Labor Productivity in Construction

September 2025

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ABSTRACT

An important way that goods and services have gotten cheaper over time is via improving labor productivity – reducing the amount of labor it takes to make a given amount of something. One industry where it would be valuable to have steadily improving labor productivity is the construction industry: even just considering the housing sector, construction labor productivity directly impinges on the biggest expense of most Americans. Unfortunately, most measures of construction productivity show flat or declining labor productivity over time. By some estimates, productivity in the construction industry had only improved by a factor of 1.1 between 1947 and 2010, while agriculture improved by a factor of 16.1 and manufacturing improved by a factor of 8.6. A primary driving factor is that the construction industry has been limited in its ability to introduce process improvements that do not also introduce costs elsewhere in the system. This paper aims to lay out the factors driving the current path of labor productivity in the construction sector and examine strategies to raise productivity.

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Introduction

Historically, a major proportion of the cost of many goods and services has been from labor - the amount of human effort it took to produce them. Before the invention of the Bessemer Process for making steel, for instance, making steel was done by the labor-intensive cementation process, which required mixing iron ore with charcoal in a bloomery furnace to produce wrought iron, putting that wrought iron in clay chests with more charcoal, and heating the chests over a period of several days. Making a ton of steel (roughly the amount of steel in a single car) via this process would require on the order of 1,000 days of labor just to make the charcoal (Potter 2023).

Thus, an important way that goods and services have gotten cheaper over time is by way of improving labor productivity - reducing the amount of labor it takes to make a given amount of something. Understanding how labor productivity in an industry is changing over time can help us understand whether and what sort of progress is being made, and whether there are impediments to progress that could potentially be addressed.

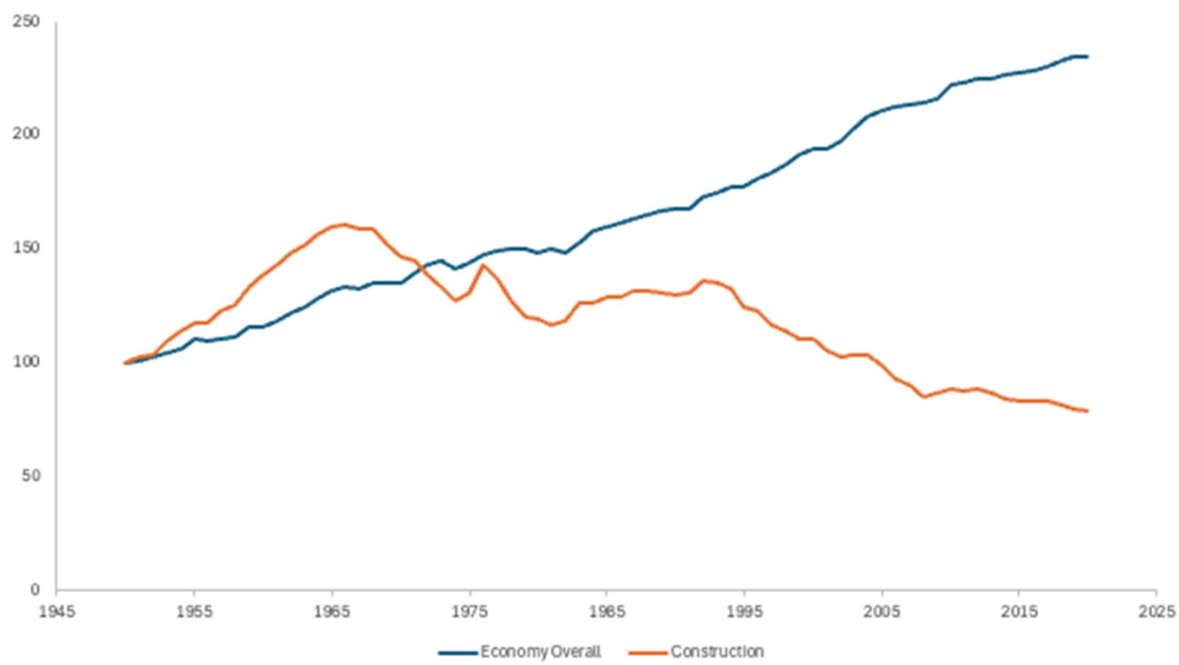
One industry where it would be valuable to have steadily improving labor productivity is the construction industry. While the construction industry's share of total US GDP is not particularly high (around 4.5 percent, compared to manufacturing at around 9.5 percent), construction is responsible for a very large share of the budget of most Americans (BEA 2025a, 2025b). For most US households, rent is by far the largest budget line item: housing costs are equal to 31 percent of income for the median US renter, and 21 percent of income for the median US homeowner paying off a mortgage (Census 2024). Housing costs, in turn, are in large part a function of the costs of construction. Around 60 percent of the sales price for a new single family home in the US is due to the costs of construction (NAHB 2023), and around half of construction costs are from labor (with the other half from materials and components). Thus, even just considering the housing sector, construction labor productivity directly impinges on the biggest expense of most Americans. If we included the labor involved in constructing other major infrastructure - power plants and transmission lines, water treatment systems, roadways - the cost paid by Americans (either directly or indirectly) would be even greater. Understanding and improving labor productivity in construction, and making it cheaper to build housing, roads, and useful infrastructure, could materially improve millions of lives.

Note: For most of this essay I'll use examples and data from homebuilding in the US, chiefly single family home building, for two main reasons. One, there exists a great deal of data on home construction in the US that doesn't exist for other types of construction. Two, a very large fraction of construction spending in the US is on residential construction. Residential construction in general makes up around 42 percent of all US construction spending, and new single family home construction is around 20 percent of all construction spending, making homebuilding very representative in terms of "what construction tasks are most commonly being done." But the issues and lessons from homebuilding will broadly apply to other types of construction as well.

