAM2D
USB controller	Freescale	Kinetis SCK20DN51Z
Power Management	Austria Microsystems	AS3713
Camera SoC	Ambarella	A770
Samsung Gear 2		
Applications Processor	Samsung	Exynos 3250
MCU	ST Microelectronics	STM32F401B
6-axis Gyro/Accelero	Invensense	MP65M
DC-DC Converter	Maxim Integrated	MAX77836
Radio	Motorola	MPS14X
Audio Codec	Yamaha	Y831
Fitbit Flex		
MCU	STMicroelectronics	STM32L 151
Accelerometer	STMicroelectronics	8304 AE D42 oW
Bluetooth	Texas Instruments	CC2540F128
Charger IC	Texas Instruments	BQ24040

Source: Company Data, Morgan Stanley Research

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Watches

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Watches

Louise Singlehurst
Hiroshi Taguchi
Edward Lui

How would wearables change consumer-spending behavior with regard to wristwatches?

Consumers could shift from the traditional view that a premium watch is a “one-off” purchase for multiple years to a “rolling spend” mindset, seen across high-end consumables. The new normal could also include the consumer expectation that all wrist-worn devices are connected, with functionality extending beyond time/time-related features. While wearable devices could increase watch usage, the definition of exactly what a “watch” is might be very different.

How might watch retailers and watchmakers respond?

Some traditional watchmakers have indicated they will be launching their own smartwatches, whilst others have explored partnerships with tech companies. In our view, watch brands most at risk are low- to mid-range price brands, especially those with a more masculine following, and they must evolve to keep up with the new segment. However, we believe that watch retailers will likely remain with the status quo and not carry smartwatch devices. Swiss watch retailers in China/Hong Kong are currently indifferent towards the smartwatch threat, as retailers do not believe they are a credible substitute for luxury Swiss watches. However, our analysis in this report suggests the threat in the low- to mid-range is real, and Hengdeli is most exposed to that segment.

- **Challenged:** Swatch Group, Casio, Citizen, Seiko, Hengdeli

The Threat to Traditional Watches

The very high-end price brands (\$5,000+ retail value) will remain largely unaffected, we believe. Whilst consumers who purchase timepieces in that price range might be tempted by the functionality of smartwatches, it is more likely that they would purchase a smartwatch in addition to a traditional watch, rather than substituting it with a smartwatch. This is because consumers tend to purchase higher-end watches for their emotional significance and craftsmanship value, which we believe are criteria largely non-applicable to smartwatches for now.

In our view, most at risk are brands in the entry to mid-range price points (\$200-1,000), and those with a strong male following. These brands include Tissot, Rado, and Longines, for example. Tissot is particularly vulnerable, we believe, given its sporty heritage, current touch screen

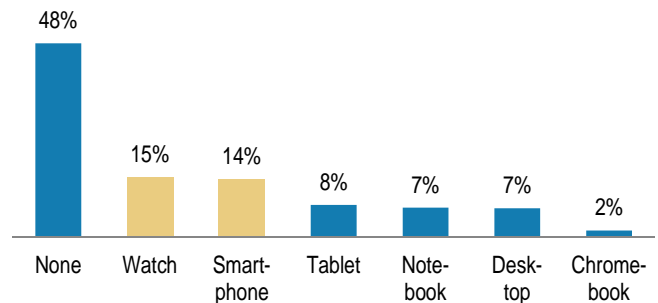
functionality (e.g. T-Touch), and its younger, predominantly male consumer base. Our research suggests that ~30% more males than females would buy a wearable device.

However, we expect that Apple’s decision to have more than one collection will broaden appeal. The Apple Watch comes in three collections and two sizes, and will address a larger target audience than previously expected – pre-launch, consensus expected one watch design and one price point. In addition, the interchangeable watch straps that Apple has designed are more fashionable than pre-existing smartwatches, which we believe also poses a risk to watches that are designed as jewelry pieces. It also widens the appeal of smartwatches to female wearers. We note that this is Apple’s first foray into the wearables market and expect further development (in both design and functionality) in this space, similar to the evolution of the Apple iPod from the original iPod to the Mini, Shuffle, Nano, and Touch.

Exhibit 71

Wearables Could Cannibalize Watches

Does Wearable Replace Another Purchase?

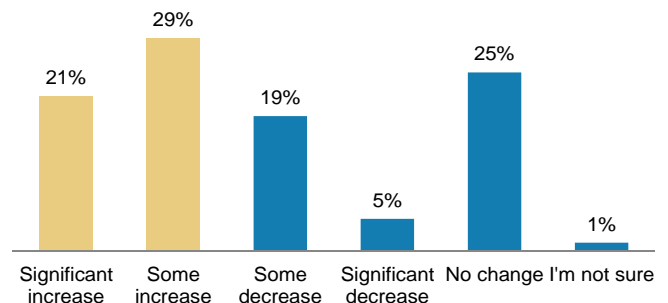


Source: Morgan Stanley Research

Exhibit 72

Wearables Could Increase Watch Usage

Change in Watch Usage Due to Wearable



Source: Morgan Stanley Research

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Wearables are invading the turf of traditional watches at points-of-sale. Currently in retail stores, wearables are sold with other consumer electronics such as smartphones, while watches have their own separate sales area. Very few watch specialty stores are currently selling wearables. However, wearable brands are fully aware of this situation. For example, Apple set up a temporary display section in Colette in Paris during fashion week. We think this is just the beginning, and Apple plans to compete against traditional watches head-on. The company made significant investments by hiring senior retail and marketing experts from luxury brands. Apple invited many journalists covering fashion, especially luxury brands and high-end watches, to its Watch event in September 2014. Since then the Watch has been featured on the cover of *Vogue China*, and Apple's head designer, Jony Ive, has given an interview to *Vanity Fair*.

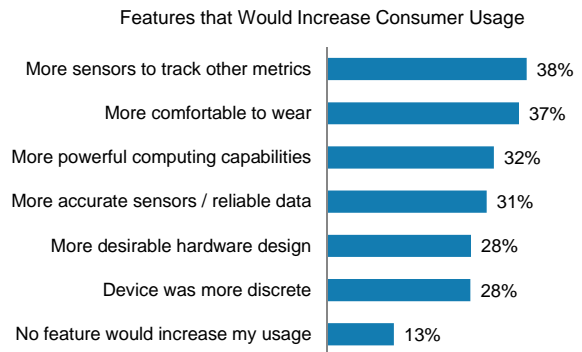
Wearables build on strong computing platforms. Ultimately, we think wearable companies plan to aggregate all information related to the user's life into central depositories, such as Apple's Health app. The utility and convenience these ecosystems create may be too hard for traditional watchmakers to overcome, as users soon would likely not be able to conceive of day-to-day lives without these features. If this is the future, then existing watchmakers could sell wearables themselves even if they could not realize the same level of profitability and at the risk of appearing to be copycats. This could become a matter of survival. However, note that it has not yet been established that the wrist is where wearables should be placed. If non-wrist-based wearables become mainstream, we think the impact on existing watchmakers should be slight.

Over time, the watch industry will be forced to "modernize" and adapt to a new environment where technology companies are also competing for wrist real estate. This could be a positive, in our view, as younger consumers, especially those who do not currently wear watches, would be introduced to wrist-worn timepieces, and could trade up over their lifetime to higher-end Swiss watches. However this still means that wearables could take share from low to mid-range watches. As the luxury consumer is getting younger, especially in the increasingly important emerging markets, we believe the threat to traditional watchmakers is real in the near term.

In the new "normal," consumers expect more than time/basic functions from watches. As technology and fitness companies roll out devices that widen the functionality of wrist-worn devices, such as activity monitoring, interactivity, connectivity, etc., consumers could come to expect such

functionality as basic features. A division between the purposes of devices according to price could emerge. Luxury wristwatches could come to be seen as art pieces, and watches priced lower than that as multi-functional, connected devices. Alternatively, the consumer could expect that every wrist-worn device is able to sync with other devices and ecosystems, such as wireless music players, mobile phones, home lighting/heating, personal finance, etc. As such, luxury watch brands will need to enforce the brand positioning they offer to overcome any potential perceived functionality gap.

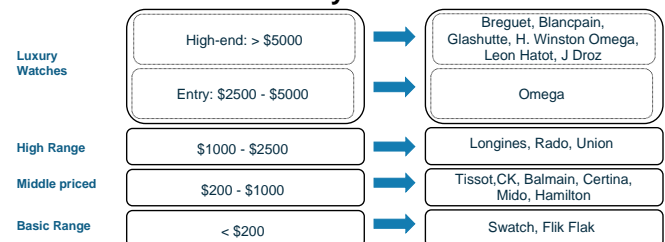
Exhibit 73
Consumers Want More Watch Functionality Than Just Telling Time



Source: AlphaWise Survey August 2014, Morgan Stanley Research/Risks to Swatch

We do not rule out that brands such as Omega at the entry level could also be at risk. Apple's multi-price strategy could pose a threat not just to low to mid-range watch brands, but also to higher-priced watches. The premium Apple Collection Watch (18k yellow gold alloy) could be priced closer to the entry-level luxury watches (e.g. \$2,500 Omega). Omega's sporty and male-centric branding could also make it more vulnerable to the smartwatch threat. In our base case, we assume that the ~33% Swatch group EBIT from mid/high brands is most at risk, and over 50% of EBIT is exposed when including entry-level Omega luxury watches.

Exhibit 74
Swatch Brand Portfolio by Price Classification

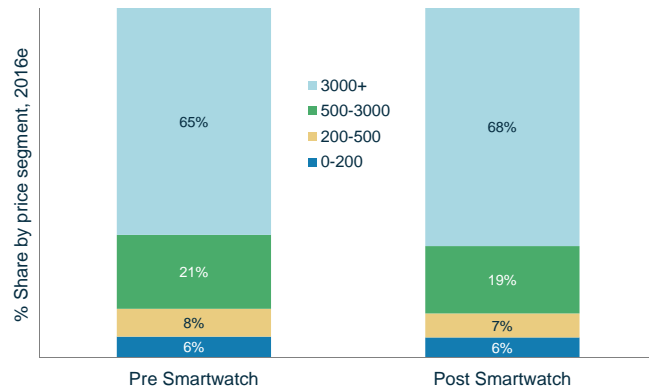


Source: Morgan Stanley Research estimates

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Exhibit 75

Low- to Mid-Range Watches Lose Share to Smartwatches; High-End Swiss Watch Exports Increase Share from 64% to 68%



Source: Morgan Stanley Research estimates

Culture Prevents a Strong Response

Swiss brands from across the price spectrum have discussed possibilities for their own smartwatch offerings. Tag Heuer has announced its intention to launch a smartwatch (Reuters, September 14, 2014) – the brand has previously made a one-off smart device for the Oracle sailing team.

Importantly, Swatch has also confirmed it will launch a smartwatch product within its Swatch Touch line in 2015. While the functionality of Swatch's new Swatch Touch line has not been confirmed, the company has suggested it will incorporate fitness monitoring capabilities.

A range of smart Swiss movement wristwatches have already made their way onto crowd-funding platforms – the Kairos and the Hyetis (both pre-order only) are examples of a hybrid Swiss movement-smartwatch. Both watches have Bluetooth connectivity, and include a touch screen, gesture detection and motion sensors. The Kairos does not rely on Android Wear or iOS (it can use Kairos OS), and is an example of how Swatch could 'go it alone' with the Swatch Touch. Tizen, an open source OS, is another potential platform.

"The implications for us of a rise in wearables are clear... Adapt to this new business model and don't underestimate the technology."

– Jean-Claude Biver, LVMH Watches and Jewelry, President

However, we believe that consumer expectations have moved beyond fitness stats monitoring, especially with the launch of Apple Pay and other potential capabilities using NFC in the Apple Watch. The Apple Watch responsive Taptic Engine, for example, allows the wearer greater tactile interaction with their watch and also offers connection to a full ecosystem of applications. The key issue for the Swiss watch brands is software. Swatch has previously expressed reluctance to collaborate with technology companies ([Swatch: the Threat from Progress in Wearables, September 12, 2014](#)), although the company now says it will not rule out partnerships. Any "go it alone" route will mean a smart device that can only operate within a closed system. Any attempts by other Swiss watch brands to develop their smartwatches independently of technology companies will limit functionality, while technology companies continue to expand their ecosystems and devices capabilities. Whilst movements, functions, and technical ability have expanded significantly over the past few years, we do not believe the industrial backbone of Swiss watchmakers has changed fundamentally. As such, we believe that culturally these traditional watchmakers may struggle to embrace wearables and wearable technology.

Risks to Casio, Citizen, and Seiko

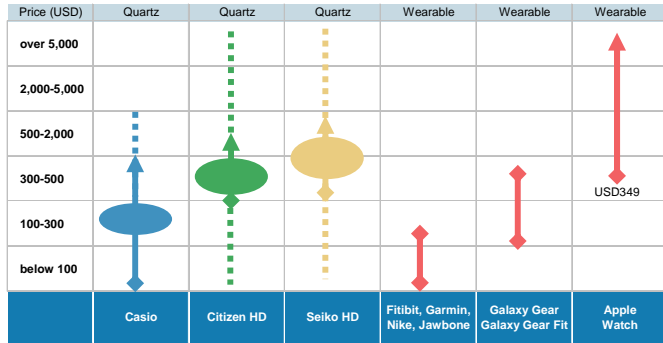
All three companies – Casio, Citizen, and Seiko – will likely be impacted, as they have high market share in the entry to mid-range price points (\$200-1,000), where the wearable disruption should be the greatest. In North America, we estimate the average price for G-SHOCK, Casio's mainstay product, to be about \$200-300. While the global average retail price is \$100, pricing is higher in North America as points-of-sale have expanded from discount stores to department stores. Citizen is the market leader in the North American \$300-500 market, and Bulova, a brand owned by Citizen, holds the number two position in this market. While Seiko is trying to distinguish itself in Japan with luxury watches (\$2,000 and above) using the Grand Seiko brand, in North America, it has fallen behind in rebuilding its brand. We estimate it has 80% share in the \$300-700 price range.

Japanese brands have significant profit dollar exposure to the entry to mid-range segment. We estimate Casio will generate 57% of its operating profit from entry to mid-range price points (\$200-1,000) in FY16. The impact will be similar for Citizen and Seiko, with 53% and 62% of operating profits coming from this segment.

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Exhibit 76

Price Range of Japanese Watches



Source: Company Data, Morgan Stanley Research

Japanese brands’ focus on younger male consumers and sporty designs compounds the problem. Japanese watches have a “sporty heritage” and use leading-edge technologies, such as touch screens, to appeal to younger and/or male consumers. For example, Casio G-SHOCK’s strength is its durability, and the company places a major focus on outdoor usage. It has achieved an image as a watch appropriate for outdoor sports, such mountain climbing and scuba diving. Similarly, Citizen is still building a sports brand image, and has recently announced renewing its contract as an official sponsor of the US Open tennis tournament until 2020. Seiko is working to cultivate a similar image and is using athletes, such as Landon Donovan in soccer and Yu Darvish in baseball, to promote its watches.

However, Traditional Watch Brands Have Unique Qualities

There are some ways, however, for Swiss and Japanese brands to differentiate themselves from smartwatches.

