BETTING ON GHOSTS: THE IMPOSSIBL ART OF VALUING PRE-REVENUE DIGIT/ HEALTH STARTUPS

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ABSTRACT

This essay examines the challenge of valuing pre-revenue digital health startups operating in environments of reimbursement uncertainty. Traditional valuation methodologies falter when applied to companies that lack both revenue streams clarity on future payment mechanisms. The essay explores why conventional ven capital frameworks prove inadequate for digital health, analyzes the structural f that create reimbursement uncertainty, and proposes alternative approaches for investors attempting to price risk in this unique market segment. Key themes in the divergence between consumer technology and healthcare economics, the role regulatory capture in value creation, and the emergence of novel valuation heuri adapted to healthcare's peculiar constraints.

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THE VALUATION PARADOX IN DIGITAL HEALTH

There exists a special circle of hell reserved for investors who must assign a doll value to a company that has no revenue, no customers paying actual money, and certainty about whether anyone will ever pay for their product. This is the daily reality of early-stage digital health investing, where the fundamental inputs to ev valuation model are either missing or misleading. The entrepreneur sits across t table with a pitch deck showing a total addressable market of seventeen billion dollars, a slide about Medicare reimbursement codes that might apply in three y and a demo of software that doctors seem to like but haven't actually purchased. question hanging in the air is deceptively simple: what is this company worth?

Traditional venture capital has evolved elegant solutions to the problem of valui pre-revenue companies. Consumer internet investors got comfortable writing ch to companies with no business model by focusing on user growth metrics and assuming monetization would follow. Enterprise software investors developed frameworks around annual recurring revenue multiples and cohort retention cu Even biotech, despite its binary outcomes and decade-long timelines, has relativ well-understood milestone valuations tied to clinical trial phases and regulatory approval probabilities. Digital health startups occupy an uncomfortable middle ground where none of these frameworks quite fit.

The core problem is that digital health companies often look like software busin on the surface while operating under the economic constraints of healthcare del

They may have impressive user engagement metrics that would justify a consum technology valuation, but those users aren't paying customers in any convention sense. The actual economic buyers, if they can be identified at all, are health syst payers, or government programs operating under budget constraints and bureau procurement processes that bear no resemblance to bottom-up SaaS adoption. T path from product-market fit to revenue is not a matter of scaling sales and mar spend but rather navigating a labyrinth of payor medical policies, coverage determinations, and benefit design decisions that may take years to resolve.

This creates a peculiar situation where a digital health company can appear to b succeeding by every conventional startup metric while remaining fundamentally unvaluable by traditional methods. They have users who love the product, retent rates that would make a consumer app jealous, clinical evidence of improved outcomes, and a management team with impressive credentials. Yet no one can a with any confidence whether the company will generate ten million or one hund million in revenue three years from now, because the answer depends on decisio being made in the Centers for Medicare and Medicaid Services or in the medical policy departments of United Healthcare, Anthem, and Humana. The uncertaint not about execution but about the structure of the market itself.

WHY SOFTWARE MULTIPLES DON'T WO IN HEALTHCARE

The venture capital industry has become remarkably good at valuing software companies using relatively standardized multiples. A fast-growing enterprise so company with strong unit economics might trade at ten to twenty times annual recurring revenue. A consumer subscription business with excellent retention m command eight to twelve times revenue. These multiples are grounded in decad data about how software companies scale, what margins they can achieve, and ho much acquirers are willing to pay. The implicit assumption is that revenue today predicts revenue tomorrow in a relatively linear fashion, adjusted for growth rat market size.

Healthcare economics breaks this model in several fundamental ways. First, reve in healthcare is often not a choice variable under the control of the company. A software company can decide to raise prices, expand to new customer segments, add new features that command premium pricing. A digital health company seek reimbursement is price-taker in a system where rates are set by government prog and negotiated through opaque contracts with commercial payers. The company might have a product that delivers five thousand dollars of value per patient but receives reimbursement of three hundred dollars, not because their pricing strat wrong but because that is what the system will bear.