Measuring construction labor productivity

Unfortunately, most measures of construction productivity show flat or declining labor productivity over time. McKinsey (2025) showed that in terms of value added per hour worked, the construction industry had only improved by a factor of 1.1 between 1947 and 2010, while agriculture improved by a factor of 16.1 and manufacturing improved by a factor of 8.6. Teicholz (2013) showed slightly declining labor productivity in construction from 1964 to 2012, while labor productivity in the rest of the economy increased by 2.5x. D'Amico et al. (2023) found that productivity rose between 1930 and 1960, after which it began to fall. Goolsbee and Syverson similarly found that construction productivity increased until the 1960s, after which it began to fall.

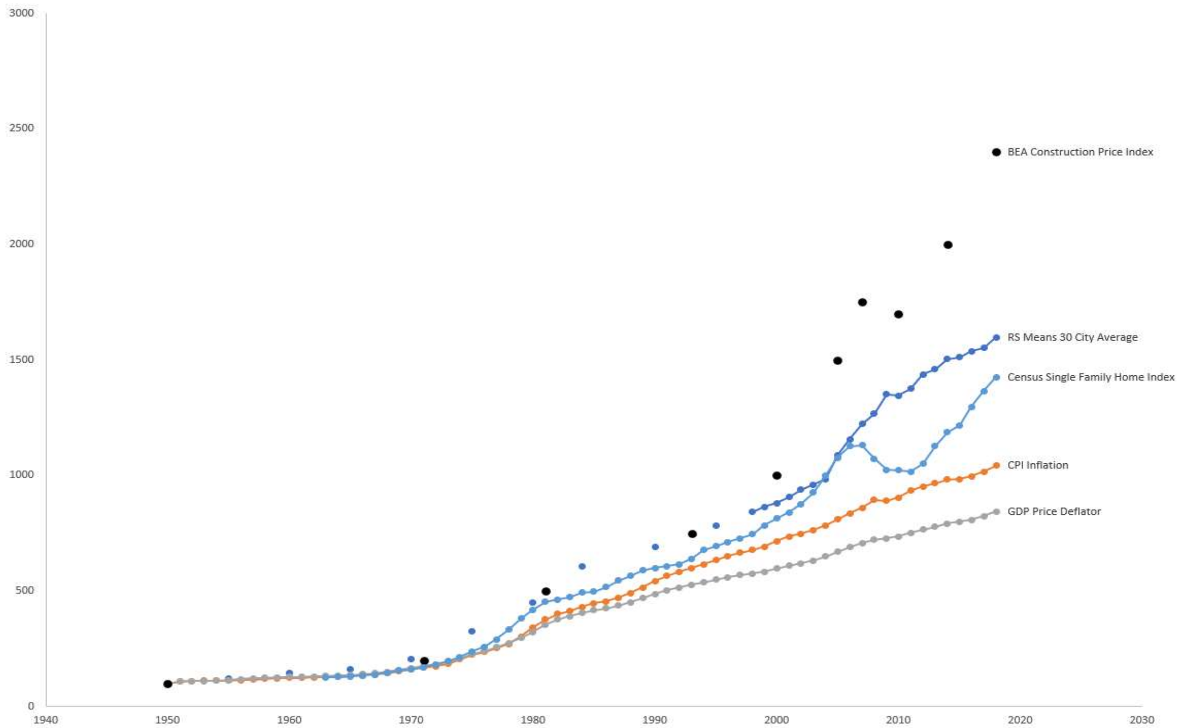
Figure 1: Productivity Changes in Construction vs. Economy Overall (1950 = 100)



Source: Goolsbee and Syverson 2025.

There are a number of potential challenges to measuring labor productivity in the construction sector, including the choice of construction output and inflation, which I consider in the appendix. But there are other ways we could track trends in construction productivity. One is to simply look at trends in construction costs. This is a more indirect measure of productivity, since it doesn't correct for inflation, or for the amount of labor input, but that also means it can't be distorted by mismeasurements in these factors. And since we often care about productivity only as a proxy for costs, looking at cost trends is useful in its own right. We can see whether construction is getting cheaper over time by comparing construction cost indexes (such as the Census SF home index) to measures of overall inflation (such as the CPI). Figure 2 shows several construction cost indexes against CPI and GDP inflation. Each construction cost index has increased faster than either method of inflation.

Figure 2: Construction Cost Inflation Indices (1950 = 100)



Source: Potter 2023.

One challenge with using construction costs is that there are comparatively few output indexes that track the costs of finished buildings: construction cost indexes tend to be input indexes that track the costs of one or more construction inputs such as lumber, steel, or construction labor. The Census SF constant quality index, and the BLS PPI indices for specific construction sectors are some of the only output indexes that exist for US construction. However, bundles of input indexes generally match the trends in output indexes.

Another way to look at trends in construction productivity is to go more granular, and look at the cost and time required to perform construction tasks over time. We can do this via construction estimating guides such as RSMeans, which publish estimates of the cost and labor required to perform a variety of different construction tasks. Goodrum (2002) used several estimating guides to calculate productivity changes of 200 different construction tasks between 1976 and 1998. He found that on average, task-level productivity actually increased over that time period, though there was significant variation between tasks.