We believe the traditional brands should focus on their strengths and differentiate on functionality and brand. In addition, we believe there are markets that smartwatches cannot currently address, which is an opportunity for traditional watch brands.

Traditional watches are more durable and have longer battery lives. Casio has several brands focused on durability within the G-SHOCK series. The FROGMAN has ISO 200m water resistance, the MUDMAN has a dust and mud proof form factor, and the SKYCOCKPIT can withstand centrifugal force up to 20G. These watches may be marketed for outdoor activities, but they have excellent durability for everyday wear and tear as well. While battery life is one of the biggest drawbacks of wearables, existing watches that are powered by electric batteries can last for about 3-5 years, and

automatic watches (self-winding) and solar watches can function almost indefinitely if they are used regularly.

For the Swiss brands, certain features will be difficult to match. Models such as Swatch Group’s Tissot Sea-Touch, with its underwater capabilities (indications of depth below sea level, dive logbook, etc.), will be difficult to replicate. We also think consumers who are attracted by the jewelry content, individual style, and mechanical movements are unlikely to be a key customer group for smartwatches.

Exhibit 77

Revenue Mix by Watch Type for Japanese Brands

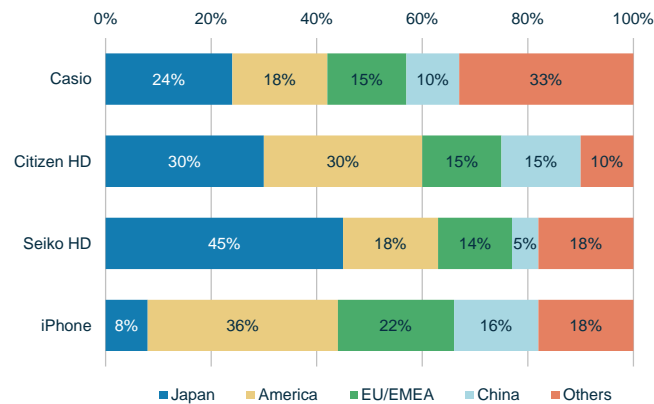
(Value base)	Analog	Digital	Mechanical	Quartz
Casio				
Watch	60%	40%	0%	100%
G-SHOCK	50%	50%	0%	100%
Citizen HD				
Watch	100%	0%	10%	90%
Seiko HD				
Watch	95%	5%	30%	70%

Source: Company Data, Morgan Stanley Research

Branding is very important in the watch market. In fact, we think this is one reason why sales of existing watches have been increasing despite the adoption of wearables. In the case of high-end watches, it is easy to appreciate the effect of brand strength. However, we believe branding is also an important factor with entry to mid-range watches. For example, Casio’s G-SHOCK has very strong branding among the \$100 watch segment. All of the brands have an existing loyal fan base, many of whom will continue to buy their watches. There is no accurate data on this, but generally speaking, about 20% of a brand’s customer base account for 80% of total sales.

Watches can function independently of other mobile devices and platforms. Currently, many smartwatches are not standalone products but instead rely on smartphones to realize their full functionality. While there are over 2B smartphones in use, there are over 5B adults among the total of 7B people in the world. Existing watches can address a much bigger market at a variety of price ranges and in more regions. For example, Casio is actively expanding its watch sales from North America and Japan to Southeast Asia and Africa.

Exhibit 78

Japanese Watch Sales by Region

Source: Company Data, Morgan Stanley Research

So far, wearables have not had an impact on watch sales for Japanese brands... In fact, watch sales continue to grow Y/Y. Near term, we believe one of reasons is that many wearable products have been on the market for less than one year, which means this market is still nascent. Long term, we believe different types of watches can coexist, even in the entry to mid-range brands as well. Therefore, in our base case, we model a slight earnings impact for the Japanese watch brands.

...or on the traditional Swiss watchmakers. So far, smartwatches have disappointed, in our view, in terms of battery life, design, and functionality. However, progress is being made at a fast pace and consumers are beginning to understand the merits of wearable devices (health, payments). With many consumers unlikely to wear both a smartwatch and traditional watch simultaneously, the traditional industry faces its biggest competitive threat, we believe.

What Should Japanese Brands Do?

We think Japanese watchmakers need a two-prong strategy. They will likely try to differentiate their traditional watches in order to co-exist in a world of smartwatches. At the same time, they will likely work on developing their own wearable devices as a counter strategy.

For the past several years, Casio has been developing a wrist device. The company has not provided any details except that it is looking to provide value to customers beyond that of watches. Casio is an electronics company with ample development capabilities in leading-edge technologies and has the ability to catch up. For example, Casio incorporated GPS modules from Sony and purchased components from

other suppliers for its GPS electronic wave G-SHOCK launched in July 2014. However, Casio tends to adopt niche strategies, and we expect it will aim for a wearables positioning that differs from other companies.

Citizen has made no official comments regarding its approach to wearable devices. We have the impression that it is attached to the traditional value of watches, but the company has an electronics division, which is separate from its watch business. We believe that it is proceeding with the development of wearables in-house, including some joint projects with other companies.

Seiko has been developing wristwatches with additional functionality for some time. It has also been working on wearables. We think it may be using its own integration capabilities. In addition, Seiko Epson has already developed its own wearables, and in the future Seiko and Seiko Epson might develop joint products.

Impact on Watch Retailers Unclear

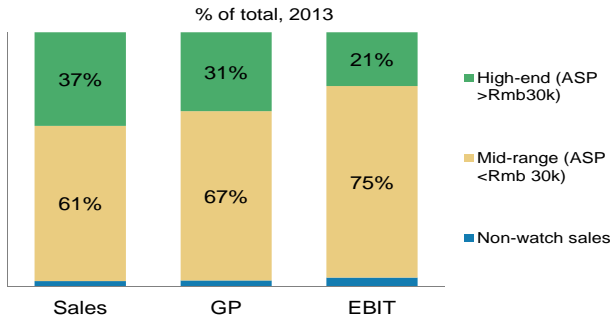
Swiss watch retailers in China/Hong Kong are currently indifferent towards the smartwatch threat, based on our understanding. Retailers such as Hengdeli, Emperor W&J, and Oriental Watch believe Chinese consumers nowadays have multiple watches for different purposes (e.g., business, sports, casualwear, etc.). Smartwatches will simply be an addition to the collection, or perhaps more of a gimmick or fad, rather than a credible substitute to luxury Swiss watches. Reasons cited include that the touch screen of a smartwatch will likely be too small to be of practical use, and that affluent Chinese watch buyers would likely want more individualization for personal taste rather than a one-size-fits-all model. Even if smartwatches gain traction, Chinese Swiss watch retailers' view is that modern electronic watches are not compatible with their traditional luxury Swiss watch store image, and therefore they likely will not carry them.

Hengdeli would likely be the most exposed to entry to mid-range watch price points out of the three retailers mentioned above, hence exposed to the greatest threat. Emperor W&J and Oriental Watch, on the other hand, have more exposure to high-end price points. About 61% of Hengdeli's sales or 75% of its EBIT is derived from entry to mid-range price points, defined as below Rmb30,000 (or US\$5,000). Hengdeli is also one of the largest retailers of Longine and Tissot, some of the most popular mid-range Swiss brands in tier-2 and -3 cities in mainland China. In fact, the Swatch Group is Hengdeli's largest supplier and accounted for 67% of its purchases in 2013.

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Exhibit 79

Mid-Range Accounts for 75% of Hengdeli's EBIT

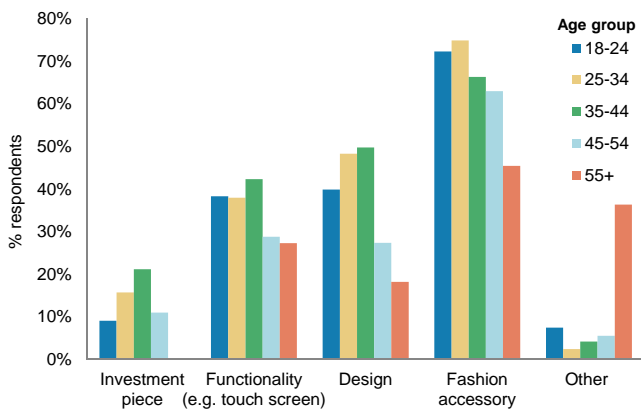


Source: Hengdeli, Morgan Stanley Research estimates

Chinese watch buyers care more about aesthetics than functionality, at least for now. According to our AlphaWise survey, the biggest reason for owning a watch currently is aesthetics (fashion and design), while functionality remains a lower priority. One can argue that is simply because current watches do not offer much functionality. However, if consumers continue to value aesthetics over functionality, Swiss watches could prove to be more resilient to survive the smartwatch threat as Swiss watches and smartwatches present two totally different fashion value propositions to consumers. Swiss watches represent tradition and luxury, while smartwatches stand for modern and tech savvy.

Exhibit 80

Chinese Consumers' Main Reasons to Own a Watch



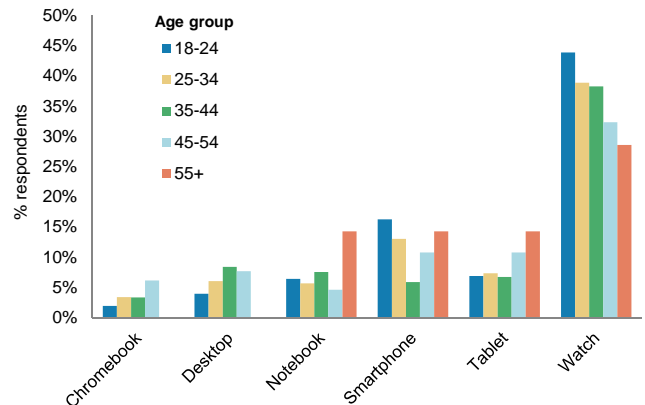
Source: AlphaWise, Morgan Stanley Research

Younger Chinese consumers are most likely to replace a traditional watch purchase with a wearable purchase. Responses as to whether the future purchase of a wearable would replace any of consumers' planned purchase of other

electronics indicate that watches appear to be the most vulnerable. This is especially true for the youngest age group (18-24).

Exhibit 81

Watches Seem to Be the Most at Risk vis-à-vis Wearables Cannibalization in China

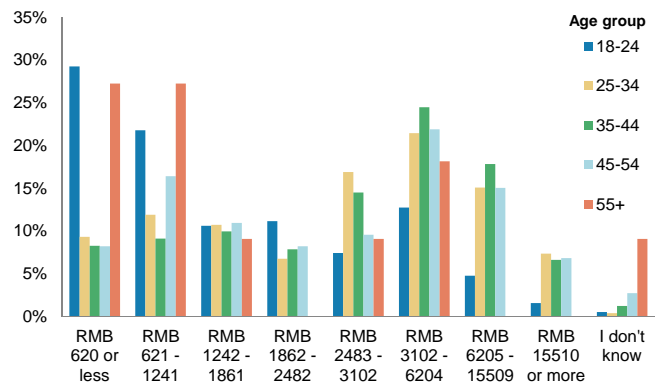


Source: AlphaWise, Morgan Stanley Research

Younger Chinese customers tend to purchase lower-priced watches. Chinese consumers between 35-44 are most willing and able to spend, followed closely by 45-54 and then 24-34, with the mode price range being Rmb3,102-6,204, followed by Rmb6,205-15,509. For younger customers (aged 18-24), the prices paid for watches are generally lower, with more than 50% paying less than Rmb1,241. This means their willingness to pay likely matches more closely the expected price range for smartwatches.

Exhibit 82

Younger Chinese Consumers Generally Pay Less, Likely More Receptive to Smartwatch Price Points



Source: AlphaWise, Morgan Stanley Research

Wearable Devices
Apparel

Apparel

Jay Sole
Louise Singlehurst

Is this overall good for the industry?

Yes. We believe wearables accelerate an ongoing health and wellness trend. Consumers have identified fitness and health as the primary use cases for a potential wearable purchase. As wearable penetration rises and more consumers become more focused on fitness, we expect a lift in demand within the athletic apparel and footwear space.

What do brands plan to do?

We expect brands to focus on partnerships with hardware manufacturers. Major athletic brands like Nike, Adidas, and Under Armour should leverage the rise of wearable technology as another avenue to connect with consumers and generate product innovation rather than attempt to compete against hardware manufacturers with their own products.

- Best-positioned: Nike, Adidas, Under Armour

Wearables Benefit Athletic Brands

The rise of wearable technology creates another avenue for brands to connect with consumers and generate insights. While multiple brands have already produced their own devices, we believe brands ultimately understand they are better-served seeking partnership with hardware companies rather than competing against them. A commitment to applications on multiple established platforms would allow brands to focus on longer-term top-line benefits from consumer connections and insights.

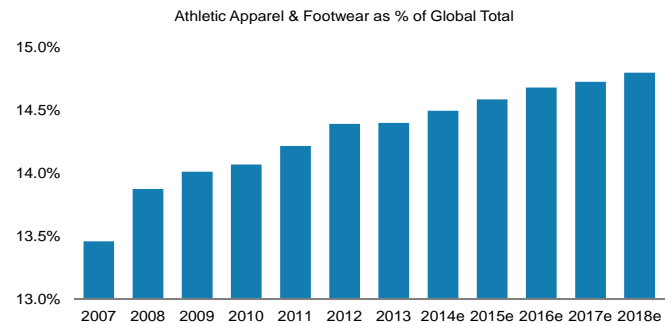
We believe athletic brands are the likely primary beneficiaries initially. In our survey, respondents identified tracking health and fitness as the primary use cases for a potential wearable purchase. While the type of available applications and desired use may evolve over time, we expect this should benefit athletic brands mostly—many of which already have their own hardware and applications. Consumers' choice to be more active should result in more athletic apparel and footwear purchases. All the brands understand their consumers' desire to track their activity and/or improve their health. Wearables add another dimension to this.

Athletic brands already benefit from strong athletic trends, in our view. Athletic apparel and footwear remains

one of the strongest categories in retail for several reasons. While the US leads, we expect this trend to continue globally as well. Over time, athletic apparel and footwear should outpace industry growth.

Exhibit 83

Athletic Is Growing as a Percentage of Total



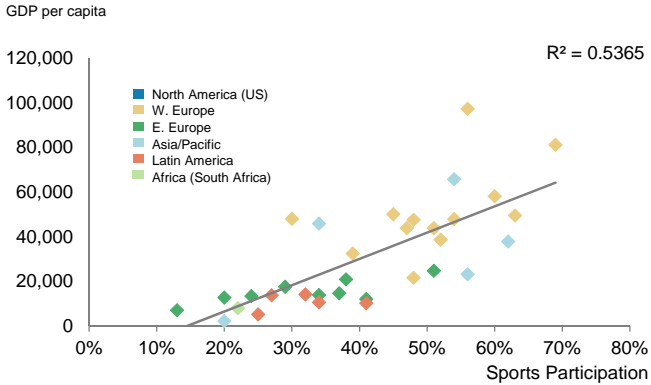
Source: Euromonitor, Morgan Stanley Research

We see several reasons for secular growth in athletic:

- **Consumers are focusing more now on health and wellness than in the past.** For example, the number of participants in running events in the US has grown at a 9% CAGR since 2005 (12% for women). We expect this trend to continue.
- **The increased innovation from rising competition in the space has driven consumer demand.** The athletic brands' ability to continue to support premium pricing in a softer retail environment over the last few years suggests consumers' willingness to absorb price increases for the sake of innovation.
- **Consumers are choosing comfort.** The "athletic leisure" trend does have a fashion element, but we expect the trend towards casualization and comfort to continue. This also favors athletic brands over the jeans category.
- **We expect this to become a global trend.** We think the rise of the middle class in emerging regions like China and Latin America should benefit athletic brands over time. As the GDP per capita rises, the consumer has more discretionary income to spend, and we broadly see sport participation rise.

