Evaluating Disaggregated Capital Stock Statistics for U.S. States

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August 27, 2025

Abstract

The Bureau of Economic Analysis (BEA) publishes national statistics on fixed capital stocks, yet no official measures exist at the state level, limiting regional economic research. This paper explores alternative methods to construct state-level capital stock series consistent with national totals and evaluates their performance. We develop three measures that vary in their allocation strategy: (1) allocating national industry capital stocks to states using value added shares, (2) allocating investment using value added shares and applying the perpetual inventory method (PIM), and (3) allocating investment using state-level capital spending from the Annual Survey of Manufactures and constructing stocks via the PIM. We assess these measures against theoretical and empirical benchmarks, focusing on (i) the joint dynamics of capital, employment, and compensation, and (ii) the predictive relationship between Tobin's Q and subsequent labor market outcomes. The results provide mixed evidence: while no method is uniformly superior, the third approach more closely aligns with theory and demonstrates stronger predictive validity. Notably, high Tobin's Q is associated with rising compensation but a weaker and less persistent employment response, highlighting an unresolved puzzle in the interaction of capital, labor, and productivity at the regional level. These findings underscore both the feasibility and the challenges of constructing state-level capital stock measures, and they point to the importance of using data tied directly to capital purchases in order to capture underlying economic dynamics.

1 Introduction

For many decades, the Bureau of Economic Analysis (BEA) has published statistics on stocks of fixed capital as part of the national income and product accounts. Such statistics are invaluable for evaluating national total and industry-level productivity levels as well as in the compilation of statistics on consumption of fixed capital (i.e., depreciation) that are integral to net measures of production. However, while BEA publishes a number of statistics by subnational areas such as states and counties, it does not publish capital stock statistics for any region other than the country as a whole.

The limitation in the scope of published capital stock statistics can be traced to limitations in the availability of source data as well as difficulties in identifying the locations in which fixed capital stocks are attributable. In terms of source data limitations, while in many cases establishment or household surveys offer excellent information on the construction or purchase of capital goods nationally, sample size problems (and thus potential confidentiality issues) may preclude publication of state statistics. In terms of difficulty in identifying location, while a building typically remains in the same location after it is constructed, other capital goods such as machines, vehicles, or software programs are movable to varying degrees. The former difficulty can be addressed via existing data where assumptions link these data to state capital stocks, while the latter will likely require ongoing research on the topic.

In this paper, we consider possible paths forward for constructing measures of capital stocks by state by compiling such measures under various assumptions and then evaluating them. We evaluate these measures in two ways. First, we consider the short- and long-run relationship between the growth of real capital stocks

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and the growth of employment or real total compensation. Second, we consider the relationship between future employment on real total compensation growth and the ratio of the replacement cost of the market value of capital to its average cost, i.e., Tobin's Q (hereafter, "Q"). Broadly, the value of Q should be related to whether industries wish expand or contract their operations in the state.

Capital stocks are an important input to study a variety of questions. These questions include regional convergence ([4]), the effects of labor supply shocks on regional labor markets ([8]), and the relationship between capital flows and productivity ([13], [5]). Without official measures of capital stock, researchers are required to use proxies (e.g., [5]) or to construct their own series (e.g., [4]).

The methods that we consider are grounded in what others have done to construct measures of capital stock by state. This rather compact literature includes two (relatively) recent studies. In one, [4] appoint capital by industry to states using value added shares. This is a relatively simple application, as it requires only statistics that are already published as part of the national income and product accounts (NIPAs) and of the regional economic accounts (i.e., value added by state and industry). Yet while parsimonious, the assumption that at the industry level, value added and capital stocks are proportional is very strong. For example, if capital and labor are the only inputs and production follows a Cobb-Douglas functional form, a constant ratio of capital and output across states would require a constant rental rate of capital across states. While an assumption of free capital mobility would imply equalized rental rates and constant productivity, such an assumption would be unlikely to hold in the short term. Moreover, CES or other more complex functional forms, combined with an assumption of a constant output to capital, would typically require that rental rates, wages, and productivity follow a rather complicated functional relationship across locations.

[12] construct a long panel of farm, manufacturing, and non-manufacturing capital stocks by state. Their measure of manufacturing capital combines several sources, including the Census of Manufactures and the Annual Survey of Manufactures (ASM). While more complex than the method of [4] in some ways, their measures of manufacturing capital stock do not appear to be segregated by industry, and so are constructed under the assumption that overall capital values or capital spending for all manufacturing industries are good allocators for total manufacturing capital stocks or formation. It is also unclear if manufacturing capital stocks and investment levels are benchmarked to NIPA totals, but this does not generally seem to be the case.

In this paper, we contruct three separate measures of capital stocks by state with methods that vary from the one applied by [4] to a modified method that is more similar to that of [12]. In doing so, we follow several key principles. First, we construct measures of capital stock for as fine a level of industry classification as possible, and then sum to generate sector totals (by state). Second, we ensure that all measures of investment, depreciation, and capital stock aggregate to NIPA totals for each industry. Finally, we construct measures of depreciation rates (when needed) based on the average depreciation rates of capital in the NIPAs for each industry, rather than based on an assumed depreciation rate.