Table 1: Compounded annual rate of change in labor and multifactor productivity for activities by division from 1976 to 1998

Construction division	Change in labour productivity 1976–1998 (compound annual rates)	Change in multifactor productivity 1976–1998 (compound annual rates)
Sitework	+2.8%	+2.4%
Doors & Windows	+1.6%	+1.8%
Metals	+1.5%	+1.0%
Finishes	+1.2%	+1.6%
Masonry	+1.2%	+0.8%
Concrete	+1.1%	+1.4%
Mechanical	+1.0%	+1.4%
Wood & Plastic	+0.3%	+0.4%
Moisture & Thermal Protection	+0.2%	+0.6%
Electrical	+0.0%	+0.8%

Source: Means, Richardson, *DCG*.

Source: Goodrum 2002.
Note: RSMeans, Richardsons' Process Plant Construction Estimating Standards, and Dodge Cost Guides.

Similarly, Potter (2023) looked at task-level productivity changes for 40 construction tasks by using RSMeans data from 1954, 1985, and 2003. Contrary to Goodrum, it found that tasks on average increased in cost roughly at the same rate as the consumer price index, and that labor productivity measured by material install rates on average didn't increase.

Another more granular way to measure productivity is to measure the amount of hours it takes to actually build something, such as an individual house. A 1969 Bureau of Labor Statistics study found that it took 85 labor hours to build 100 square feet of housing in 1962, and 82 hours in 1969. Modern estimates, based on estimating guides, find that it takes around 86.5 hours to build 100 square feet of house - a slight increase over 1962.

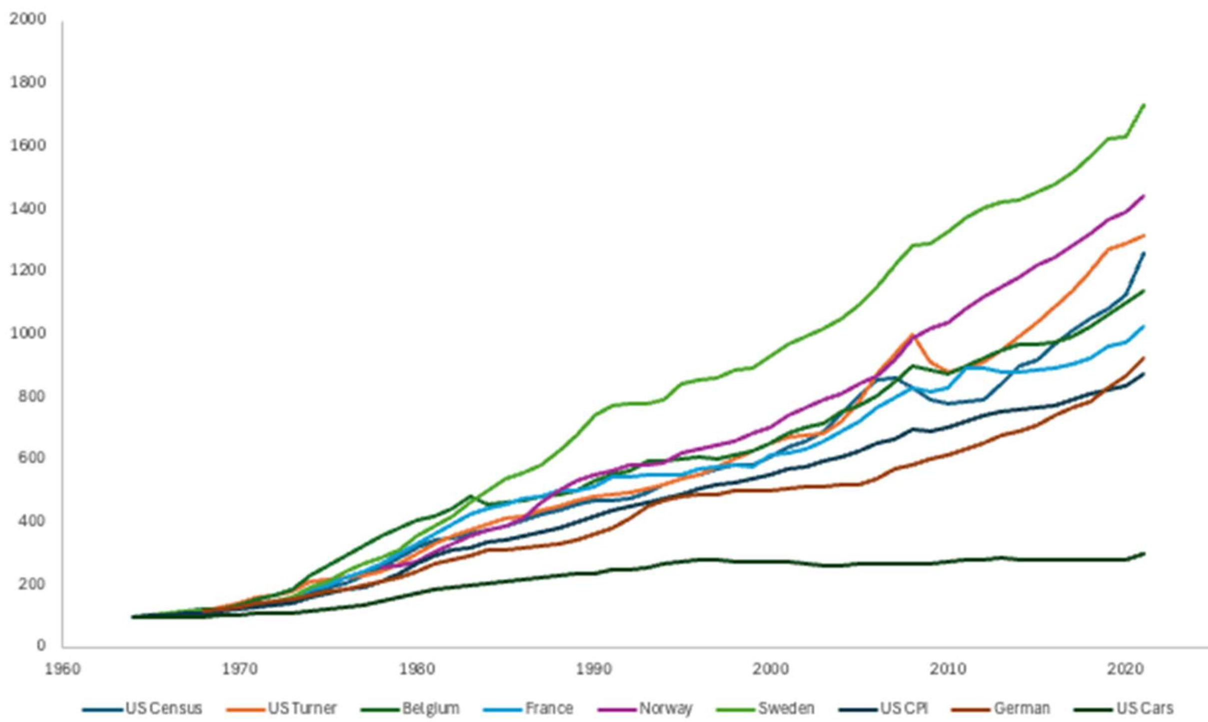
Many of these task-level measures have an issue related to the "deflator" problem: it's hard to be sure that the output of some underlying task isn't changing in some meaningful way over time. A modern single family home isn't the same as a single family home from the 60s: it has different types of mechanical systems, its more energy efficient, it has more bathrooms, and so on. The Census does try to adjust for quality changes, but it likely can't capture many of them. Similarly, the output of individual construction tasks may change meaningfully over time. For instance, modern homes must be designed to much more stringent wind and earthquake force requirements than homes in the 1960s and 70s, so even a task like exterior wall framing is likely different today (requiring the installation of more hurricane ties and holdowns) than it was historically. Measuring task-level productivity of wall-framers (how long it takes them to build 100 square feet of wall, say) that didn't correct for this would show a decline in productivity due to more work being required for wall-framing over time. (Of course, the changing nature of goods and services over time isn't simply a construction issue, but will bedevil measuring productivity in many industries. Cars, TVs, and electronics have all similarly improved in ways that are tricky to capture in productivity estimates.)

Construction productivity trends and causes

One thing that makes these challenges in measuring construction productivity somewhat less acute is that they almost universally point in the same direction. Productivity measures nearly all show stagnant, if not declining, productivity. And unlike with most manufactured goods (cars, TVs), construction costs have almost always risen as fast as, or faster than, overall inflation (as measured by CPI). This state of affairs seems to persist as far back as we have data, to the late 19th/early 20th century. And there's at least some evidence that this situation exists at the level of individual construction tasks.