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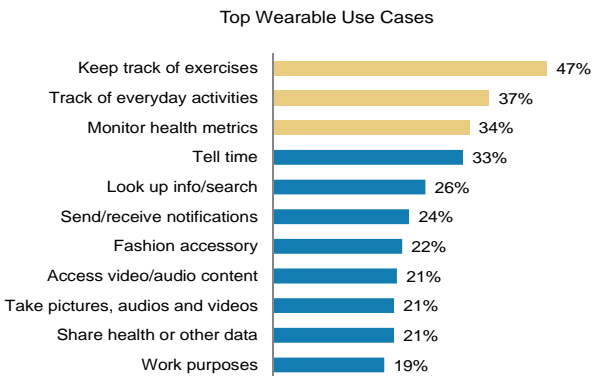
Exhibit 84
Sports Participation Is Loosely Correlated with GDP



Source: University of Alberta, Morgan Stanley Research

The rise of wearables should accelerate the trend towards health and wellness. Survey respondents identified “keep track of exercises,” “track everyday activities,” and “monitor health metrics” as the top three use cases for owning a wearable. We believe this confirms the consumers’ greater interest towards fitness and health.

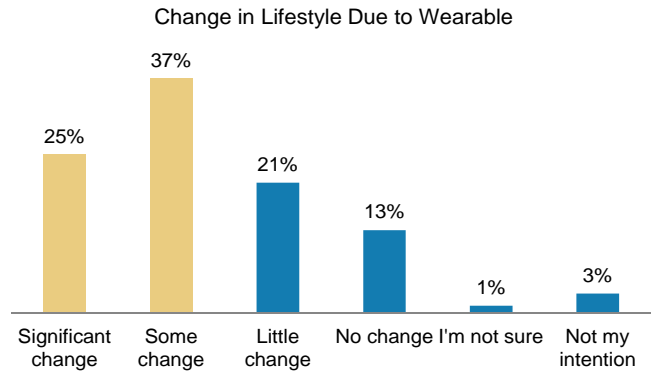
Exhibit 85
Health and Fitness Uses Drive Interest in Wearables



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Wearables change the behavior of the owner. 83% of wearable owners surveyed saw at least a “little change” in their lifestyle due to the wearable, and 62% saw at least “some change.” We believe this speaks to the ability of wearables already on the market to help owners make the desired change in their lifestyles. The launch of the Apple Watch and the continued evolution of the market overall will likely only reinforce the permanent shift in consumers’ behavior towards health and fitness.

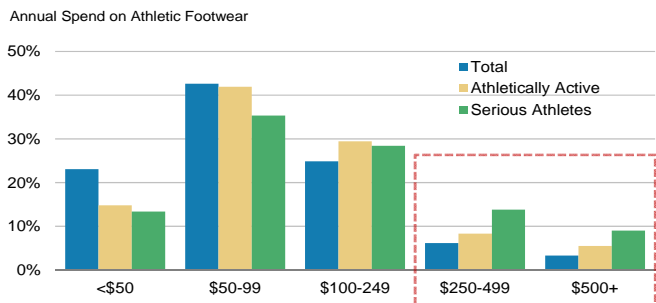
Exhibit 86
Vast Majority of Wearable Owners See Some Lifestyle Change



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Wearables could lead to increased activity and a rise of athletic apparel and footwear purchases, in our view. Our prior 2012 athletic apparel AlphaWise survey questioned respondents in the US about how much they spent on athletic apparel and footwear over the prior year. We found individuals who were athletically active (engaged in a physical activity at least once a week) and serious athletes (competed in a sport at least once a week) were more likely to spend more on athletic gear than the overall population. We believe as consumers shift their lifestyles due to wearables, more athletic apparel and footwear purchases will likely follow. Based on the weighted averages, the athletically active consumer spent 16% more than the average consumer did, and the serious athlete spent 41% more.

Exhibit 87
People Who Are More Active Spend More on Athletic Footwear



Source: AlphaWise, Morgan Stanley Research

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Exhibit 88

Active People Also Spend More on Athletic Apparel

Annual Spend on Athletic Apparel



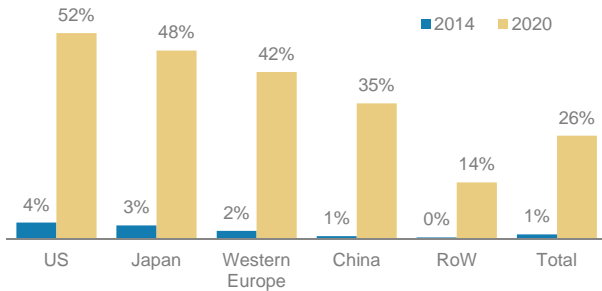
Source: AlphaWise, Morgan Stanley Research

Our wearable projections suggest substantial penetration of the population over the next few years. As wearables continue to ramp and consumers sustainably adjust their lifestyles to be more active, we believe this trend can be a tailwind for the demand of athletic apparel and footwear sales over time. However, we would note that although not all wearable purchases are health and wellness-focused, the overall penetration looks substantial.

Exhibit 89

Wearables Should Be the Norm in a Few Years

Wearables Installed Base as a % of the Internet Population (Base Case)



Source: Euromonitor, Morgan Stanley Research

Nike

Nike offers a suite of apps and devices: Nike offers a variety of wearables and other technologies as part of its Nike+ ecosystem (more than 30M members with a goal to exceed 100M). The Nike Training Club app (which serves as a personal trainer for users) has been downloaded over 17M times. Nike+ shoe inserts in running, basketball, and training shoes link with Nike+ apps allowing customers to track runs and workouts over time. The Nike+ watch and most notably the soon-to-be-discontinued \$100 Nike Fuelband SE were released in late 2013 (1st generation launched in late 2011), with a corresponding phone app which uses an accelerometer

to allow users to track and make a game of daily activity as well as compete with friends.

Exhibit 90

Nike Fuelband SE



Source: Nike

Going forward, Nike looks to partner with various platforms and focus on apps. Given the Nike+ Move app for carrying phones and the Nike+ app for the Fuelband, we would expect a similar app for the Apple Watch. Nike recently launched a pre-loaded running Samsung Gear app in August. Wearables allow Nike to understand their customers better and help them train more effectively in line with their goals. We expect to see consumer insights manifest in new product. Monitoring user activities and interests could foster the design of a new trail running shoe, for example.

Adidas

Adidas launched its Smart Run (\$400) and Fit Smart (\$199) fitness wearable wrist devices this year, which both sync with its miCoach app. The Fit Smart is a “light” version of the fitness band (not a constant activity tracker), while the Smart Run has much more capability, including an MP3 player with Bluetooth connectivity (to a headset). Adidas does not disclose unit numbers of its fitness devices or number of miCoach users. This is in line, in our view, with the company’s focus on providing performance-focused, tailored coaching solutions, over volume growth of users. As such, Adidas’ miCoach offering includes the X_Cell, Speed_Cell (both can be attached to any piece of apparel), and Heart Rate monitor, which provide the user with detailed performance and coaching feedback. Adidas’ wearables sync with its miCoach app (Android and iOS pairing), which tracks distance, speed, workout intensity and offers real-time voice coaching and guided workout movements (both devices have built-in memory). We expect that Adidas should be able to gain greater consumer insight through its miCoach platform (e.g., develop products depending on consumer training patterns or preferences), although it will likely be used less as a means of raising brand awareness, for the moment.

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Exhibit 91

Adidas Smart Run and Fit Smart



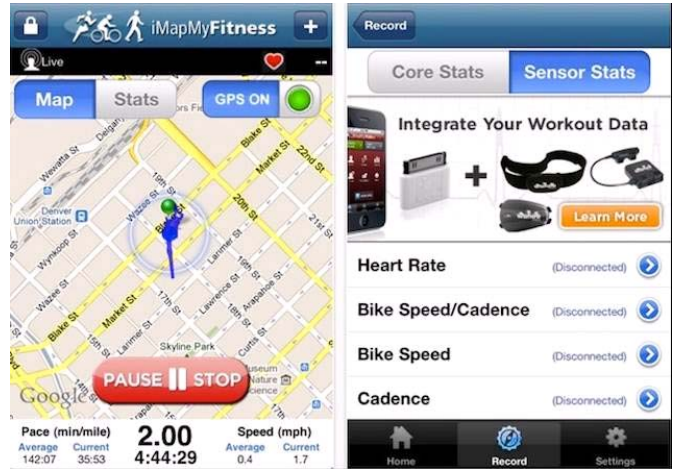
Source: Adidas

Under Armour

Under Armour has also made moves to focus on hardware partnerships: Under Armour offers the Armour39 chest strap coupled with an app to track activity during workouts. The Under Armour app works with numerous heart rate monitoring devices so we would expect some evolution as new products like the Apple watch come to market. The company also recently completed a \$150M purchase of MapMyFitness (30M+ global users), which operates a popular global app. This app helps athletes manage their fitness through mapping running routes, tracking their diet, tracking their activity, and sharing with friends. Similar to Nike, we expect Under Armour to generate insights from the consumer data (according to UA data, the average run, for example, is 3 miles). The brand connection may be weaker than with Nike+, but we would still expect similar longer-term benefits from consumer insights and direct-to-consumer sales.

Exhibit 92

Under Armour’s Map My Fitness



Source: MapMyFitness

Many other brands offer apps. Other brands including Puma, Asics, The North Face (VF Corp.), Saucony (Wolverine World Wide), Mizuno, New Balance, etc. also offer some activity tracker or fitness app. However, we would view the top three major brands as the leading players in the space due to recognition and resources.

Wearable Devices
Payments

Payments

Katy Huberty
Betsy Graseck
Smittipon Srethapramote

How will wearable adoption affect the payments industry?

Wearables should increase card transaction volumes. They can make payments even easier to use than smartphones and tablets through persistent identity: biometric sensors on Apple Watch can confirm identity through continuous contact with the user. This means transactions are more secure than cards, and argues for lower merchant discount rates, much like Apple's Touch ID on the iPhone. These cardholder-present merchant discount rates should be lower than fees for other mobile wallet solutions. Combined with reduced fraud, higher data security, and increased volumes, this meaningfully reduces the friction for card usage. Assuming global adoption, technology like Touch ID, tokenization, Secure Element, and Near-Field Communications (NFC) could reduce fraud costs by \$6.7B over time, allowing for investment in other areas or reduced costs for the consumer.

Which companies are best positioned or most challenged?

We believe the constituents of the existing value chain all stand to benefit, while trusted service managers (TSMs) and alternative payment offerings could be challenged. Higher transaction volumes benefit networks, merchant acquirers, issuers, certain merchants, in addition to Apple. We believe Google Wallet and certain alternatives could adopt Apple's implementation, as past attempts have seen little success. This is again good news for all players in the card industry today. However, TSMs, which are not part of Apple's implementation, and other competing offerings are likely challenged.

- **Best-positioned:** networks (Visa, MasterCard, American Express, Discover), merchant acquirers (Vantiv, TSS, Heartland Payments, Evertex, Global Payments), issuers (Bank of America, JPMorgan, Citigroup, Capital One in the US), payment terminal manufacturers (Verifone, Ingenico)
- **Challenged:** trusted service managers (Gemalto), competing payment options (PayPal),

Apple

Apple Pay is seeing some early success. Since Apple launched the service on October 20 in the US, it has received generally positive reviews for its ease-of-use and security compared to other ways to pay. Whole Foods (covered by Vincent Sinisi), which is one of Apple's partners, said it had processed 150,000 Apple Pay transactions by November 6, which equates to roughly 1% of its sales at the current run

rate, assuming a basket size of \$36 based on past company disclosures. McDonald's said Pay accounts for half of its tap-to-pay transactions and Walgreens said mobile wallet payments doubled since Pay launched, according to the *New York Times*. Apple CEO Tim Cook noted a week after launch that Pay is already the leader in contactless payments and bigger than all the competitors combined. In fact, the service was popular enough at CVS and Rite Aid that those retailers turned off NFC functionality in their payment terminals to prevent customers from using it. They are part of MCX, a group of retailers working to build an alternative to the current credit card value chain.

New technologies in the iPhone 6 and 6 Plus made Apple Pay possible. The fingerprint sensor (Apple's Touch ID) allows users to confirm payments by simply placing their finger on the home button without even waking up their phone first, which is much faster and easier to use than mobile payment apps that take multiple taps to access. The new iPhones include NFC connectivity and Secure Element. The latter enables tokenization, which improves security since it generates a code and does not send credit card numbers for each transaction.

Apple Watch will have an even easier-to-use implementation of Pay. Visa and MasterCard said Apple understands the security risks and would likely use biometric sensors to identify the user, according to Recode. We believe users have to verify their identity by entering a password when they put on the Watch, but for the duration they are wearing it, the Watch can continuously confirm identity using its biometric sensors so users do not have to verify again with a fingerprint or password for each transaction. We think this would be just as secure as Pay on iPhones but even easier to use.

Exhibit 93

Biometric Sensors on the Back of the Apple Watch



Source: Company Data, Morgan Stanley Research

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Card Networks and Merchant Acquirers/Processors

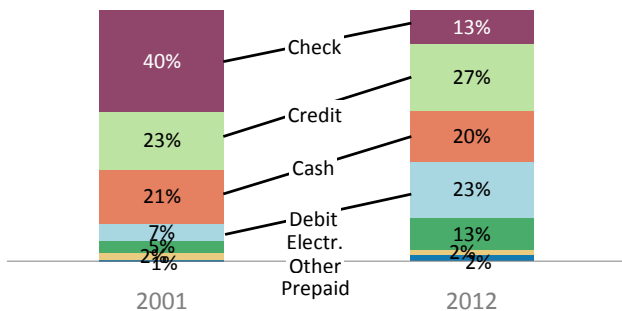
Apple Watch and other wearables are a positive for card networks and merchant acquirers. We believe Apple's easy-to-use and secure implementation of Pay on the iPhone and soon Watch will accelerate the shift from cash and checks to electronic transactions. This benefits networks and acquirers, as more transactions will take place over their rails. In addition, we expect Apple Pay to work with in-app and in-browser transactions in the future.

Wearables in particular could drive the shift away from cash. Cash as a portion of transaction volume has remained very steady in recent years because so far there has not been a superior method of payment, especially for small-ticket items (i.e., transit fare, vending machines). We think that is about to change because wearables allow users to pay quickly for things without taking out their wallet or even smartphone with the same or better security.