Second, healthcare revenue streams are path-dependent in ways that software revenues are not. Once Medicare establishes a coverage policy and reimburseme rate for a digital therapeutic, that rate becomes an anchor that influences all subsequent negotiations with commercial payers. The first few coverage decisio create precedents that constrain the entire future revenue potential of the comp This means that early-stage valuation is not just about discounting uncertain fut cash flows but about estimating the probability that the company will successful navigate a sequence of regulatory and payor decisions that will determine wheth they capture ten percent or fifty percent of the theoretical value they create.

Third, the relationship between product quality and revenue is far weaker in healthcare than in traditional software markets. The best product often does not A digital health company might have superior clinical evidence, better user experience, and lower cost structure than competitors, yet still lose in the marke because a competitor has better relationships with health system procurement departments or has structured their contracting in a way that aligns with existin budget silos. The competitive moat in digital health is often not technical but ra regulatory and contractual, which means that traditional SaaS metrics around product-led growth and net revenue retention tell you very little about long-terr defensibility.

These structural differences mean that applying software valuation multiples to revenue digital health companies is an exercise in false precision. An investor mi look at comparable SaaS companies and decide that a pre-revenue digital health

startup should be valued at some discount to established software multiples to account for healthcare's slower sales cycles and lower margins. But this approac fundamentally misunderstands the nature of the risk. The uncertainty is not abc whether the company will grow slightly faster or slower than a typical software business. The uncertainty is about whether the economic model itself will ever v at scale.

THE REIMBURSEMENT UNCERTAINTY PREMIUM

The single largest source of valuation uncertainty in pre-revenue digital health companies is reimbursement risk. Will Medicare cover this? Will commercial pa follow? At what rate? Under what circumstances? These questions are not merel important inputs to a financial model. They are existential determinants of whet the company has a viable business. The gap between a world where a digital therapeutic receives broad coverage at adequate rates and a world where it rema cash-pay or employer-sponsored benefit is the difference between a billion-dolla outcome and a failed company.

Reimbursement uncertainty manifests in several distinct dimensions that compc each other in ways that make probabilistic valuation extremely difficult. Coverag uncertainty involves whether payors will agree to cover the intervention at all. R uncertainty involves what they will pay for it. Volume uncertainty involves how r patients will be eligible for coverage. Durability uncertainty involves how long coverage policies will remain stable. Each of these uncertainties is substantial or own, and they interact in non-linear ways that make scenario analysis more art t science.

Consider a digital therapeutic for Type 2 diabetes that is seeking reimbursemen through the existing preventive service benefit. The company needs Medicare to a national coverage determination that the intervention is reasonable and necess for diabetes prevention. Then they need Medicare to establish a billing code and payment rate. Then they need Medicare Advantage plans to decide whether to cc

under their supplemental benefits. Then they need commercial payers to each m independent coverage decisions based on their medical policies. Then they need health systems and physician practices to actually adopt it and bill for it. The probability of success at each stage is unknown, the timeline is uncertain, and th amount of revenue that would result from success varies by an order of magnitu depending on the specifics of how coverage is implemented.

Traditional venture capital deals with uncertainty through portfolio constructio staging capital. An investor can write smaller checks into more companies and r capital for follow-on rounds as uncertainty resolves. This works well when uncertainty is about execution, product-market fit, or competitive dynamics. It w much less well when uncertainty is about whether the fundamental economic m of the business will be permitted to exist by regulatory authorities who move on timelines measured in years.