It's also not simply the US that has this problem. Countries around the world show similar trends in their construction productivity.

Figure 3: International Construction Costs Over Time (1964 = 100)



Source: Potter 2025.

So while the degree of stagnation is a matter of some uncertainty, we can be confident that there's been little to no improvement, and possibly a decline, in construction productivity over a very long period of time.

What's the cause of construction's poor record of productivity improvement? This is a subject that could fill one or more books, but at a high level, the industry has been limited in its ability to introduce process improvements that don't also introduce costs elsewhere in the system. At the same time, a steadily increasing burden of regulation and administrative overhead has made it increasingly difficult to build efficiently.

Process improvement in construction is limited by a number of factors:

High variability. Making a process more efficient often relies on a process being repetitive in some manner, with the same operations being performed over and over again. But this can be difficult in construction, because so much of the process varies from building to building. Opportunities for repetitive, high-volume construction are limited by the fact that building sites differ (sizes, shapes, slopes, orientation to the sun, location of utility connections) by different permitting jurisdictions with different requirements (the US has on the order of 20,000 permitting jurisdictions), and by geographic variation in design requirements (different regions have different temperatures, different types of soil, different wind and earthquake loads, and so on).[1]

Limited economies of scale. Related to the above, there's much greater opportunities for efficiency improvement if your repetitive operation is operating at a very large scale, and will produce hundreds of thousands or millions of a given item. But this is also difficult in construction. Partly this is because buildings themselves are built in smaller numbers compared to other goods. Even the very large market for single family homes (the largest construction sector in the US) produces "only" around 1 million homes per year. By comparison, there are around 15 million cars, 100 million smartphones, and 100 billion aluminum cans sold in the US each year. And the number of single family homes is an outlier: most types of buildings don't come anywhere close to the 1 million per year mark.

Limited ability to transport bulky construction components (such as building modules) long distances due to high transportation costs limits economies of scale even more. Even if we move our construction process into a factory to try and make it more efficient, that factory will only be able to serve the relatively small market of what can be cost-effectively driven to (typically this is on the order of a day's drive). Factory-produced mobile homes, for instance, are produced in dozens of factories around the US, each one serving a small market within a short drive from the factory.

Limited gains from factory production. Most processes achieve their repetitive, high volume operations within a factory, where the production process can be controlled and specialized

[1] It's sometimes argued that variation in consumer demand - that people want unique homes - is a major contributing factor as well. However, I find little evidence of this (Potter 2022).

equipment can be used. But substantial efficiency improvements have in general not materialized with factory-based construction. Partly this is a result of the previously-mentioned issues of high variability and limited economies of scale (it's hard to make your factory particularly efficient if you're producing a relatively small number of highly variable goods). Partly it is because moving construction into a factory in many ways adds cost. Constructing your building in a factory requires breaking it into parts small enough to be shipped, transporting those parts to the jobsite, then stitching them together. This adds cost - extra transportation, extra structure in the building components so they can withstand being moved, extra connectors so they can be stitched together - compared to the conventional construction process of building on-site.

Limited room for material improvements. Roughly half the cost of constructing a single family home is the cost of materials. But making building materials substantially cheaper is difficult. Bulk building materials like lumber, drywall, and concrete are already produced in efficient, large volume factories, and are basically as cheap (in per cubic foot or per pound terms) as anything civilization produces. It's not obvious there are large opportunities in reducing their costs further. And the fact that building materials are already so cheap makes it difficult to substitute new materials that might make efficiency improvements easier. Many builders, for instance, would love to have an alternative to drywall, which is relatively time-consuming and labor-intensive to install. But while there have been many attempts to introduce alternatives, they're all substantially more expensive than drywall (Potter 2022).

The above is not an exhaustive catalog of why improving construction productivity is difficult. But they do show us the general "shape" of the construction productivity problem: namely, that it's in large part due to the nature of the construction process itself.

Levers to boost construction productivity

Given the above issues with construction productivity, what policy changes could be made to the construction industry to try and improve it?

Broadly, there are two categories of productivity improvement, each with its own set of strategies for implementation.

The first type of productivity improvement is to push places that have inefficient construction to the efficient frontier. We've been looking at productivity aggregated over the entire US, but there's a great deal of variation in construction cost and construction efficiency from place to place in the US. The 2023 Turner and Townsend construction survey, for instance, shows that the cost to build a townhouse in San Francisco or New York is nearly twice the cost to build a single family home in Houston or Dallas. Similarly, construction costs in the US are often much higher than they are in Europe for many types of building. The Second Avenue Subway in New York, described as "The Most Expensive Mile of Subway Track on Earth", cost an astounding

$2.5 billion per mile, compared to $327 million per mile for similar tunneling in Berlin and $243 million per mile in Barcelona (Rosenthal 2017, Nasri and Nicholas 2020). Simply eliminating construction inefficiencies in the highest cost areas, and bringing them more in line with worldwide best practices could have an enormous impact, especially because these high costs are typically in places of exceptionally high demand.

Areas of low productivity exist due to things like coordination failures, bad incentives, and overly restrictive regulation. For instance, construction costs in New York are so high in part because of extremely strict regulations on tower cranes, and liability law that allows workers to sue their employers for workplace injuries, driving up insurance costs (Connor 2022). Similarly, one factor that drives up the cost of US construction compared to European construction is that building an elevator is much more expensive in the US (Smith 2024). These higher costs are driven by regulations that require larger elevators in US buildings, and a powerful elevator installers union that resists efficiency-enhancing improvements like prefabrication.