Exhibit 94

Apple Watch and Other Wearables Could Finally Drive a Shift in Payment Volume from Cash to Card

Share of Consumer Payment Volume



Source: The Nilson Report, Morgan Stanley Research

Tokenization is an additional revenue stream for Visa and MasterCard. Apple has implemented the Secure Element in new iPhones and iPads, and soon the Watch for tokenization. MasterCard has confirmed that it will charge new issuers fees related to tokenization of card accounts. The new fees will include a \$0.50 digitization fee, which will be collected from issuers for each instance that a mobile device is provisioned with a tokenized payment credential. MasterCard will also charge issuers a \$0.10 monthly fee per digitized/tokenized account per device. Visa has also introduced a fee schedule for its tokenization services but has not made it public yet.

There is a potential risk if wearable brands become the merchant of record for payments. Visa and MasterCard

could lose their ability to collect transaction data. Merchant acquirers could see lower processing fees or value-added services opportunities. If wearable brands choose to adopt the PayPal model and offer wallets, consumers could have the option of using their checking accounts instead of cards, which would be a negative for the whole card value chain. However, we do not believe Apple is interested in doing so in the foreseeable future. It is possible, however for merchant acquirers to be disintermediated from merchants in the long run, if tokenization and biometric verification reduce the need for security solutions.

Issuers/Banks

Issuers are enthusiastic about Apple Pay. Issuers are giving Apple 15 bps of all credit card transaction volumes that goes through Apple Pay, according to multiple reports including the Financial Times. We believe Apple's fee for debit card transactions would be much lower, potentially 1-3 cents per transaction. However, higher electronic transaction volumes and potentially lower fraud due to better security technologies could somewhat offset Apple's cut. Fraud costs issuers 3-10 bps of transaction volume. Long term, similar to networks and merchant acquirers, any shift from cash to card usage is a positive for issuers.

Banks can also improve services with wearables. We note that several large US banks are already testing Apple Watch use cases with consumers. Retail brokers, for example, routinely require clients to sign documents or approve transactions. With the Watch, which clients wear all day and do not put into their purses or pockets, brokers can facilitate quicker transactions and overall improve customer service.

Merchants

We believe Apple's merchant partners for Pay are happy with the launch. As mentioned above, Pay already accounts for roughly 1% of Whole Foods' transactions after only two weeks. A regional US grocer called Meijer continues to accept Apple Pay despite its being part of the MCX coalition that is working to build an alternative to credit cards. Similarly, Target, another MCX member, is going to incorporate Apple Pay buttons in its app though it will not accept Pay in stores. We believe Apple Pay's ease-of-use and superior security could increase traffic and basket size, and improve the branding of merchants. In fact, Stratos, a start-up building a connected credit card that aggregates users' existing cards, conducted a survey in the US and found 17% of smartphone users said they would spend more given the option to use Apple Pay or Google Wallet.

Customer usage and loyalty cards key to merchants' adoption rate. Not all merchants are on board with Apple Pay, especially MCX. Apple announced 220,000 merchant partner locations at launch, which represents less than 5% penetration in the US. In addition, we estimate less than 20M new iPhones have been sold in the US to-date, which represents about 7% penetration of the smartphone user base. As penetration and usage increase, more merchants will adopt Pay as those that do not accept it will be at a disadvantage. Another key consideration is whether Apple will accept private label credit cards (PLCCs) in its system. Large retailers derive 40-50% of their revenue from PLCCs and generate 5-20% of their income through extending credit. We believe Apple is working to develop better solutions for merchants using Pay and iBeacon, including PLCC acceptance, but the company has not commented publicly.

Terminal Manufacturers

Apple Pay and Watch could increase merchant appetite to upgrade to NFC, which should be additive to average selling price for Verifone and Ingenico. It could also drive increased demand for Verifone's Payment-as-a-Service (PaaS) offering, as merchants look to outsource in order to future-proof their investments.

Trusted Service Manager (TSM)

Apple Pay does not use TSMs. Until Apple and Google launched their payment products, the "classic" NFC system used TSMs to deploy and manage NFC applications. This separates the management of payment credentials from mobile operating systems, so a 3rd-party can take responsibility for payment security. Telecoms have favored this model in their offerings. Our conversations with industry participants suggest cost and user experience issues prevented the TSM model from taking off. Today, Visa, MasterCard, American Express, and likely other networks in the future provide tokenization services for Apple Pay, which represents a major challenge to independent TSMs such as Gemalto, Oberthur, and Giesecke & Devrient. There may be an opportunity for TSMs to work with Google and others that use host card emulation (HCE), a system that provisions tokens in the cloud or using a virtual Secure Element. However, we believe certain Android smartphones could also implement the physical Secure Element, similar to Apple.

Alternative Payment Methods

There is still a window of opportunity for competitors. Apple Pay is only available on Apple devices and the Watch

has not launched yet. While each Apple user tends to spend more through their devices, iOS only has 40% browsing share (a proxy for usage) and lower shipment share. It will take time for Apple Pay to ramp internationally, though the company plans to expand as fast as it can. While we believe Apple will eventually provide a solution using either Apple Pay and/or iBeacon to enable loyalty cards for merchants, which is something merchants really want, Apple has not said anything about the matter publicly.

Google and Facebook are the most interesting players to watch. Both are very interested in payments because they could monetize transaction or purchase intention data, which Apple is not collecting. However, Google Wallet, which uses the cloud-based implementation for NFC called HCE has not gained much traction so far. Facebook recently hired former PayPal President David Marcus to head its messaging products. It is not completely clear what Facebook's offering will be, if any, but they may take inspiration from Tencent's Wechat and other messaging products. From a payment perspective, while Google and Facebook are interested in the transaction data, neither has shown signs that they will attempt to replace the existing card infrastructure in the foreseeable future.

We believe PayPal will have to invest and lower margins in order to compete with default payment options. PayPal is a formidable competitor with over 150M accounts, but we think it has to increase investments as a stand-alone company to improve its products, launch new ones, and invest in marketing and branding in order to compete. It will not be the default option on wearables and other devices made by Apple. PayPal could try to partner with other brands in order to increase usage on their devices, as it has done with Samsung recently. PayPal could also charge a lower take rate than Apple Pay, where issuers charge cardholder present rates. However, price competition will also lower PayPal's margins unless it can convince more users to use checking accounts, which is hard since many users enjoy rewards on their credit cards.

Most other alternatives do not have a clear value proposition. Carriers in the US and Europe have tried to build their own mobile payment products. Many large retailers in the US have joined forces to form MCX in order to bypass credit cards and use only debit. There are many start-ups constantly trying to disrupt the payment industry. However, these alternatives are neither easier to use nor more secure than Apple Pay.

Wearable Devices
China Retail

China Retail

Robert Lin
Edward Lui
Angela Moh

How can China's offline retailers become more competitive with the advancement of wearable technology?

The future of retail is about location, service, and technology. The old adage that retail is about location, location, location is diminishing in value rapidly. Leading big-box department store/shopping mall operator Intime is collaborating with Alibaba and Baidu to equip its stores with technology solutions to improve customer experience and data analytics capability – necessary steps to stay competitive in the next stage of evolution in China retail: mobile commerce – online to offline (O2O) or omni-channel.

Leading specialty jewelry retailer Chow Tai Fook is putting RFID chips in its products to capture the pre-purchase decision-making process of its customers. Even China sportswear companies may start launching wearables soon, with local product Aiyiqi launching its GPS-based Budiu shoes that allow parents to track the location of their children.

Should retailers share or not share customer data?

The data isolation approach of traditional retailers is no longer competitive in an increasingly connected world. The future of big data analytics is moving to "data as a product" in which online and offline partnerships are formed to improve both data sets. We think Intime's embrace of data sharing among multiple parties to better understand its existing and new customers will make Intime more competitive as long as the economic interests of the data-sharing parties are aligned.

Which companies are best positioned or most challenged?

We believe Intime is best positioned to benefit from the potential wearable boom given its proactive O2O strategies and close cooperation with leading eCommerce and Internet giants with data insights

Chow Tai Fook also stands to gain a competitive advantage over its peers given its leadership in integrating smart technology into its offline retailing, which is crucial to gauge fast-changing customer demand and tastes.

Traditional retailers that are slow in adapting to a data-driven retailing model would be challenged. Luk Fook, with 93% of its stores in mainland China franchised to third parties, may be more challenged in rolling out a unified O2O or digital strategy.

- Best-positioned: Intime and Chow Tai Fook
- Challenged: Luk Fook

Retail's New Rule: Location, Service, and Technology

Intime is one of our top picks in the China Retail sector. In our view, it is the front-runner to leverage technology and data to improve its customer experience. It is one of the leading offline department store / shopping mall operators in China with 2.16M m² GFA as of 1H14, of which 48% are shopping malls and 52% are department stores. Intime is teaming up with several large internet companies in China (i.e., Alibaba and Baidu) to upgrade its service, technology, and data analytics capability – providing its stores and staff with capabilities "similar" to eCommerce companies.

To be sure, one of the key advantages that eCommerce companies have over physical retailers is their ability to see the database browsing history, page view, and product / brand preferences of its users to enable better recommendations. Physical retailers are limited to "personal" recommendations by front-end staff and the "touch and feel" factor that is diminishing in importance given transparent product information and feedback online. Retailers are unable to gain greater consumption insights beyond purchasing history. Below are two use cases of Intime's wearable initiatives to enhance its stores' competitiveness.

The Push Strategy: Taobao Taodiandian Cooperation

Intime established a joint venture with Alibaba to explore opportunities in O2O commerce (online to offline or omni-channel retail) with emphasis in mobile commerce. Alibaba currently owns directly (equity 8.11%) and indirectly (convertible bond 18%) about 26.11% of Intime.

According to Intime, one of its Hangzhou shopping malls is cooperating with Taobao's Taodiandian (淘点点) to pilot test an iBeacon-like technology. This mall has installed >400 iBeacon-like low frequency Bluetooth devices called "Deng Ta" (登塔) that constantly broadcast and detect radio signals of Bluetooth-enabled devices (i.e. smartphones, tablets, wearables, etc.) without being WiFi-connected.

Deng Ta is a proprietary technology developed by Taodiandian – a subsidiary of Alibaba that focuses on location-based services (LBS). The cost of the sensor hardware is low at around RMB60 each. Currently, the deployment is available only for shopping malls, and not department stores and individual retailers.

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As illustrated below, when a consumer walks into the Intime shopping mall, his or her mobile would be pushed a notification that offers coupons or sales events. Once the customer taps on the notice, an indoor map showing the location of the promotional (powered by Alibaba’s AutoNavi) would be displayed on the smartphone. So far, the economics of advertisements and commissions among the related parties are not available given the initiative’s early stage trial.

Exhibit 95

Intime’s Shopping Malls Have iBeacon-Like “Deng Ta” Hardware to Push Targeted Notifications to Consumers



Source: Company Data, Morgan Stanley Research

We believe wider and accelerated deployment of such technology is conceivable given an inexpensive hardware solution coupled with potentially better alignment of economic interests over data ownership and sharing in the long term. While this technology is unlikely exclusive, Intime’s first mover advantage on consumer insights and enhanced experience is key.

The Pull Strategy: Baidu Eye Cooperation

Intime became Baidu’s first retail partner to leverage its **Baidu Eye technology** (i.e., Baidu’s Google Glass-like eyewear device) that features facial and gesture recognition, image search, precision positioning, and deep-learning capabilities.

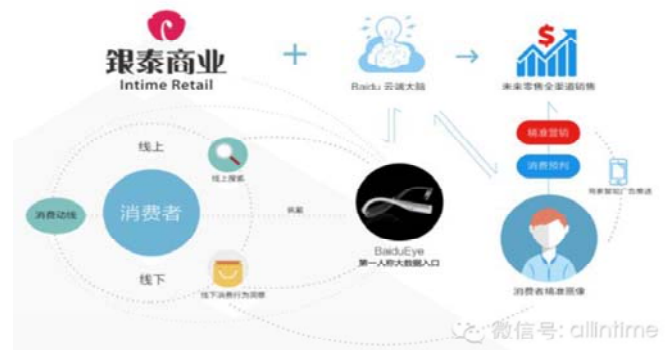
What challenge does it address? Baidu Eye has the potential to provide physical retailers technology similar to what eCommerce companies have online. Select features of Baidu Eye that are important to retailers include *facial recognition* to identify and track consumers’ positioning (or eyeball-tracking feature online), *image recognition* to understand the types of brands / products consumers have touched (or similar to clicked online), and *deep learning* to aggregate consumption behavior for targeted recommendations to the same customer during the next visit.

How could it increase efficiency? Improved technology could help better serve the customers and reduce employee headcount in the stores. We think consumers’ adoption of Baidu Eye will be slow, but equipping front-end sales staff with Baidu Eye and incorporating Baidu Artificial Intelligence + Search technology in Intime’s store will not be. In fact, Intime seeks to deploy the Baidu Eye technology in selected stores as early as 2015. Ultimately, front-end sales staffs will be fed customer preference information through Baidu Eye to better serve the customers as they approach and shop in the store counters.

Functions such as inventory check, identification of customers as repeat vs. new, and “real-time” promotion offers by front-end staff are all possibilities. Given a centralized database of consumer intelligence (rather than at staff level), the stores could serve the customers better with potentially less staff in the future – a value proposition desired by the tenants inside Intime’s department stores and shopping malls, we believe.

Exhibit 96

Baidu Eye’s Facial/Image Recognition and Search Capabilities Capture More Customer Behavior Data for Analysis



Source: Company Data, Morgan Stanley Research

China Department Stores: Better Technology Adoption = Transitioning into Higher-Margin Consignment Model

Better technology adoption could help China department stores transition into a higher-margin consignment model that provides operators the ability to better control products and pricing – away from the landlord concession model. The Street believes the solution for China department stores is the direct sales model like the US operators – to incubate one's own merchandise team and control the products. We disagree. The insufficient scale of these chains and the abundance of lower-priced alternatives online make the direct sales model a high-risk proposition in China.

We believe Baidu Eye and Deng Ta could drive the move to the consignment model (in which staff costs are borne by the department stores while brands bear all the inventory risks) and away from the concession model (in which both staff and inventory risks are borne by tenants). The department stores should focus on knowing and serving the local customers better and work with brands to display / price what would sell in the cities / regions. Brands should focus on branding and product design as the current concession model in China does not allow brands to train and manage the front-end staff effectively with daily staff management done by the department store operators.

Exhibit 97

Compared with matured department stores operator, Intime's margin still has large room for improvement.

	Matahari		Intime	
	Consignment Indonesia		Concession China	
	FY2013	US\$	US\$	FY2013
Gross Sales (mn)		1,019	2,526	Gross Sales (mn)
Sales Per sqm (000)		1,325	2,711	Sales Per sqm (000)
Gross Margin		34.3%	16.8%	Gross Margin
Consignment		41.8%	17.2%	Concession
Direct Sales		30.7%	14.1%	Direct Sales
OP Margin		14.0%	6.5%	OP Margin
Net Margin		9.0%	5.5%	Net Margin

Source: Company Data, Morgan Stanley Research

Intime Embraces the “Open to Share” Philosophy

The key debate in the future of retail is whether to share consumer data (within limits of consumer privacy law). Intime's partnership with Alibaba and Baidu hinges on data sharing – a practice that most traditional retailers believe to be suicidal, believing purchasing history of its customers is proprietary and highly valuable. To date, most Chinese retailers have yet to collect these insights in any meaningful way.