The reimbursement uncertainty premium should theoretically be reflected in valuation through a higher discount rate or lower terminal value multiples. In practice, this rarely happens cleanly. Entrepreneurs pitch their companies on a b case that assumes successful reimbursement because any other assumption mak business look uninvestable. Investors either believe the base case and invest at valuations that implicitly price in high probability of reimbursement success, or don't believe it and pass on the deal entirely. There is very little middle ground w investors systematically discount valuations to reflect reimbursement risk while finding the deal attractive. This creates a bimodal distribution where digital hea companies either raise at lofty valuations that assume away the hard problems or struggle to raise at all.

ALTERNATIVE VALUATION FRAMEWORK

Given the inadequacy of traditional software valuation multiples, investors in pr revenue digital health companies have developed alternative frameworks that att to more directly model the specific risks and opportunities in healthcare. These

approaches vary in sophistication and usefulness, but they share a common recognition that healthcare requires different analytical tools than other sectors.

One approach is stage-based valuation analogous to biotech, where companies ar valued based on specific milestones related to clinical evidence and regulatory approval rather than revenue metrics. A digital health company might be valued three million post-money after completing a pilot study with promising results, million after publishing peer-reviewed clinical evidence, twenty million after sec their first payor contract, and fifty million after achieving national Medicare cov This framework has the advantage of tying valuation to concrete de-risking even rather than revenue projections that are fundamentally speculative. The challeng that digital health milestones are less standardized and binary than drug develop phases, making it harder to build consensus around appropriate milestone valua

Another approach is to value digital health companies based on the addressable patient population and estimated revenue per patient, then apply a heavy discou factor to account for the probability and timeline of achieving broad reimburser An investor might estimate that a diabetes prevention program could theoretical reach five million covered lives at three hundred dollars per participant per year generating one and a half billion in annual revenue. They then discount this by f percent for the probability of achieving Medicare coverage, another fifty percent the likelihood that commercial payers follow, and spread the revenue ramp over years instead of three. This framework at least attempts to explicitly model reimbursement uncertainty rather than assuming it away, though the discount fa themselves are largely arbitrary.

A third approach focuses on enterprise value to patient value ratios, attempting estimate what percentage of total clinical and economic value created the compa might capture as revenue. Healthcare has enormous value transfer from stakehol who benefit from innovation to those who pay for it. A digital therapeutic that reduces hospital readmissions might create twenty thousand dollars of value for health system but capture only five hundred dollars through reimbursement. Inv who understand these value flows can estimate more realistic revenue potential t

those who simply extrapolate from clinical benefit without considering who has budget authority to pay for it.

Perhaps the most intellectually honest framework is to treat early-stage digital h investments as options rather than direct equity investments with quantifiable expected returns. The investor is purchasing an option on a future in which reimbursement uncertainty resolves favorably and the company achieves scale. T value of the option depends on the volatility of outcomes, the time to potential p and the strike price of future financing rounds. This framework acknowledges t the primary value of an early-stage investment is preserving the right to invest m later if uncertainty resolves positively, rather than any deterministic discounted flow from the initial investment itself.

THE PATH DEPENDENCY PROBLEM

Digital health companies face a particularly acute version of the path dependenc problem that plagues many platform businesses. Early decisions about clinical indication, reimbursement strategy, and go-to-market approach create constrain that persist for years and can foreclose entire categories of future opportunity. A company that initially targets employer wellness programs may find it extremely difficult to pivot to Medicare reimbursement later because they have built the w type of clinical evidence and structured their product in ways that don't align wi fee-for-service billing. The path chosen early, often with limited information and resources, determines the set of possible futures far more than in typical softwar businesses.

This creates a valuation challenge because the value of a pre-revenue digital heal company depends heavily on whether management has chosen a path that will le viable reimbursement, yet this is often impossible to know at the time of investm Two companies with identical products and similar traction might have wildly different expected values based solely on whether one is pursuing a medical ben reimbursement strategy and the other is pursuing a pharmacy benefit strategy, e

though this distinction might seem like a minor tactical detail to someone outsi
healthcare.