Land use regulation may also have an impact on construction productivity. Most land use regulation will have the effect of limiting what can be built (a land parcel that is only zoned for single family homes), making it more difficult to start building (laws that require extensive environmental studies before construction can be begin), or require building additional things (such as the UK requirement to build an enormously expensive shield to protect bats from being harmed by a high-speed rail line) (Perry 2024). None of these will impact construction productivity directly. But there's some evidence that land use regulation may also impact construction productivity. Research by D'Amico et al suggests that land use regulation may partly be responsible for construction firms being very small, resulting in fewer economies of scale and higher building costs.

Coordination failures and bad incentives can also cause poor productivity. For instance, the high costs of mass transit in the US are partly due to the fact that transit agencies often outsource many of their design and construction functions, which leads to poor contractor management and excessive fees paid to consultants (Goldwyn et al. 2025). Similarly, the nature of construction work (done by numerous subcontractors who may have little coordination with each other, and are relying on comparatively sparse drawings which may not fully define a building) relies heavily on informal standards, common knowledge about methods of practice, tacit knowledge, and worker expertise (Potter 2025). This structure makes it difficult to introduce new, better construction methods due to high upfront costs (extra design work and worker training) and excess risk (a new, poorly understood method risks a project going massively over budget) (Potter 2021).

Policy advocacy can successfully address many of these sorts of regulatory and coordination issues. For instance, one regulation that drives up apartment building construction cost is the requirement that apartment buildings have two stairways for fire safety. European apartments, by contrast, often just have one single stairway. Advocacy by groups such as the Center for Building has helped pass laws allowing single stair construction in several jurisdictions in the US.

The second type of productivity improvement is to push the efficient frontier forward, making it possible to build buildings even more cheaply and efficiently using improved construction processes. Broadly, this means improving construction technology: new tools, materials or methods that make it possible to build more cheaply. If it were possible to automate large portions of construction work using inexpensive robots, for instance, this could theoretically greatly improve construction productivity and reduce building costs.

Developing new construction technology can be done directly, by way of funding such efforts. For instance, most new building systems need to undergo significant testing at a major testing lab such as ICC, IAPMO, or Intertek before building professionals will be willing to specify their products. The government could contribute to the development of new technology by funding this testing for new building materials and systems. It could also be done indirectly, by incentivizing it in other ways. For instance, many building codes, such as the International Residential Code that governs most single family home construction in the US, are highly prescriptive: telling the designer exactly the way a building must be built. Changing building codes to be more performance-based — to have a performance target that must be met, but not specifying the way it must be met — could make it easier and less risky to introduce novel building technologies.

With both types of productivity improvement, there are difficulties and risks with trying to pursue them, and success isn't guaranteed. Policy advocacy and regulatory changes can take an extremely long time to move forward. Model building codes, for instance, are typically only updated once every 3 or 5 years, and it can take years of advocacy to get new provisions adopted. Updated code requirements that allowed tall wood buildings made from large timber beams, columns and floors (so-called heavy timber or mass timber) took over a decade to enter the model code. And once a new requirement has been adopted by some model code (such as the International Code Council's International Building Code), it will take even longer to actually be adopted by states and have the force of law. The most recent version of the International Building Code is from 2024, but some states are still using the 2012 and 2015 versions of the code. And vested interests might lobby against code changes that harm their interests. Changing requirements to allow simpler and cheaper plastic PEX piping instead of copper pipe, for instance, have been lobbied against by plumbers unions, as PEX is easier for non-plumbers to install and so would reduce the demand for plumbers (Blumgart 2018).

With advancing technological capabilities, it's hard to be confident that any given effort will be successful. There have been numerous failed efforts to create efficient, factory-based construction methods in the US, for instance. And even if a method is successful, the long record of building costs rising faster than inflation (even during periods when building technology changed significantly) makes it hard to be confident that funding new technology will have substantial impacts on productivity. The widespread adoption of efficiency-enhancing technologies like drywall (which replaced the more labor intensive plaster), power tools, wood trusses, and prefabricated windows do not appear to have been sufficient to stop construction costs from continuing to rise over time (though they may have prevented them from rising even faster).

Conclusion

Understanding construction productivity is important, as it can aid us in understanding whether and how construction processes are improving, and what might be done to help make the industry function better. Measuring productivity can be difficult, and the factors that go into productivity (total outputs and labor inputs) are easily distorted. However, regardless of which measure we choose, we get the same or nearly the same conclusion: productivity in construction has been stagnant or declining for decades, due in large part to the nature of the construction process which makes it difficult to introduce the sort of efficiency-improving measures that have been successfully used in other industries. The main strategies we have to address this are policy changes which can push particularly inefficient places to the efficient frontier and making investments in new technology to help push that efficient frontier forward.

References

Allen, Steven. 1985. "Why Construction Industry Productivity is Declining." NBER Working Paper #1555. https://www.nber.org/papers/w1555

Blumgart, Jake. "Changes to plumbing code expected to sharply reduce Philly construction costs." WHYY. 28 September 2018. https://whyy.org/articles/changes-to-plumbing-code-expected-to-sharply-reduce-philly-construction-costs/

D'Amico, Leonardo, Edward Glaeser, Joseph Gyourko, William Kerr, and Giacomo A.M. Ponzetto. 2023. "Why Has Construction Productivity Stagnated? The Role of Land-Use Regulation." Working Paper. https://crei.cat/wp-content/uploads/2024/02/WCPS.pdf

Engineering News Record. "Engineering News Record Construction Cost Index." Accessed 18 September 2025. https://enrcostdata.com/cost-indexes

Goldwyn, Eric, Alon Levy, Elif Ensari and Marco Chitti. 2025. "Transit Costs Project: Understanding Transit Infrastructure Costs in American Cities." Accessed 17 September 2025. https://transitcosts.com/wp-content/uploads/TCP_Final_Report.pdf