We agree that past insights are valuable, but a “larger and improved” data set that offers predictive power and recommendations of existing and, more importantly, new potential customers is more valuable. Put another way, online eCommerce and internet companies are already collecting data about consumption behaviors from multiple sources online and offline. They are equipped with better intelligence, technology and likely recommendation capability than most offline retailers.

Therefore, the data isolation approach of retailers is no longer competitive in an increasingly connected world. The future of big data analytics is moving to “data as a product,” in which online and offline partnerships are formed to share and improve each others' data set (within limits of consumer privacy law). We think Intime's approach to embrace data sharing among multiple parties to understand its existing and new customers is more competitive as long as economic interests are aligned among partners.

Wearable Trends for Performance Footwear in China

Wearable technology is moving into the performance footwear category in China. While Nike long ago launched the Nike+ sensor in its running shoes to work with Apple's iPod to track running, a Chinese company called Angela and Lucas (Aiyiqi in Chinese) has launched a GPS-based smart shoe called “Budiu” that can track the location of children and alert their parents when they are out of pre-determined “safe range”. Budiu charges a 2-year GPS service fee (about Rmb730 in total) in addition to offering four pairs of Budiu shoes and one GPS chip for free.

We have checked with domestic sportswear brands Anta and 361 Degrees, as both have their own children's collection for footwear and apparel. Both brands are keeping an eye on this technology, and would not rule out the possibility of introducing something similar in the future. In fact, 361 Degrees has already started a strategic cooperation with Baidu Times, a subsidiary of NASDAQ-listed Baidu (covered by Philip Wan) to develop something similar – “Smart Shoes” equipped with GPS and pedometer functions. While this has not yet gone mainstream, it could prove to be the next footwear trend for performance footwear in China.

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Exhibit 98

Budiu Shoes, by Chinese Company Angela and Lucas, Use GPS to Locate Children for Parents



Source: TechNode.com

Chow Tai Fook: “Smart Tray” and RFID Sensor for Big Data Analysis

One of the advantages of wearables and online retailers is that they capture customers browsing history in order for retailers to analyze their shopping behavior and preferences prior to the actual purchases. On the other hand, brick-and-mortar retailers usually have access only to the customers’ actual purchasing history. Not anymore, according to Chow Tai Fook (CTF), the largest listed jewelry retailer in Hong Kong/China.

CTF has developed a new technology to track the pre-purchasing decision of a customer, using a “Smart Tray” and radio frequency identification (RFID) chips linked to every jewelry SKU, like a bar code. Every jewelry SKU requested for viewing by a customer would be taken out of its display shelf and placed on the Smart Tray, which then automatically captures the product information via high frequency radio signal. Over time, CTF would have access to which SKUs have been viewed the most/least, which SKUs have been purchased the most/least, in order to analyze placement issues, or pricing issues, as an example. It would also allow retailers to better understand every store’s customer demographics and preferences, in order to better allocate inventory between stores, which is especially important for capital-intensive businesses like jewelry retailers, in order to maximize working capital efficiency.

This new technology is currently being piloted in a handful of stores in Hong Kong, and once the technology and data analysis matures, will be rolled out to CTF’s more than 2,000 points of sale in Hong Kong and mainland China.

Exhibit 99

Smart Tray Developed In-House by Chow Tai Fook



Source: Chow Tai Fook

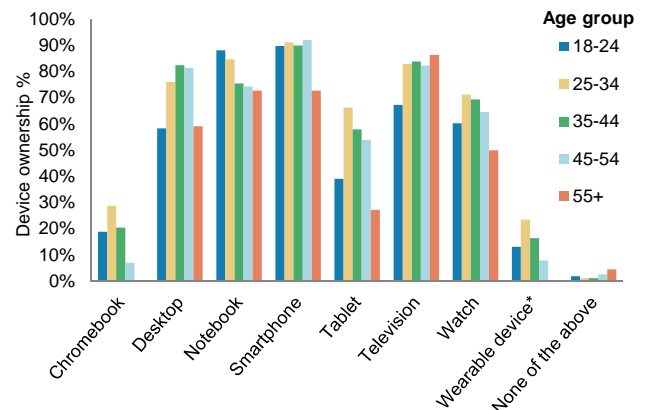
Chinese Consumers More Tech Savvy Than Others

According to our AlphaWise survey, the most tech-savvy consumer age group in China is 25-34, followed by 35-44 and 18-24. This observation is consistent across the world, where the 25-34 age group tends to have the highest adoption rate of electronic gadgets. The ownership of smartphones is 90-91% for 25-44 year olds in China, vs. 78-85% in the US and 84-92% in the UK.

However, the bigger difference is seen in the older age group (e.g. age 45-54), where smartphone adoption remains high at 92% in China, vs. 65% in the US and UK. In terms of “wearables”, China also has the highest adoption rate of 24% for its 25-34, more than 22% in the US and 15% in the UK. In general, the ownership of electronics starts to tail off for the 45-54 group and more significantly for the 55+ age group, except for “TV” and “Notebook”.

Exhibit 100

Electronic Device Ownership in China, by Age Group



Source: AlphaWise Survey August 2014, Morgan Stanley Research

Wearable Devices
Healthcare

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Wearable Devices

Healthcare

Ricky Goldwasser
David Lewis
Andrew Schenker
Ben Uglow

Are wearables the key to unlocking Big Data in healthcare?

Healthcare in the United States continues to be at the forefront of medical innovation but the system is beset with waste, which weighs on costs and patient care. In aggregate, the Centers for Medicare and Medicaid Services (CMS) estimate that the US healthcare system wastes over \$765B in spend annually. Unnecessary services are the greatest source of wasted spend, followed by excess administrative costs, inefficiently delivered services, price, fraud, and missed prevention.

Wearables could be the key to disrupting the current healthcare market. A prerequisite for eliminating waste, improving patient care, and rationing of reimbursement models will be to integrate reliable patient data that can be linked in real time across the continuum of care and support providers' decision-making. Today, insufficient infrastructure is holding back this system's evolution. Looking ahead, wearable devices that can measure daily routines and collect vital data, sensors in emergency rooms, and data analytic tools that will integrate all this are going to become critical components in the evolution of the US healthcare system.

- **Best-positioned:** Dexcom, Insulet, Abbott, Medtronic, Philips, UnitedHealth Group, CVS Health

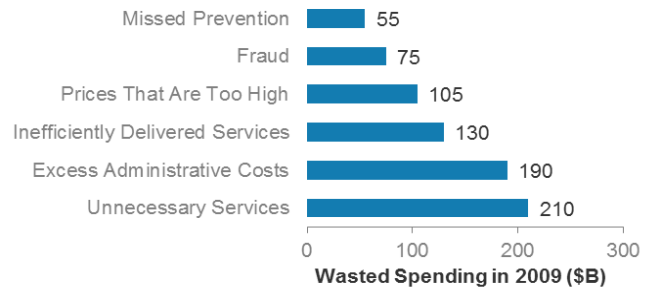
Wearables as the Data Hub

Wearable technology will likely facilitate data sharing among various healthcare players. As payment models in the healthcare environment continue to shift towards value-based reimbursement models, connectivity and the underlying technology infrastructure will become increasingly important. We estimate ~7-8% of provider revenues today are based on risk-sharing reimbursement, a figure that could reach as high as 30% by 2020. Over time, as a larger portion of the patient population gets treated in a value-based care setting, such as Accountable Care Organizations (ACOs), big data analytics and patient engagement become increasingly important.

Exhibit 101

Healthcare Market Is Ripe for Disruption

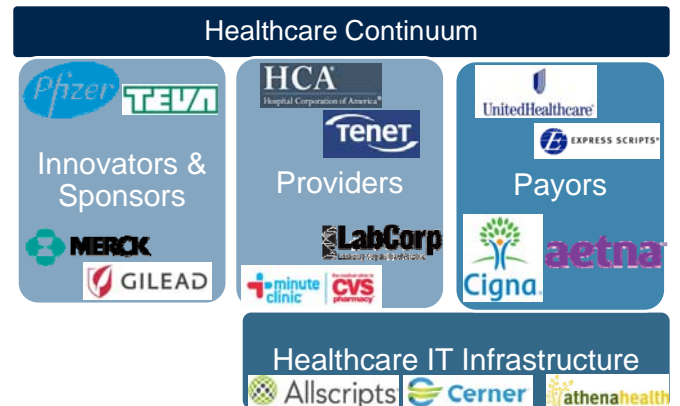
\$765B or ~1/3 of All HC Spend Is Wasted



Source: CMS, Morgan Stanley Research

Exhibit 102

Where We Stand Today

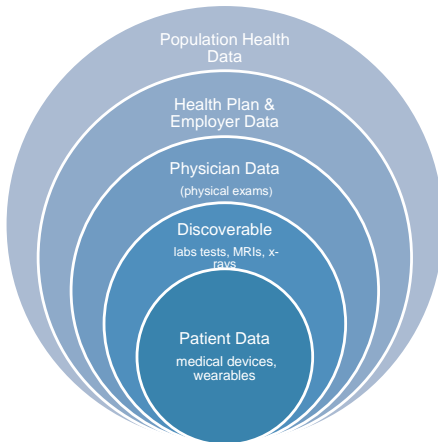


Source: Company Data, Morgan Stanley Research

The introduction of a patient-centric “data hub”, such as a wearable device, could be a key catalyst to breaking through the data silos inherent in the US healthcare system today. Importantly, the elimination of data segregation is essential to achieving big data analytics required for population health management.

Exhibit 103

Patients Positioned at Epicenter of the Healthcare Continuum Along with Wearables



Source: Morgan Stanley Research

In theory, a healthcare consumer engaged in health analytics using a wearable (heart rate monitoring, medication adherence, temperature, etc.) can exchange data feeds with medical devices, health insurers and employers, PBMs, pharmacists, and pharmaceutical innovators running a clinical trial, thus creating a real-time electronic health record.

Which subsectors are most ripe for disruption? Medical devices, Managed Care, Pharmacies and healthcare IT providers are all exposed to disruption and benefits from wearables, in our view.

Opportunities: We see three distinct areas in the healthcare market that are likely to benefit from increased penetration of wearable devices.

- Medical device integration and innovation
- Employer-sponsored health programs
- Pharmaceutical compliance

Notably, across all three sections, chronic disease management is highlighted as a low-hanging fruit opportunity for disruption, underscoring the inefficiencies in healthcare and the potential for cutting costs from the system.

Obstacles to achievement: While wearables represent a key opportunity for technology innovation and disruption in the healthcare market, the following fundamental issues must be addressed for the opportunity to materialize:

- **Patient privacy regulations** (i.e., HIPAA in the US) limit medical data sharing between various constituents in the healthcare market. Data sharing of an individual's health

records is on a need-to-know basis and includes a minimum amount of detail unless preapproved by the patient. Given these restrictions, data sharing among various devices and players will require high levels of security/encryption and explicit approval from patients to achieve mass adoption.

- **Geographic data fragmentation** remains a key obstacle for the success of wearables. Traditionally, US health systems have operated independently within geographic silos, with limited data sharing outside a regional provider network. Without a standardized national data network, it will be challenging for wearables to overcome geographic barriers and gain significant traction.
- **Data accuracy** remains an unknown in wearable devices given the relative infancy of the space. Similar to FDA regulations around drug efficacy and accuracy, medical devices that connect with wearable devices will likely be required to achieve predetermined metrics. This presents a near-term obstacle that could add cost or lengthen the time to achieve substantial data sharing between medical devices and wearables.
- **Connectivity between different IT platforms** has historically been an industry pressure point. Spurred by Meaningful Use incentive payments, interoperability has made advances over the last few years, but connectivity to various players in the industry requires further updates, advancements, and standardization.

Medical Devices

We see a larger future opportunity for wearable technology in the medical devices industry. That said, development is still at an early stage. The initial target markets for such devices will likely be found in a variety of diagnostic and monitoring applications. While the path to truly wearable therapeutic (as opposed to diagnostic) devices is less clear, information gathered from diagnostic devices could play a significant role in optimizing the administration of existing therapies.

Key opportunities could lie in widespread, chronic diseases such as diabetes, hypertension, cardiac arrhythmias, and heart failure, particularly as consumer health and preventative medicine become a more important way to reduce costs.

At the moment, it is difficult to gain exposure to wearable medical devices in public equities, as most innovation in this space is either concentrated in small private companies or constitutes an immaterial contribution to the portfolio of larger, more established players. The best opportunities to

invest in wearables likely lie in diabetes with Dexcom and Insulet; larger players with some programs in wearable devices also include Abbott and Medtronic.

Up until now, most doctors have had a limited ability to collect and monitor information on patient health status once the patient leaves the hospital. While some technologies have offered the requisite technical capabilities, adoption has been limited by the often burdensome practical requirements for using such devices, which tend to be reserved only for cases where accurate monitoring is critical to diagnosis or safety.

For example, a Holter monitor, a device used to record the heart's electrical activity and detect heart arrhythmias, requires the patient to attach a number of electrodes and accompanying wires to his or her chest, making it an impractical solution for monitoring periods longer than 24-48 hours. Similarly, today's ambulatory blood pressure monitors can provide continuous blood pressure information throughout a patient's daily activities, but require the patient to wear a bulky pressure cuff.

To ease these constraints, some companies have developed smaller devices that can be implanted in a patient and are therefore unnoticeable externally. These include Medtronic's Reveal LINQ cardiac monitor and St. Jude's CardioMEMS blood pressure sensor. However, these devices require a surgical procedure (albeit usually a simple one) to implant, making them inappropriate or cost-prohibitive for many patients.

We expect wearable medical devices to become much more prominent in the coming years following an acceleration of product development. While few (if any) products are yet in wide commercial use, a number of devices are in the early stages of launch and may offer some insight into future medical applications. Though existing consumer health and fitness devices could offer some useful templates for medical device features, gaining additional accuracy and reliability is critical to developing the robust data needed to inform health care decisions by doctors and patients.

In the near term, we see the best prospects for wearable devices in clinical uses that already have established at-home diagnostic and monitoring protocols. In these capacities, wearable devices would represent natural, incremental improvements over conventional technology and could offer greater ease of use or reach a broader patient population.

Cardiac monitoring and diagnosis: Up to 15 million Americans have some type of cardiac arrhythmia, such as tachycardia, atrial fibrillation, or bradycardia. According to Centers for Disease Control and Prevention (CDC) estimates, over 500,000 Americans each year experience sudden cardiac death caused by cardiac rhythm disorders. In up to 50% of cases, these disorders have not been diagnosed.

The difficulty of diagnosis typically stems from the unpredictable and intermittent nature of such disorders. Most of the time, the heart will function normally, but periodic disruptions in cardiac rhythm can occur suddenly and have potentially deadly consequences. To detect arrhythmias, patients are typically sent home with a monitoring device for at least several days. As mentioned above, conventional devices include Holter monitors and implantable sensors and suffer from limitations in patient compliance due to inconvenience (Holter) and a required surgical placement (implantables).

In September 2014, however, Medtronic brought wearable technology to cardiac monitoring with the launch of its Seeq cardiac monitor. Seeq is a wire-free, adhesive heart monitor that is worn on the skin. It automatically captures cardiac data and transmits it to the appropriate physicians for review. It can provide data for up to 30 days, increasing the chance of capturing a cardiac rhythm event compared to Holter monitors that are typically tolerated only for several days. A number of private companies have developed similar tools, such as Preventice (the BodyGuardian) and Nuubo.