The path dependency is compounded by the fact that digital health markets are
characterized by strong network effects on the payor side. A company that estab
coverage with one major national payor finds it much easier to establish coverag
others because subsequent payors can point to the existence of a coverage policy
elsewhere to justify their own decisions. The first coverage determination is
exponentially harder to achieve than subsequent ones. This means that early-sta
valuation depends heavily on assessing management's ability to achieve that cruc
first breakthrough, which in turn depends on relationships, regulatory strategy,
timing that are difficult for outside investors to evaluate.

Interestingly, path dependency cuts both ways. A company that successfully achi
reimbursement through one channel may find themselves locked into that chann
even if more lucrative opportunities emerge elsewhere. A digital therapeutic tha
establishes itself as a covered benefit under Medicare may find it difficult to late
negotiate premium pricing with self-insured employers because the market will
anchor to the Medicare rate. The early path determines not just whether the con
survives but what the ceiling on ultimate value might be.

REAL OPTIONS AND HEALTHCARE PIVO

The concept of real options provides a useful lens for thinking about pre-revenu
digital health valuation. A real option is the right to make a business decision in
future based on information that doesn't exist today. A digital health company a
formation has multiple potential paths it could pursue, each of which might lead
very different outcomes. The company could target Medicare fee-for-service
reimbursement, Medicare Advantage supplemental benefits, commercial payor
medical management programs, direct-to-employer wellness, cash-pay consumer
market, or pharmaceutical partnerships for patient support programs. Each opti
has different probability of success, different timelines, and different revenue
potential.

The value of the company should theoretically reflect not just the expected value the most likely path but also the value of having the option to pursue alternative if the initial strategy fails or if new information emerges. A company with a flexi technology platform that could pivot between different reimbursement strategie more valuable than one that is locked into a single approach, all else being equal optionality is rarely explicitly valued but should be a major consideration in earl stage investment decisions.

Healthcare pivots are notoriously difficult compared to pivots in consumer technology. A consumer app that isn't gaining traction can pivot to a different us segment or monetization model relatively easily. A digital health company that h spent two years pursuing Medicare coverage cannot easily pivot to a direct-to-consumer model because they have likely built clinical evidence and product fea optimized for the medical benefit pathway. The pivot cost is high because health business models have deep structural dependencies on clinical evidence standar regulatory pathways, and contracting mechanisms that don't transfer across strategies.

This creates an interesting paradox where early-stage digital health investors sh value optionality and flexibility, but achieving meaningful progress toward any specific reimbursement pathway requires exactly the kind of strategic commitm that forecloses other options. Companies that maintain maximum optionality by keeping all potential paths open often make slower progress on any single path t focused competitors. The optimal strategy is probably to maintain adjacent optionality while driving hard toward a primary path, but distinguishing betwee valuable optionality and unfocused wandering is difficult from the outside.

WHAT ACTUALLY PREDICTS SUCCESS

After watching hundreds of digital health companies navigate the path from pro to reimbursement, certain patterns emerge about what actually predicts success. These patterns often have little to do with the factors that investors traditionally on when valuing early-stage companies. Technical product quality matters less t

expected. Clinical evidence rigor matters more than expected. Team healthcare expertise matters enormously. Timing and regulatory environment matter most

The single strongest predictor of whether a pre-revenue digital health company achieve sustainable reimbursement is whether the founding team deeply unders healthcare payment systems and has pre-existing relationships with key decision makers at CMS and major commercial payors. This sounds obvious but is freque underweighted by investors coming from traditional venture capital background where product-market fit can be achieved through rapid iteration and A/B testir Healthcare payment decisions are made by a relatively small number of people w have worked together for years and who trust specific voices. A company with a mediocre product but whose CEO previously worked at CMS and knows exactly to call at every major payor has dramatically better odds of success than a compa with a brilliant product led by first-time healthcare founders.