Goolsbee, Austan and Chad Syverson. "The Strange and Awful Path of Productivity in the US Construction Sector." In Technology, Productivity, and Economic Growth. Edited by Susanto Basu, Lucy Eldridge, John Haltiwanger, and Erich Strassner. University of Chicago Press. https://www.nber.org/books-and-chapters/technology-productivity-and-economic-growth/strange-and-awful-path-productivity-us-construction-sector

Harris, Connor. 2022. "Deconstructing New York's Building Costs." City Journal. Accessed 17 September 2025. https://www.city-journal.org/article/deconstructing-new-yorks-building-costs

McKinsey Global Institute. 2025. "Reinventing Construction: A Route to Higher Productivity." Accessed 17 September 2025. https://www.mckinsey.com/~/media/mckinsey/business%20functions/operations/our%20insights/reinventing%20construction%20through%20a%20productivity%20revolution/mgi-reinventing-construction-a-route-to-higher-productivity-full-report.pdf

Munfah, Nasri and Paul Nicholas. "Why Tunnels in The US Cost Much More Than Anywhere Else in The World." Tunnel Business Magazine. 18 August 2020. https://tunnelingonline.com/why-tunnels-in-the-us-cost-much-more-than-anywhere-else-in-the-world/

National Association of Home Builders (NAHB). "60% of a Home's Sales Price Goes to Construction Costs " 13 March 2023. https://www.nahb.org/blog/2023/03/60-percent-of-home-sales-price-goes-to-construction-costs

Parry, Louise. "Why does it cost £100m for HS2 to protect bats?" *BBC News.* 11 November 2024. https://www.bbc.com/news/articles/c9wryxyljglo

Potter, Brian. "Debunking the 'Housing variety as a barrier to mass production' Hypothesis." *Construction Physics*. 7 October 2022. https://www.construction-physics.com/p/debunking-the-housing-variety-as

Potter, Brian. "Goolsbee and Syverson on Construction Productivity." *Construction Physics*. 26 January 2023. https://www.construction-physics.com/p/goolsbee-and-syverson-on-construction

Potter, Brian. "Which Construction Tasks Have Gotten Cheaper?" *Construction Physics*. 7 December 2023. https://www.construction-physics.com/p/which-construction-tasks-have-gotten

Potter, Brian. "Comparing Process Improvement in Manufacturing and Construction: Duco vs. Drywall." *Construction Physics*. 17 November 2022. https://www.construction-physics.com/p/comparing-process-improvement-in

Potter, Brian. "Building Complexity and the Construction Community of Practice." *Construction Physics*. 25 August 2021. https://www.construction-physics.com/p/building-complexity-and-the-construction.

Potter, Brian. "The Rise of Steel: Part I." *Construction Physics.* 5 January 2023. https://www.construction-physics.com/p/the-rise-of-steel-part-i

Potter, Brian. "Why It's Hard to Innovate in Construction." *Construction Physics*. 30 June 2021. https://www.construction-physics.com/p/why-its-hard-to-innovate-in-construction.

Rosenthal, Brian M. "The Most Expensive Mile of Subway Track on Earth" The New York Times. 28 December 2017. https://www.nytimes.com/2017/12/28/nyregion/new-york-subway-construction-costs.html

Smith, Steven Jacob. “The American Elevator Explains Why Housing Costs Have Skyrocketed.” 8 July 2024. https://www.nytimes.com/2024/07/08/opinion/elevator-construction-regulation-labor-immigration.html

Teicholz, Paul. 2013. “Labor-Productivity Declines in the Construction Industry: Causes and Remedies (Another Look).” AECbytes. Accessed 17 September 2025. https://www.aecbytes.com/viewpoint/2013/issue_67.html

Turner Construction. “Turner Business Cost Index.” Accessed 18 September 2025. https://www.turnerconstruction.com/cost-index

US Bureau of Economic Analysis (US BEA). 2025a. “Value Added by Industry: Construction as a Percentage of GDP (VAPGDPC).” FRED, Federal Reserve Bank of St. Louis, last updated June 16. https://fred.stlouisfed.org/series/VAPGDPC

US Bureau of Economic Analysis (US BEA). 2025b. “Value Added by Industry: Manufacturing as a Percentage of GDP (VAPGDPMA).” FRED, Federal Reserve Bank of St. Louis, last updated June 16. https://fred.stlouisfed.org/series/VAPGDPMA

US Bureau of Economic Analysis. 2025c. “Employment by Industry.” Accessed 18 September 2025. https://www.bea.gov/data/employment/employment-by-industry

US Bureau of Labor Statistics. 2025. “Employment by major industry sector.” Accessed 18 September 2025. https://www.bls.gov/emp/tables/employment-by-major-industry-sector.htm

US Census Bureau. 2025a. “Characteristics of New Housing – Current Data.” Accessed 18 September 2025. https://www.census.gov/construction/chars/current.html

US Census Bureau. 2025b. “Nearly Half of Renter Households Are Cost-Burdened, Proportions Differ by Race.” Accessed 17 September 2025. https://www.census.gov/newsroom/press-releases/2024/renter-households-cost-burdened-race.html

Appendix: Issues when measuring construction productivity

Measures of construction productivity are all constructed in similar ways. They start with some measure of overall construction output, often dollars spent on construction. (McKinsey, Teicholz, and Goolsbee and Syverson cited above all use dollar-denominated construction output, while D'Amico uses a different measure, total number of homes produced.) This measure can be obtained from sources such as the Census or the Bureau of Labor statistics, which each track construction spending (and in the case of the Census, total number of homes built).