Diabetes: Conventional medical devices are closest to wearables in the diabetes space. Over time, we see diabetes as a key target market for wearable innovation given the large market size (30M Americans live with diabetes), chronic but treatable nature, and increasing patient emphasis on quality of life.

Accurate blood glucose monitoring is critical to managing diabetes and drives daily treatment decisions, including both insulin administration and dietary adjustments. Many patients use a glucose test strip that requires them to deposit a drop of blood on the testing device via a small needle several times daily. In contrast, continuous glucose monitoring (CGM) devices offer patients real-time information on blood glucose levels through a device that consists of an adhesive patch bearing a small sensor inserted below the skin. The devices that are available today are essentially wearable devices despite the need for a small needle insertion, though the challenge of measuring blood glucose without access to blood makes it difficult to develop a completely non-invasive monitoring device. Some large, diversified players such as

Abbott and Medtronic have CGM offerings, but the leading CGM pure play is Dexcom.

Wearable technology is making a growing impact on the therapeutic side of the diabetes market as well. Insulet (PODD) produces the OmniPod, a wearable device that contains a reservoir of insulin sufficient to last three days. The device replaces syringe or pen needle administration of insulin and can be pre-programmed to a specific drug delivery regimen. Similar to CGM, the OmniPod is not truly wearable, as insulin delivery happens through the insertion of a small cannula into the patient, but the level of invasiveness is very low. Insulet is exploring ways to adapt its technology for the administration of drugs other than insulin.

In the longer term, wearable devices could push into new patient management opportunities that are not adequately addressed by any current device offering. We see potential uses in broader lifestyle monitoring that can be used to optimize treatment for a variety of chronic diseases. In addition, achieving better compliance with pharmaceutical prescriptions is a tough problem that wearables (or in this case, ingestibles) may be able to help with.

Lifestyle monitoring and chronic disease management:

Tens of millions of patients in the US (and hundreds of millions globally) are living with obesity, heart disease, and other chronic diseases. While recreational activity and fitness monitors have gained popularity over the past several years, these devices may not yet be robust enough for useful medical monitoring. For medical purposes, devices that offer reliable measurements of simple but critical health indicators such as physical activity, blood pressure, or weight and are able to share that data with monitoring physicians or nurses could prove useful in managing chronic diseases.

Pharmaceutical compliance: Patient compliance with pharmaceutical prescriptions is a major limitation to the effectiveness of pharma therapies. This is particularly true in older patients, who may be juggling multiple prescriptions and are more likely to forget to take their pills. Proteus Digital Health (private) has an innovative solution to monitor both compliance and response to medication. The company combines pills with tiny ingestible sensors. A wearable monitor detects the activation of the sensors when the pills are ingested, creating a detailed record of drug administration patterns. In addition, the wearable sensor can record basic physiological data such as heart rate and activity/rest, generating some record of drug response. Remote monitoring capabilities enable patients, doctors, and other family members to make certain that drugs are being taken as prescribed.

Homecare Monitoring

We see key opportunities in the homecare monitoring space. Philips is currently the market leader in North American home healthcare monitoring with about 1 million patients. The company already offers wearable products like the Actiwatch, which is used in sleep monitoring. As wearable technologies develop, we think there is an expanding consumer base using wearables that are not designed for a single purpose, which creates an opportunity for Philips. The company could launch applications on other wearable platforms that could collect and monitor a range of vital data points, offering a more comprehensive remote monitoring – indeed, care providers could follow patient vitals more precisely, and use prevention or even intervene more quickly in case of unusual/alarming data.

Exhibit 104

Philips Already Offers the Actiwatch, a Wearable for Sleep Monitoring



Source: Company Data, Morgan Stanley Research

Philips is already expanding into the health software

space. Philips is already involved in the healthcare smartphone app space. For example, it offers the “Brush Busters” app for iPhone, aimed at children to encourage them to brush their teeth, and can record the activity when using a compatible brush. Launching apps like this for smartwatches should allow Philips to aggregate data from an even wider range of sources—including heart rate, exercise, sleep, distance walked/run, blood pressure, diet, etc.—using a single third-party device, as it seems unlikely that consumers would be willing to have different devices for different activities. This could give healthcare specialists access to a much wider breadth of patient data. Integrating this data into the existing healthcare systems is an area where Philips could have a strong competitive position, as it already operates in hospital IT and user data.

There are clear benefits from extended use of wearables.

Philips estimates that its current remote patient-monitoring offering can reduce hospital visits by 38%, and save \$27,000 per patient per year. This includes the benefits of telehealth

where patients can speak to healthcare workers from home, but a complete wearable solution would improve the quantity and quality of data collected and could further improve the benefits of remote healthcare.

However, there is a competitive risk for Philips. In our view, the most meaningful risk from the growth in wearables is if people choose not to use Philips products and instead just purchase smartwatches or fitness trackers. This would hurt Philips' hardware sales. We believe the telehealth and home treatment businesses are unlikely to be affected, but aspects of the monitoring certainly could be. More importantly, Philips could find itself under much more pressure, should other companies enter the software space. Philips already has a presence in app stores and on smartphones, which should help mitigate the threat. However, wearables is a whole new user experience, so existing companies will likely need to adapt their business models along with new entrants.

Home healthcare and preventative medicine are segments that could see some of the biggest changes due to wearable technology. The shift in focus at industrial companies like Philips is already clear and the real question is whether they can coexist and "team up" with computing companies like Apple, Samsung or Google. If they can, then there is still the question of data ownership and usage. Overall, we see wearables as an opportunity for Philips given it is already a leader in remote monitoring and healthcare IT.

Managed Care

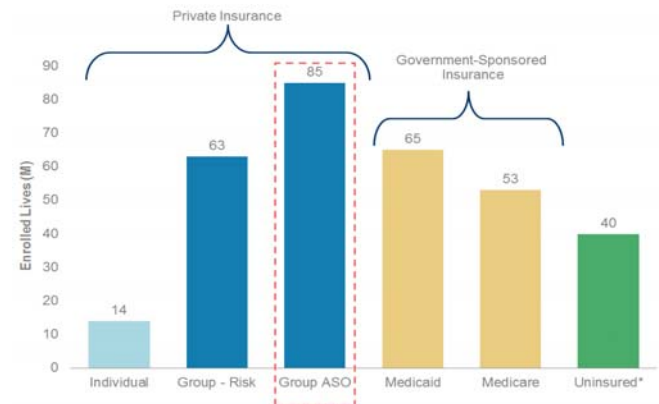
Lower healthcare costs for consumers and employers could drive wearables adoption in the managed care business. According to a study conducted by *TechnologyAdvice*, 75% of US adults do not track their weight, diet, or exercise using a fitness tracking device or app. In fact, the most commonly cited reason for not using a wearable fitness device was lack of interest, followed by cost of the device itself. However, 57% of these non-tracking adults said the possibility of lower insurance premiums would make them more likely to use a fitness-tracking wearable device.

Given current underwriting restrictions in the US health insurance market (i.e., an insurer's ability to vary premiums based on health status), it is unlikely that insurers in the risk-based market would be able to lower premiums for a particular population that uses wearable devices. While this could change over time with new regulation, we expect the self-insured employer market to be the first mover in attempting to tie data from wearables to insurance premiums as part of broader wellness programs.

Roughly 80-90M individuals, or ~30% of all insured lives, have employer-sponsored insurance today. These are self-insured offerings or Administrative Services Only (ASO) where the employer is responsible for paying employees' healthcare costs. The employer still contracts with a health insurer to access their provider network and manage claims (i.e., use them for administrative services). Notably, the employer-sponsored insurance market is less regulated than the broader commercial market, and employers are not subject to the same underwriting restrictions as insurers.

Exhibit 105

Profile of the US Insurance Market



Source: Morgan Stanley Research

The Affordable Care Act established new incentives for employers to build on existing wellness program policies and encourage healthier workplaces. These participatory wellness programs are generally available regardless of an employee's health status and can include rewards up to 30% of the cost of healthcare coverage. Additionally, the maximum reward could reach 50% for programs designed to prevent or reduce tobacco use.

We believe a number of employers are already exploring ways for wearable devices to lower premiums or offer other rewards for healthy behavior. For example, BP, which self-insures, provided 14,000 employees with a Fitbit Zip if they allowed the company to monitor their steps over the course of the year. If employees crossed 1 million steps, they were awarded 500 wellness points that went towards a financial reward. In addition to the "Million Step Challenge," other wellness offerings for BP's 38,000 employees included health advisor calls, biometric health screenings, and onsite campaigns targeting weight management and physical activity, among others.

According to a case study prepared by StayWell Health Management, the 3rd-party wellness organization that partnered with BP, 92% of employees achieved their incentive

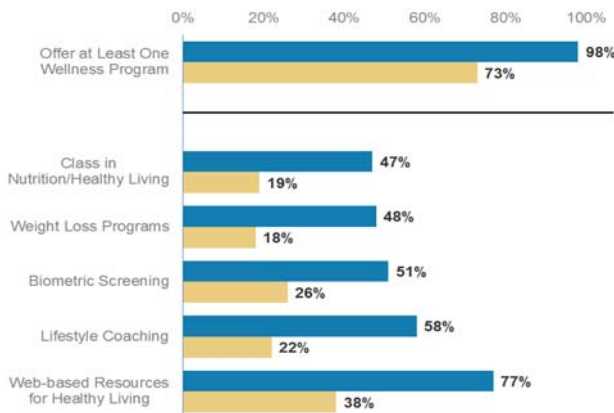
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goal of 1,000 points. Additionally, overall health risks declined by 8.6%, and for employees who participated in a lifestyle management program, risks declined by 11.1%. Finally, BP reduced its overall healthcare spend by 3.5% vs. broader healthcare spending, which increased 3.6% in 2013.

Interestingly, according to Kaiser's Employer Health Benefits survey, 51% of large firms (200 or more workers) reported providing a financial incentive for employees to complete health risk assessments (HRA), and for 36% of those firms, the financial incentive for completing a HRA was \$500+. In fact, virtually all large employers and most small employers offer at least one wellness program to their employees, which bodes well for the future of wearables in this space.

Exhibit 106

Almost All Large Employers Offer at Least One Wellness Program



Source: Kaiser/HRET Survey of Employer Sponsored Health Benefits, 2014

There are certain wellness initiatives that insurers will embed into their ASO offerings to employers, but employers can also purchase additional features. For example, an employer could purchase a disease management or lifestyle management program from the carrier for an additional fee. The insurers can help employers bend the healthcare cost curve. Still, the benefits of lower costs ultimately fall to the employer's, not the insurer's, bottom line. That said, the goal of any managed care company is to produce the lowest cost trend possible for clients, which will likely lead to happier clients, better retention, and the ability to cross-sell ancillary products.

Many managed care companies have already launched consumer-facing apps on smartphones and other devices with the aim of improving health and lowering overall costs. For example, UnitedHealth's subsidiary Optum offers employers the "OptimizeMe" app, which motivates and encourages individuals to live healthier lives. OptimizeMe, which is available on iPhone and Android devices, integrates

with Fitbit, and tracks personal nutrition, exercise and lifestyle initiatives among others. We expect these types of applications to be incorporated into new wearable devices.

Insurers are also offering direct-to-consumer applications. Humana's HumanaVitality is an app for users of its wellness rewards program. The app integrates with several fitness devices and offers individuals incentives like movie tickets and fitness equipment to eat better, be more active, or lose weight. The consumer health app will also be available in Apple's HealthKit and can incorporate data from other HealthKit programs.

Exhibit 107

OptimizeMe and HumanaVitality Apps



Source: UnitedHealthcare (Optum) and Humana

Retail Pharmacy/Pharmaceutical Benefit Managers (PBMs)

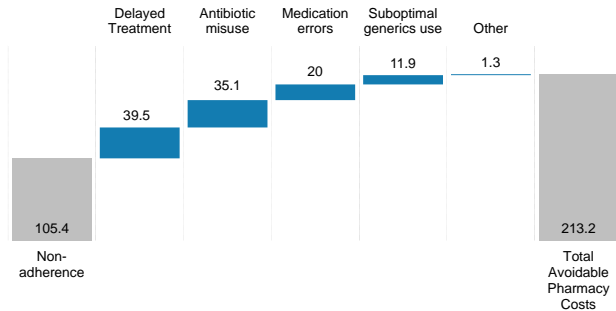
In our view, pharmaceutical benefit managers (PBMs) and drug retailers are well positioned to benefit from changes in pharmaceutical utilization behavior driven by greater penetration of wearable devices. Looking at the various costs associated with pharmaceutical utilization habits, we have identified medication adherence as the greatest opportunity for wearables to disrupt.

The CDC currently estimates that patients do not fill 20-30% of all prescriptions written in the US. In addition, patients complete only ~50% of pharmaceutical treatments. Costs associated with medication adherence account for approximately half of the estimated \$200 billion in annual avoidable pharmacy costs in the US, or ~8% of total US healthcare spend. Near term, we think increased patient engagement in healthcare consumption coupled with greater physician and pharmacist contact should lead to improvements in medication adherence.

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Exhibit 108

Non-Adherence Accounts for ~50% of Total Avoidable Pharmacy Costs Annually



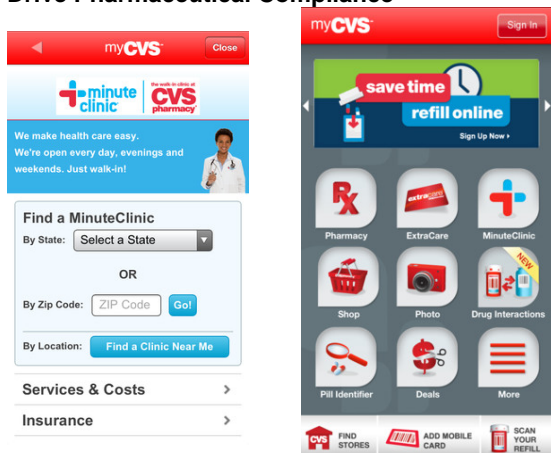
Source: US Centers for Disease Control (CDC)

Mobile app programs currently offered through PBMs and pharmacies could have a broader impact when used with a wearable device.

Apps today feature capabilities such as refill scanners, prescription management, pill identifier, prescription history, immunization scheduler, and pill reminder. Walgreens' mobile app offers customers 24-hour access to a pharmacist through its "Pharmacy Chat" feature that allows patients to seek advice confidentially regarding their pharmaceutical treatments. Retail pharmacies can also leverage mobile apps to bring more patients to lower-cost care settings through location capabilities. For example, a patient can locate the closest retail clinics, such as CVS' MinuteClinic or Walgreens' Healthmart, look up specific services offered at that location, and verify insurance coverage.

Exhibit 109

Wearables to Leverage Features in Mobile Apps Today to Drive Pharmaceutical Compliance



Source: CVS Health

A reduction in medication non-adherence could translate into broader disruption. Therapeutic areas such as diabetes, cholesterol, and blood pressure monitoring

represent "low-hanging fruit" for disruption. According to studies from the New England Health Care Institute, every 900 bps improvement in medication possession ratio (measure of medication compliance) translates to ~20,000 fewer heart attacks, ~5,000 fewer strokes, and ~3,000 fewer deaths. Thus, the implications of improved pharmaceutical adherence reach beyond costs associated with non-adherence and into the broader industry. For example, of the estimated ~\$765 billion in wasted healthcare spend, \$55 billion or 7% is attributed to missed prevention.