Clinical evidence quality and publication strategy is another strong predictor th often misunderstood by investors. The instinct from consumer tech is to move fa and iterate, launching an MVP and improving it based on user feedback. In digi health, launching before you have rigorous clinical evidence is often fatal becaus only get one chance to make a first impression on payors. A company that publis preliminary positive results in a low-tier journal may find that payors use those results as justification to deny coverage, whereas a company that waits an extra y publish strong results in JAMA creates a much stronger foundation for reimbursement. The timing of clinical evidence publication relative to reimburs strategy is one of the most important strategic decisions a digital health compan makes, and very few early-stage investors have the expertise to evaluate whether management is approaching it correctly.

Regulatory timing is perhaps the most important and least controllable factor. A company that is ready to seek Medicare coverage at exactly the moment when CI focused on that particular condition area may succeed where an identical compa with different timing would fail. The shift toward coverage of digital therapeuti mental health that occurred during and after the COVID-19 pandemic created a window of opportunity that was worth billions of dollars to companies that hapı

to be ready at that moment. Companies that were too early spent years educating market without getting paid, while companies that were too late found the opportunity already crowded. Valuing a company requires assessing not just whe their strategy is sound but whether their timeline aligns with broader regulatory payment trends that may be outside their control.

PRACTICAL APPROACHES FOR INVESTO

Given all these challenges, how should investors actually approach valuing pre-revenue digital health companies with uncertain reimbursement? The honest an is that precise valuation is impossible, but there are frameworks that can help investors make more informed decisions about relative value and appropriate pr points.

The most practical approach is to explicitly model multiple scenarios with assig probabilities rather than building a single financial model. The base case should assume no meaningful reimbursement and model the company as a cash-pay or employer-direct business. The upside case should model successful commercial adoption at realistic rates and penetration. The best case should model Medicare coverage at scale. Each scenario should be assigned a probability based on assess of team quality, clinical evidence, regulatory strategy, and market timing. The valuation can then be calculated as a probability-weighted average of scenarios, the recognition that the probabilities themselves are highly uncertain.

Investors should focus much more attention on team evaluation and much less o product evaluation than they would in typical software investing. The right team a mediocre product will likely pivot and iterate their way to product-market fit. wrong team with a great product will likely fail to navigate the reimbursement process regardless of how much users love their solution. Team evaluation shoul specifically assess healthcare payment expertise, relationships with key stakehol track record of navigating regulatory processes, and ability to think strategically about sequencing and timing.

Stage-appropriate valuation discipline is crucial. Pre-revenue digital health com should be valued like pre-revenue companies, not like early-revenue companies growth is temporarily constrained. The temptation is to look at strong user metr impressive pilot results and assign a valuation that implies successful reimburse is nearly certain. This is how investors end up with Series A companies valued a million dollars that still have no paying customers and no clear path to revenue. Better to invest at lower valuations with explicit milestones tied to reimburseme progress and strong pro-rata rights to participate in future rounds as uncertaint resolves.

Finally, investors need to be ruthlessly honest about their own edge and expertis Generalist software investors who occasionally dabble in digital health are at an enormous disadvantage relative to specialized healthcare investors who understa payment systems and have networks into CMS and major payors. If you don't ha that expertise internally or through your network, the correct valuation for most revenue digital health companies is zero. Not because the companies have no val but because you lack the ability to distinguish good bets from bad ones and will up with adverse selection. Better to pass on all deals in a sector where you can't evaluate risk than to pretend you can apply generic venture frameworks to a don that doesn't work that way.

The uncomfortable truth is that valuing pre-revenue digital health companies w uncertain reimbursement is more art than science, and investors who pretend otherwise are fooling themselves. The best we can do is acknowledge the uncert model it explicitly, invest at prices that reflect it, and build portfolios large enou that a few big successes can offset the many failures. Digital health is not softwa healthcare is not a normal market, and reimbursement risk is existential in ways are difficult to diversify away. Investors who truly understand these constraints price accordingly may find significant opportunities, because the market is full people who don't.

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