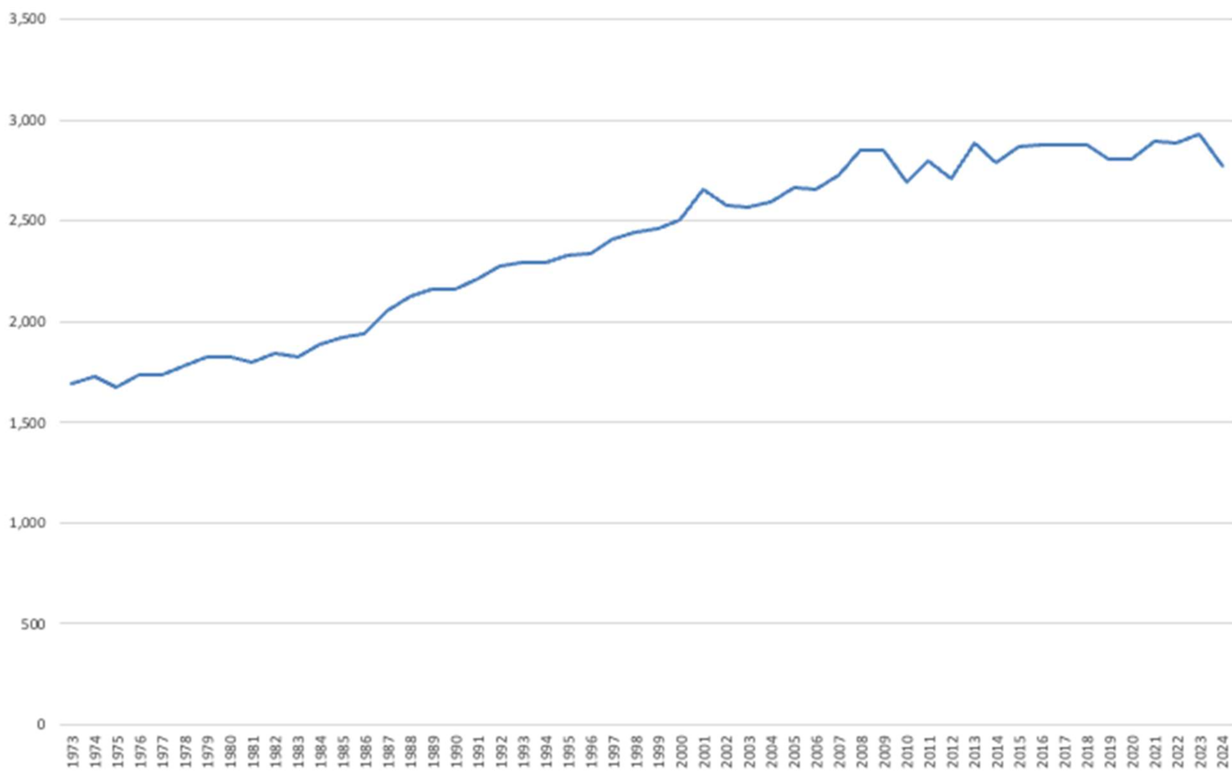
For dollar-denominated measures of output, the values need to be corrected for inflation using a deflator. Two common, widely known deflators are the consumer price index (CPI) (which measures the change in price of a basket of consumer goods over time), and the GDP deflator (which measures the change in price of goods and services across the entire economy). There are also a variety of construction-specific deflators that we can use. Teicholz 2013 uses a variety of different deflators, and Goolsbee and Syverson use a Bureau of Economic Analysis deflator. (D'Amico, which doesn't use dollar-denominated output, does not require a deflator.)

Once we have our inflation-adjusted measure of construction output, we then divide it by some measure of total labor input, such as the Bureau of Economic Analysis' (BEA) and BLS measures of the number of employees in the construction sector (BEA 2025c, BLS 2025). Goolsbee and Syverson, for instance, use full and part-time construction employment measured by the BEA, and total employment measured by the BLS. Dividing construction outputs by labor inputs gets us labor productivity, in terms of output per employee or output per labor-hour.

There are several issues when using these sorts of measures of construction productivity. One is that measures of construction output often lump together many different types of construction. They also clump together activities that are taking place in many different geographic areas - construction in Texas is lumped together with construction in California and New York. The Census' value of construction put in place survey, for instance, includes every type of construction done in the US - housing construction, skyscraper construction, interstate highway construction - across every state in the union. If different types of construction or different geographic locations differ in their labor productivity, then changes in the type and location of construction - what we might call changes in the output mix - will show up as a change in construction productivity, even if no such change in productivity took place. When Allan 1985 looked at construction productivity, he found that changes in the output mix from 1968 to 1978 - workers moving from capital intensive civil construction to labor intensive single family home construction - was responsible for the lion's share of the measured decrease in productivity.

Even narrower measures of construction output are susceptible to distortion due to changes in the output mix. The D'Amico paper noted above, for instance, uses total number of homes built as its measure of construction output, and "homes built per employee" as its measure of productivity. But homes in the US have changed over time. For one, the size of new homes steadily grew larger over the course of the 20th and early 21st centuries, from around 1500 square feet to over 2500 square feet. Since larger homes take more labor to produce, with correction simply measuring homes per employee would show a substantial productivity decrease even if productivity in terms of material deployment rates stayed the same. (A common correction for this is to use something like "square feet per employee" rather than housing units per employee.)

Figure A1: Average Square Footage of New US Single Family Homes



Via Census (2025).