Wearables also present a key opportunity in chronic disease management. Specialty drugs require a greater level of attention given complex delivery methods and treatment schedules. Longer term, as the US population continues to age and more complex drugs enter the market, the demand for continuous information sharing between patient and provider will also grow. Information sharing could include medication reminders, delivery instructions, nurse support, and refill information from the provider and heart rate, temperature, and physical activity information from the patient's wearable device.

For example, a complex 30-week treatment plan, such as Temodar, requires high-touch support as the patient faces challenges such as varying dosages, alternating treatment and break phases, and physician surveillance. Wearables provide a unique opportunity for bi-directional information sharing as providers push medication reminders, delivery instructions, nurse support, and refill information while wearables can detect changes in heart rate, temperature, and physical activity.

Net, we estimate PBMs and drug retailers could see 1-3% top-line benefit if wearables improve medication adherence by 25%, in our 2015 base case. Key beneficiaries of medication adherence should be CVS, Walgreens, and Express Scripts (ESRX), with CVS likely to see outsized benefits among the group. Additionally, the pharmaceutical distributors (McKesson, Cardinal Health, and AmerisourceBergen) could see ~1-2% top-line benefit from an increase in overall volume. We view CVS as best-positioned to gain share from wearables given their PBM and Retail pharmacy diversification, in addition to their exposure to the provider community through onsite retail clinics.

Pharma risk sharing could be a wild card opportunity for wearables. As large pharma companies look for new growth opportunities, our conversations with industry experts suggest some companies have expressed interest in expanding the direct relationship between pharmaceutical innovators and the patient population. Through this model, pharma companies

would assume the risk associated with an entire patient population undergoing specific disease regimens. In this scenario, contact between pharmaceutical developers and patients becomes critical to treatment success and to curtailing the risks associated with treatment failure.

Wearable Devices
Industrials

Industrials

Ben Uglow
Lucie Carrier
Markus Almerud

What are the industrial use cases for wearables?

We see benefits of wearables within home automation, beyond those already afforded by a smartphone or tablet. However, the addressable market is unlikely to be on the same scale as in other sectors, such as healthcare and fitness, which we covered in the Healthcare section and where we see Philips as best positioned. In our view, home automation is an opportunity for industrial companies in the space and not cannibalistic to existing businesses, if the unique characteristics of wearables vs. mobile devices can be harnessed – we see Legrand and Assa Abloy as having been the most proactive in that field so far, leveraging their core business leadership into increased connectivity and wearable technologies.

- Best-positioned: Legrand, Assa Abloy, Philips
- Lagging the trend: Osram Licht

Home Automation

Industrial companies are building smart home products.

We looked at the impact of home automation in an earlier Blue Paper, [The 'Internet of Things' Is Now: Connecting the Real Economy](#), and believe there are opportunities for industrial firms, such as Philips (Hue lighting), Legrand (connected wiring devices), or Assa Abloy (connected locks). We see benefits from an energy efficiency and convenience standpoint. For example, homes could detect owners' movements and automatically turn on the lights or unlock the doors. If homes can detect when owners are waking up, they could automatically turn on the lights or activate the hot water for the shower, removing waste by simply having the system on a timer. Currently the controls of these devices are built into smartphones and tablets, but by offering a more personal connection to technology and by always being with the user, wearables offer a range of new possibilities for home automation.

Wearables could be better than other mobile devices at automating smart homes. When we looked at the Internet of Things (IoT) benefits to the home, we focused on applications that change the atmosphere in the home manually, through

controlling lights or temperature. With wearables, we see additional benefits in automation. For example, Assa Abloy plans to install locks in hotels and offices that can be unlocked with smartphones, removing the need for keys or cards. However, we see an issue with rolling this out to homes. To be more efficient than regular keys, the device would have to be capable of unlocking the door without input from the user.

In addition, wearables can solve a problem with security. A stolen phone could provide location and access to the owner's home. However, devices that incorporated persistent identity verification technology, enabled through biometric sensors in wearables, as we discussed above, would be better for home automation than smartphones. For example, Apple Watch uses biometric sensors to verify the user's identity for Apple Pay. The user has to confirm his or her identity through a pin code when he or she first put on the device. Once skin contact is broken, the user has to re-enter the code to enable the wearable. We believe this gives a degree of convenience *and* security not possible with smartphones or other mobile devices. This level of interaction with the device increases the areas of the home that can be automated.

Wearables can further personalize home automation products.

Assuming users do not set down wearables as they would a phone or tablet, devices like Philips' Hue lightbulbs could detect if there are people in the room or not, and turn the lights on or off as users move around the house. Another possible application is in heating, ventilating, and air conditioning (HVAC) technologies. Wearables could communicate changes in room temperature to the air-conditioning system, automatically adjusting the house temperature to suit the users' preferences.

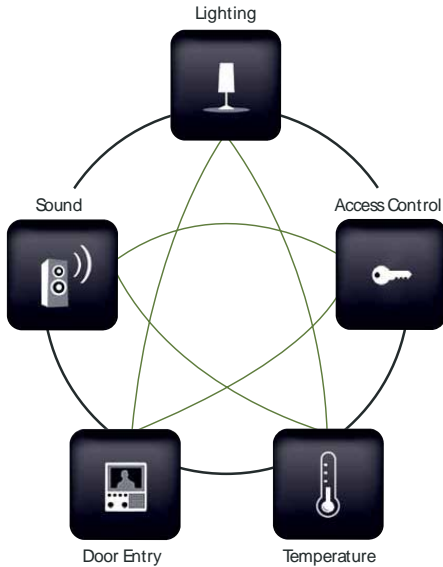
Legrand, Assa Abloy, and Philips look well-positioned.

They already have a presence in home automation and connected products. The growth in wearable tech, in our view, simply increases 1) the range of products that can be offered by these companies, 2) the interest in home automation as consumers become more aware of the devices available, and 3) the usefulness of the Internet of Things. The Legrand Arteor system can already automate lighting, temperature, door entry, and blinds. Adding to it a wearable that could tell where in the home you are could further improve this system and customize it for each user.

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Exhibit 110

Legrand Arteor Connects Several Different Aspects of the Home



Source: Company promotional materials

However, there are risks from new competitors. In the move to a more connected home, new entrants to the market, like Nest, are emerging, and could gain strong positions. But Philips, Legrand, or Assa Abloy can remain relevant if their systems and apps are connected to wearables. If that is the

case, there is no reason to think that their systems, already in place and performing, would not be competitive.

There is a risk of missing the market by not moving fast enough. For example, just in 2014, Google acquired Nest in February, Dropcam in June, and Revolv in October. Nest offers wireless thermostats and smoke alarms, with more products to come. Dropcam offers WiFi-connected webcams and sensors that allow owners to check on their homes remotely through the Internet. Revolv made smart home hubs and apps, but will focus on its software platform going forward. The opportunity presented by wearables is quite specific and from that of smartphones. The home automation players would need to move fast to change their products to accommodate the specific advantages offered by wearables as we described above, especially when competing against Google, whose Android operating system runs the majority of the smartphones and tablets in the world.

Security concerns will only increase as we move towards home automation, in our view. If control of the temperature, lighting, or door and window locks is accessible over the Internet to the owners, it could also allow someone to break into the virtual system to check if the owners are home, or worse, take control of the house. If virtual break-ins over the internet occur, then the very concept of the automated home would, in our view, be threatened as it would become less likely that consumers would purchase the products.

Appendix: Wearables Model

Exhibit 111

Wearables Base Case Units and Mix

	1Q13	2Q13	3Q13	4Q13	1Q14	2Q14	3Q14	4Q14e	1Q15e	2Q15e	3Q15e	4Q15e	2013	2014e	2015e	2016e	2017e
Units (Millions)																	
Units by Region																	
US	0.3	0.4	0.7	1.2	1.4	1.8	2.0	3.0	4.2	5.9	7.2	9.0	2.6	8.2	26.3	44.8	60.5
China	0.0	0.1	0.1	0.4	0.6	0.9	1.1	1.2	2.1	3.4	4.2	4.7	0.6	3.8	14.4	40.2	80.4
Japan	0.1	0.1	0.2	0.3	0.4	0.7	0.8	0.9	1.2	1.4	1.7	1.9	0.7	2.8	6.2	11.1	17.8
Western Europe	0.2	0.2	0.4	0.7	1.0	1.3	1.5	2.2	2.5	3.3	3.7	4.6	1.5	6.0	14.0	27.9	47.5
RoW	0.0	0.1	0.1	0.4	0.6	0.8	1.1	1.6	1.1	1.5	2.5	4.0	0.6	4.1	9.1	21.0	42.0
Total	0.6	0.9	1.5	3.0	4.0	5.5	6.5	9.0	11.1	15.5	19.3	24.1	6.0	25.0	70.0	145.0	248.1
Units by Type																	
Complex Accessories	0.6	0.8	1.3	1.6	2.6	3.2	3.5	4.8	4.4	3.9	3.9	3.6	4.3	14.2	15.8	21.8	19.8
Smart Accessories	0.0	0.1	0.2	1.4	1.4	2.2	2.9	4.0	6.5	11.3	15.0	20.0	1.7	10.6	52.9	113.1	193.5
Smart Wearables	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.3	0.4	0.5	0.1	0.2	1.3	10.2	34.7
Total	0.6	0.9	1.5	3.0	4.0	5.5	6.5	9.0	11.1	15.5	19.3	24.1	6.0	25.0	70.0	145.0	248.1
Units by End Market																	
Consumer	0.6	0.9	1.5	3.0	4.0	5.5	6.5	9.0	11.1	15.3	19.1	23.9	6.0	25.0	69.4	137.8	223.3
Enterprise	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.0	0.0	0.6	7.3	24.8
Total	0.6	0.9	1.5	3.0	4.0	5.5	6.5	9.0	11.1	15.5	19.3	24.1	6.0	25.0	70.0	145.0	248.1
Unit Mix																	
US	50%	44%	47%	40%	35%	33%	31%	33%	38%	38%	37%	37%	43%	33%	38%	31%	24%
China	0%	11%	7%	13%	15%	16%	17%	14%	19%	22%	22%	19%	10%	15%	21%	28%	32%
Japan	17%	11%	13%	10%	10%	13%	12%	10%	11%	9%	9%	8%	12%	11%	9%	8%	7%
Western Europe	33%	22%	27%	23%	25%	24%	23%	25%	22%	21%	19%	19%	25%	24%	20%	19%	19%
RoW	0%	11%	7%	13%	15%	15%	17%	18%	10%	10%	13%	17%	10%	16%	13%	14%	17%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Complex Accessories	95%	89%	84%	54%	64%	59%	54%	54%	40%	25%	20%	15%	71%	57%	23%	15%	8%
Smart Accessories	5%	10%	15%	45%	35%	40%	45%	45%	59%	73%	78%	83%	28%	42%	76%	78%	78%
Smart Wearables	0%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	2%	7%	14%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Consumer	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	100%	100%	99%	95%	90%
Enterprise	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	1%	5%	10%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: IDC, Morgan Stanley Research

Exhibit 112

Wearables Base Case Unit Growth

	1Q13	2Q13	3Q13	4Q13	1Q14	2Q14	3Q14	4Q14e	1Q15e	2Q15e	3Q15e	4Q15e	2013	2014e	2015e	2016e	2017e
Units (Millions)																	
Y/Y Unit Change																	
US			250%	300%	367%	350%	186%	150%	200%	230%	260%	200%		215.4%	221.2%	70.0%	35.0%
China			--	--	--	800%	1000%	210%	250%	280%	280%	275%		540.0%	273.7%	180.0%	100.0%
Japan			--	--	300%	600%	300%	200%	210%	95%	110%	110%		300.0%	120.5%	80.0%	60.0%
Western Europe			300%	250%	400%	550%	275%	220%	145%	150%	145%	105%		302.7%	131.2%	100.0%	70.0%
RoW			--	--	--	700%	1000%	300%	80%	90%	130%	150%		583.3%	122.7%	130.0%	100.0%
Total			400%	500%	567%	511%	333%	199%	177%	182%	196%	169%		316.3%	180.1%	107.3%	71.1%
Complex Accessories			338%	238%	349%	305%	179%	199%	73%	19%	10%	-25%		233.2%	11.4%	37.9%	-8.8%
Smart Accessories			1775%	6650%	4567%	2344%	1200%	199%	367%	414%	414%	396%		523.4%	400.7%	113.8%	71.1%
Smart Wearables			--	--	--	511%	333%	199%	177%	463%	493%	437%		362.6%	415.8%	687.7%	242.2%
Total			400%	500%	567%	511%	333%	199%	177%	182%	196%	169%		316.3%	180.1%	107.3%	71.1%
Consumer			400%	500%	567%	511%	333%	199%	177%	179%	193%	166%		316.3%	177.7%	98.6%	62.1%
Enterprise			--	--	--	--	--	--	--	--	--	--		--	--	1131.1%	242.2%
Total			400%	500%	567%	511%	333%	199%	177%	182%	196%	169%		316.3%	180.1%	107.3%	71.1%
Q/Q Unit Change																	
US	0%	33%	75%	71%	17%	29%	11%	50%	40%	41%	21%	25%					
China	--	--	0%	300%	50%	50%	22%	13%	69%	63%	22%	11%					
Japan	--	0%	100%	50%	33%	75%	14%	13%	38%	10%	23%	13%					
Western Europe	0%	0%	100%	75%	43%	30%	15%	49%	9%	33%	13%	25%					
RoW	--	--	0%	300%	50%	33%	38%	45%	-33%	41%	66%	58%					
Total	20%	50%	67%	100%	33%	38%	18%	38%	23%	40%	24%	25%					
Complex Accessories	19%	41%	57%	29%	58%	27%	8%	38%	-9%	-13%	-1%	-6%					
Smart Accessories	50%	200%	150%	500%	4%	57%	33%	38%	62%	73%	33%	33%					
Smart Wearables	--	--	67%	100%	33%	38%	18%	38%	23%	180%	24%	25%					
Total	20%	50%	67%	100%	33%	38%	18%	38%	23%	40%	24%	25%					
Consumer	20%	50%	67%	100%	33%	38%	18%	38%	23%	39%	24%	25%					
Enterprise	--	--	--	--	--	--	--	--	--	--	24%	25%					
Total	20%	50%	67%	100%	33%	38%	18%	38%	23%	40%	24%	25%					