Another key challenge in measuring productivity is in the use of deflators. As we noted, there are a variety of deflators specific to the construction industry, such as the Turner Building Cost Index (which tracks the cost of new buildings) and the Engineering News Record Construction Cost Index (which tracks the price of a basket of construction inputs) (Turner Construction nd, Engineering News Record nd).

Broadly, construction-specific deflators can be classified as either input deflators (which track the price of construction inputs, such as materials or labor), or output deflators (which track the price of construction outputs, like finished buildings.) Most construction deflators are input deflators, which track the cost of one or more construction inputs (such as materials or labor).

The ENR Construction Cost Index, for instance, tracks the price of 200 hours of labor, 25 tons of structural steel, 1.128 tons of portland cement, and 1088 board feet of 2x4s.

A problem with using input cost deflators is that they can underestimate gains in productivity, because they assume a constant relationship between input and output. As Goodrum 2002 notes, “Construction real outputs adjusted using input cost indices do not necessarily reflect innovation and design improvements in construction”:

> *The input cost index deflates output and uses the assumption that a constant relationship exists between the input and output. An input cost index also assumes that productivity is constant (Pieper, 1989). Many have found evidence that input cost indices in construction have overestimated construction inflation, thereby underestimating real output and understating labour productivity (Dacy, 1965; Gordon, 1968; Rosefielde and Quinn Mills, 1979). In fact, Allen (1985) acknowledged that half of the productivity declines reported in his study were a result of the inaccuracies of adjusting for construction inflation.*

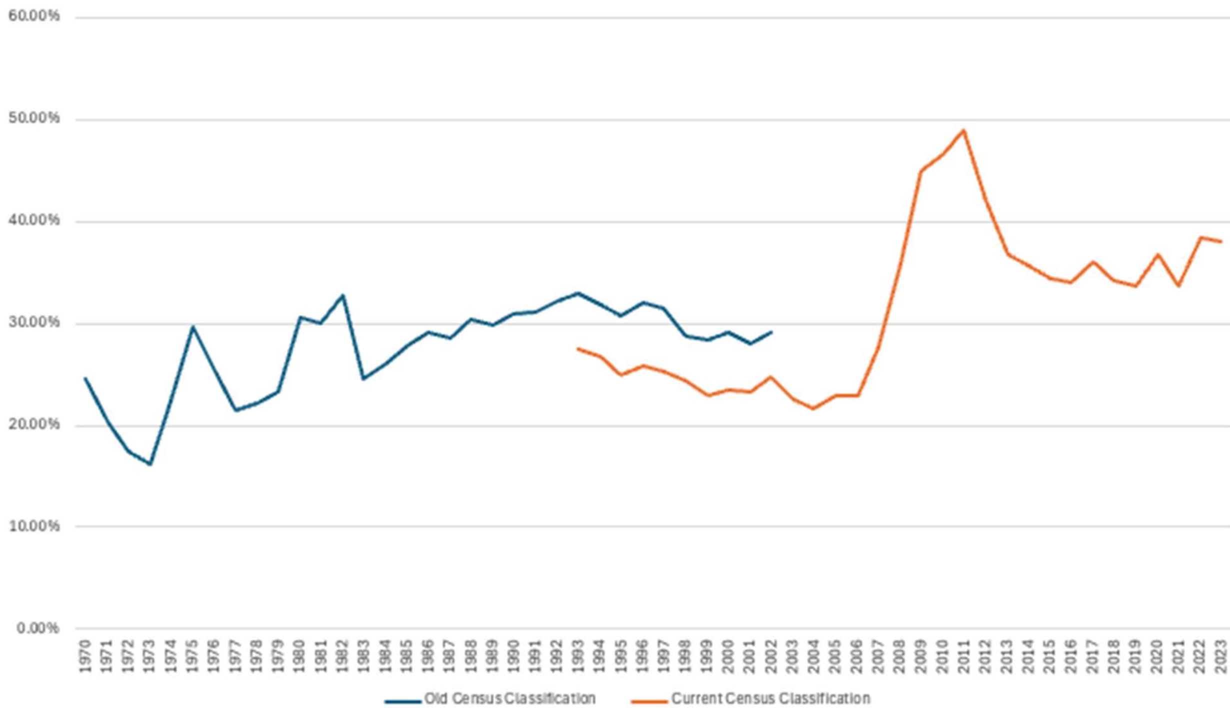
More generally, different deflators will often have significant variation between them, and it’s not uncommon for a deflator with an unusually high level of price increase to cause distortions in measured construction output and/or construction productivity. In the Goolsbee and Syverson paper above, the authors note that much of the decline in productivity is the result of using a BEA construction price index as a deflator, which has risen much faster than other construction cost indexes.

In practice, it's common for investigations of construction productivity to use multiple deflators to ensure robustness. Teicholz’ analysis above, for instance, shows trends in labor productivity using no less than seven different deflators.

Other than total construction output (and the deflator used when output is dollar-denominated), it can also be challenging to measure total labor required. This is difficult for similar reasons as measuring construction output: measures are often very high-level, lumping together employees doing distinct activities, and a shift in the worker mix can potentially distort productivity estimates.

For instance, as we noted the D’Amico paper above uses housing units per employee as its productivity measure, dividing the number of homes produced by the total number of workers employed in residential construction. But residential construction includes more than just building new homes, it also includes home renovations. If the fraction of construction workers doing home renovations changed over time, this would cause a drop in homes built per employee, even if actual productivity of the workers building homes didn’t change. And indeed, since 1970 the fraction of residential construction spending going towards renovations has roughly doubled, now making up nearly half of all residential construction spending.

Figure A2: Fraction of Residential Construction Spending Going Towards Renovations



Source: Census 2025.