Source: IDC, Morgan Stanley Research

Exhibit 113

Wearables Bull Case Units and Mix

	1Q13	2Q13	3Q13	4Q13	1Q14	2Q14	3Q14	4Q14e	1Q15e	2Q15e	3Q15e	4Q15e	2013	2014e	2015e	2016e	2017e
Units (Millions)																	
Units by Region																	
US	0.3	0.4	0.7	1.2	1.4	1.8	2.0	3.0	6.6	9.0	11.6	15.0	2.6	8.2	42.2	71.7	96.8
China	0.0	0.1	0.1	0.4	0.6	0.9	1.1	1.2	2.8	4.5	5.6	6.3	0.6	3.8	19.2	57.6	123.8
Japan	0.1	0.1	0.2	0.3	0.4	0.7	0.8	0.9	1.6	1.8	2.2	2.7	0.7	2.8	8.2	16.5	29.7
Western Europe	0.2	0.2	0.4	0.7	1.0	1.3	1.5	2.2	4.3	5.6	6.5	7.2	1.5	6.0	23.5	49.4	83.9
RoW	0.0	0.1	0.1	0.4	0.6	0.8	1.1	1.6	2.4	3.5	4.7	6.9	0.6	4.1	17.5	45.6	98.0
Total	0.6	0.9	1.5	3.0	4.0	5.5	6.5	9.0	17.6	24.4	30.6	38.1	6.0	25.0	110.7	240.7	432.2
Units by Type																	
Complex Accessories	0.6	0.8	1.3	1.6	2.6	3.2	3.5	4.8	7.0	6.1	6.1	5.7	4.3	14.2	25.0	33.7	30.3
Smart Accessories	0.0	0.1	0.2	1.4	1.4	2.2	2.9	4.0	10.4	17.8	23.9	31.6	1.7	10.6	83.7	187.8	324.2
Smart Wearables	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.5	0.6	0.8	0.1	0.2	2.0	19.3	77.8
Total	0.6	0.9	1.5	3.0	4.0	5.5	6.5	9.0	17.6	24.4	30.6	38.1	6.0	25.0	110.7	240.7	432.2
Units by End Market																	
Consumer	0.6	0.9	1.5	3.0	4.0	5.5	6.5	9.0	17.6	24.2	30.3	37.7	6.0	25.0	109.7	223.9	367.4
Enterprise	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.0	0.0	0.9	16.9	64.8
Total	0.6	0.9	1.5	3.0	4.0	5.5	6.5	9.0	17.6	24.4	30.6	38.1	6.0	25.0	110.7	240.7	432.2
Unit Mix																	
US	50%	44%	47%	40%	35%	33%	31%	33%	37%	37%	38%	39%	43%	33%	38%	30%	22%
China	0%	11%	7%	13%	15%	16%	17%	14%	16%	18%	18%	17%	10%	15%	17%	24%	29%
Japan	17%	11%	13%	10%	10%	13%	12%	10%	9%	7%	7%	7%	12%	11%	7%	7%	7%
Western Europe	33%	22%	27%	23%	25%	24%	23%	25%	24%	23%	21%	19%	25%	24%	21%	21%	19%
RoW	0%	11%	7%	13%	15%	15%	17%	18%	14%	14%	15%	18%	10%	16%	16%	19%	23%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Complex Accessories	95%	89%	84%	54%	64%	59%	54%	54%	40%	25%	20%	15%	71%	57%	23%	14%	7%
Smart Accessories	5%	10%	15%	45%	35%	40%	45%	45%	59%	73%	78%	83%	28%	42%	76%	78%	75%
Smart Wearables	0%	1%	1%	1%	1%	1%	1%	1%	1%	2%	2%	2%	1%	1%	2%	8%	18%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Consumer	100%	100%	100%	100%	100%	100%	100%	100%	100%	99%	99%	99%	100%	100%	99%	93%	85%
Enterprise	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	1%	7%	15%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: IDC, Morgan Stanley Research

Exhibit 114

Wearables Bull Case Unit Growth

	1Q13	2Q13	3Q13	4Q13	1Q14	2Q14	3Q14	4Q14e	1Q15e	2Q15e	3Q15e	4Q15e	2013	2014e	2015e	2016e	2017e
Units (Millions)																	
Y/Y Unit Change																	
US			250%	300%	367%	350%	186%	150%	370%	400%	480%	400%		215.4%	414.4%	70.0%	35.0%
China			--	--	--	800%	1000%	210%	360%	400%	410%	410%		540.0%	399.8%	200.0%	115.0%
Japan			--	--	300%	600%	300%	200%	290%	155%	175%	200%		300.0%	194.5%	100.0%	80.0%
Western Europe			300%	250%	400%	550%	275%	220%	330%	330%	330%	220%		302.7%	289.2%	110.0%	70.0%
RoW			--	--	--	700%	1000%	300%	300%	340%	330%	330%		583.3%	327.6%	160.0%	115.0%
Total			400%	500%	567%	511%	333%	199%	340%	344%	371%	324%		316.3%	343.0%	117.5%	79.5%
Complex Accessories			338%	238%	349%	305%	179%	199%	175%	88%	74%	18%		233.2%	76.3%	35.0%	-10.2%
Smart Accessories			1775%	6650%	4567%	2344%	1200%	199%	642%	709%	716%	682%		523.4%	691.7%	124.5%	72.6%
Smart Wearables			--	--	--	511%	333%	199%	340%	787%	841%	748%		362.6%	715.5%	845.3%	304.0%
Total			400%	500%	567%	511%	333%	199%	340%	344%	371%	324%		316.3%	343.0%	117.5%	79.5%
Consumer			400%	500%	567%	511%	333%	199%	340%	339%	366%	320%		316.3%	339.3%	104.0%	64.1%
Enterprise			--	--	--	--	--	--	--	--	--	--		--	--	1710.8%	284.7%
Total			400%	500%	567%	511%	333%	199%	340%	344%	371%	324%		316.3%	343.0%	117.5%	79.5%
Q/Q Unit Change																	
US	0%	33%	75%	71%	17%	29%	11%	50%	119%	37%	29%	29%					
China	--	--	0%	300%	50%	50%	22%	13%	123%	63%	25%	13%					
Japan	--	0%	100%	50%	33%	75%	14%	13%	73%	14%	23%	23%					
Western Europe	0%	0%	100%	75%	43%	30%	15%	49%	92%	30%	15%	11%					
RoW	--	--	0%	300%	50%	33%	38%	45%	50%	47%	34%	45%					
Total	20%	50%	67%	100%	33%	38%	18%	38%	96%	39%	25%	24%					
Complex Accessories	19%	41%	57%	29%	58%	27%	8%	38%	45%	-13%	0%	-7%					
Smart Accessories	50%	200%	150%	500%	4%	57%	33%	38%	157%	71%	34%	32%					
Smart Wearables	--	--	67%	100%	33%	38%	18%	38%	96%	177%	25%	24%					
Total	20%	50%	67%	100%	33%	38%	18%	38%	96%	39%	25%	24%					
Consumer	20%	50%	67%	100%	33%	38%	18%	38%	96%	37%	25%	24%					
Enterprise	--	--	--	--	--	--	--	--	--	--	25%	24%					
Total	20%	50%	67%	100%	33%	38%	18%	38%	96%	39%	25%	24%					

Source: IDC, Morgan Stanley Research

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Total	3,242		879		

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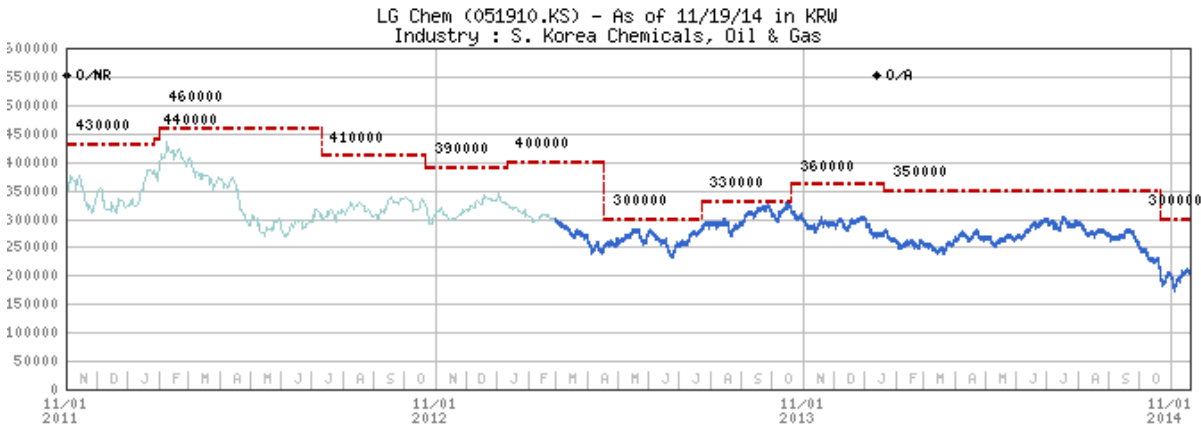
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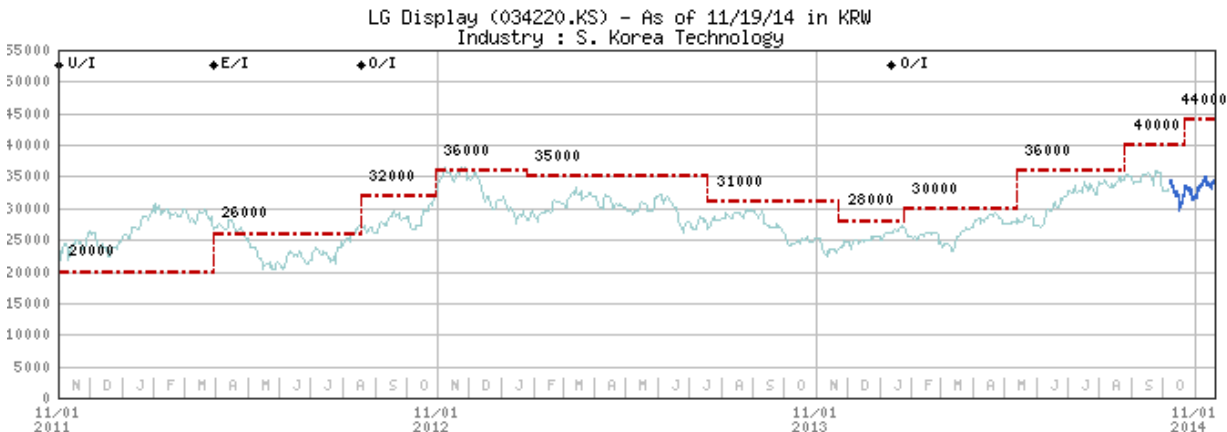
Stock Rating History: 11/1/11 : 0/NR; 1/13/14 : 0/A

Price Target History: 10/21/11 : 430000; 1/27/12 : 440000; 2/1/12 : 460000; 7/11/12 : 410000; 10/22/12 : 390000;
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Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

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Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.



Stock Rating History: 11/1/11 : U/I; 3/29/12 : E/I; 8/18/12 : O/I; 1/13/14 : O/I

Price Target History: 10/21/11 : 20000; 3/29/12 : 26000; 8/18/12 : 32000; 10/29/12 : 36000; 1/25/13 : 35000;
7/19/13 : 31000; 11/22/13 : 28000; 1/24/14 : 30000; 5/13/14 : 36000; 8/26/14 : 40000; 10/23/14 : 44000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst) ■
Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

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November 19, 2014
Wearable Devices

Samsung Electronics (005930.KS) - As of 11/19/14 in KRW
Industry : S. Korea Technology



Stock Rating History: 11/1/11 : O/I; 7/29/13 : E/I; 1/13/14 : E/I; 10/31/14 : O/I

Price Target History: 10/31/11 : 1220000; 1/30/12 : 1350000; 3/19/12 : 1500000; 11/26/12 : 1700000;
3/12/13 : 1750000; 4/8/13 : 1800000; 6/10/13 : 1750000; 7/29/13 : 1500000; 10/28/13 : 1600000; 8/27/14 : 1500000;
10/8/14 : 1400000; 10/31/14 : 1600000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target -- No Price Target Assigned (NA)
Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst) ■
Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

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November 19, 2014
Wearable Devices

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Ticker	Company Name	Close Price (as of 11/19/2014)	Ticker	Company Name	Close Price (as of 11/19/2014)
2018.HK	AAC Technologies Holdings	HKD 43.3	INGC.PA	Ingenico S.A.	EUR 82.07
ABT.N	Abbott Laboratories	USD 43.70	PODD.O	Insulet	USD44.93
ADSGn.DE	Adidas	EUR 63.1	1833.HK	Intime Retail (Group)	HKD 6.66
2311.TW	Advanced Semi Engineering	TWD 37.5	INVN.N	InvenSense, Inc.	USD 15.00
AMBA.O	Ambarella Inc	USD 49.67	JPM.N	J.P.Morgan Chase & Co.	USD 60.53
AXP.N	American Express Company	USD 90.58	LEGD.PA	Legrand	EUR 40.675
AAPL.O	Apple, Inc.	USD 115.47	051910.KS	LG Chem	KRW 203000
ARM.L	ARM Holdings Plc	GBp 881	034220.KS	LG Display	KRW 33900
ASSAb.ST	Assa Abloy AB	SEK 392.8	0590.HK	Luk Fook Holdings (International) Ltd.	HKD 23.55
ATML.O	Atmel Corp	USD 7.57	MA.N	MasterCard Inc	USD 83.90
BAC.N	Bank of America	USD 17.14	MXIM.O	Maxim Integrated Products Inc.	USD 29.32
COF.N	Capital One Financial Corporation	USD 81.29	MDT.N	Medtronic Inc.	USD 72.47
6952.T	Casio Computer	JPY 1619	MCHP.O	Microchip Technology Inc.	USD 44.02
1929.HK	Chow Tai Fook Jewellery Group Ltd.	HKD 10.52	MSFT.O	Microsoft	USD 48.74
C.N	Citigroup Inc.	USD 53.81	NKE.N	Nike Inc.	USD 96.47
7762.T	Citizen Holdings	JPY 882	NXPI.O	NXP Semiconductor NV	USD 74.55
CVS.N	CVS/Caremark Corp.	USD 90.12	OSRn.DE	Osram Licht AG	EUR 33.365
DXCM.O	DexCom	USD 51.59	PHG.AS	Philips	EUR 22.94
DFS.N	Discover Financial Services	USD 64.98	2382.TW	Quanta Computer Inc.	TWD 74
EBAY.O	eBay Inc	USD 55.38	CRM.N	Salesforce.com	USD 62.47
EVTC.N	Evertec Inc	USD 21.95	005930.KS	Samsung Electronics	KRW 1218000
FSL.N	Freescale Semiconductor Ltd.	USD 20.52	6724.T	Seiko Epson	JPY 5370
GRMN.O	Garmin Ltd	USD 56.64	6758.T	Sony	JPY 2441.5
GTO.AS	Gemalto N.V.	EUR 65.7	UHR.VX	Swatch	CHF 453.6
GN.N	Global Payments Inc	USD 83.46	TSS.N	Total System Services Inc.	USD 32.77
002241.SZ	GoerTek Inc	CNY 25.88	UA.N	Under Armour Inc.	USD 69.37
GOOGL.O	Google	USD 544.51	UNH.N	UnitedHealth Group Inc	USD 98.19
HPY.N	Heartland Payment Systems Inc	USD 54.35	VNTV.N	Vantiv Inc	USD 32.25
3389.HK	Hengdeli Holdings Ltd.	HKD 1.49	PAY.N	VeriFone Systems Inc.	USD 36.99
IBM.N	IBM	USD 161.89	V.N	Visa Inc.	USD 249.73
IMG.L	Imagination Technologies Group	GBp 190.25	4958.TW	Zhen Ding	TWD 83.2