In our first measure of capital stocks by state, we allocate capital stocks to states directly for each industry, using industry value added by state. This is the method of [4]. In our second measure of capital stock by state, we use the same allocator (industry value added by state), but allocate investment by industry to states rather than capital stocks. We then use the perpetual inventory method (PIM) to construct capital stocks by state. In our third method, we use capital spending in the ASM by industry and state to allocate investment by industry to states. Capital stocks are computed using the PIM.

To assess these measures of capital stock, we tie them to economic theory. The analysis of capital stocks builds on straightforward economic theory: when a region experiences a positive, industry-specific productivity shock, the marginal products of both labor and capital rise, unit costs fall, and firms expand output. With reasonably elastic local supplies, both employment and capital use increase, though magnitudes depend on factor supply conditions, adjustment costs, and the tradability of output. Only in extreme cases—such as highly inelastic labor supply paired with strong substitutability—would one input's response be muted. Overall, the theoretical prediction is robust: productivity shocks raise both employment and capital jointly, even if their timing differs. Regional economics research provides strong support for this joint response. Studies from [2] through [7] show that local labor markets adjust powerfully to shocks, with investment booms producing complementary employment growth across diverse contexts. Evidence from the U.S. and Europe—from Alaska's pipeline construction to coal sector shocks to FDI inflows—consistently highlights that localized productivity or capital shifts drive job creation alongside capital deepening.

Against this backdrop, Tobin's Q offers a forward-looking measure that can sharpen the analysis of

regional growth. Defined as the ratio of a firm's market value to the replacement cost of its assets, Q signals expected profitability: values above one suggest attractive returns and predict future expansion. Although most empirical work links Q to investment, the same intuition extends to employment and compensation. Firms with elevated Q values—whether during the late 1990s tech boom or in sectors with broad-based employee stock ownership—have tended to expand payrolls and raise pay, suggesting that financial valuations and labor market outcomes are closely connected. Extending this insight to the regional level, industries and states with high Q should experience stronger subsequent growth in jobs and total compensation, as investor optimism translates into local hiring and investment. Regions dominated by high-Q industries, such as Silicon Valley in the internet era, illustrate this mechanism, while declining low-Q sectors reveal the opposite dynamic. Thus, Tobin's Q provides a useful test of whether alternative capital stock measures meaningfully predict future state-industry growth.

2 Methods

As noted above, we propose three methods to construct capital stock measures by state. These are discussed in turn, including information about data sources.

2.1 Method 1: Value-added capital stock allocation

In the first approach, for each year, we distribute the industry-specific national capital stocks to each state by the state share of that industry's value-added for years between 1998 and 2021. This method is similar to that employed by [4].

$$k_{i,s}(t) = \left[\frac{y_{i,s}(t)}{Y_i(t)}\right] K_i(t), \text{ where} \tag{1}$$

$$K_s(t) = \sum_i k_{i,s}(t). \tag{2}$$

where $\frac{y_{i,s}(t)}{Y_i(t)}$ is the share of state s's nominal value-added in the industry i and $K_i(t)$ is the fixed-cost national capital stock for industry i. Then we sum over all industries i, for each state s to calculate state capital stock for each year.

2.1.1 Data sources

National capital stock controls are obtained from BEA website under "Fixed-Cost Net Capital Stock of Private Nonresidential Fixed Assets." State- and industry-level value-added shares are calculated using the state- and industry-level GDP. As noted above, under Cobb-Douglas technology, this method embeds the assumption that within each industry, each state has the same production technology and faces the same rental rate of capital.

2.2 Method 2: Value-added investment allocation and perpetual inventory

In the second approach, rather than sharing out capital stocks as in method 1, in method 2, we use the perpetual inventory method for each state to calculate the state-level capital stock for years between 1998 and 2021:

$$K_s(t+1) = K_s(t) + Inv_s(t+1) - Depr_s(t+1) \tag{3}$$

We calculate the initial state-level capital stock in 1998 ($K_s(1998)$) by sharing out national capital stocks with industry value added, as in method 1. Next, in order to create state-specific investment ($Inv_s(t+1)$) and depreciation ($Depr_s(t+1)$), we use the shares computed in method 1 to distribute national industry-specific investment and depreciation to each state based on the share of the industry-specific value added of that state (relative to the total value added of the industry).

2.2.1 Data sources

We use the same sources as in method 1 to calculate the initial state-level capital stock in 1998. National investment data are from BEA's "Fixed-Cost Investment in Private Nonresidential Fixed Assets" tables for each industry and year. Depreciation data are from BEA's "Fixed-Cost Depreciation of Private Nonresidential Fixed Assets" tables for each industry and year.

2.3 Method 3: Capital expenditures investment allocation and perpetual inventory

In this method, we compute the state-level capital by industry using capital expenditures by industry and perpetual inventory. We use source data from manufacturing capital and investment expenditures by state from the Annual Survey of Manufactures (ASM).

$$K_{i,s}(t+1) = K_{i,s}(t) + Inv_{i,s}(t) - Depr_{i,s}(t) \tag{4}$$

Initial state-level capital stocks (by industry) in 1998 are computed in the same manner as in the above methods. Then, we use capital expenditure shares to calculate each industry's investment and state's depreciation rate for each industry.

$$Inv_{i,s}(t) = Inv_i(t)^{NIPA} \left[\frac{Inv_{i,s}(t)^{ASM}}{Inv_i(t)^{ASM}} \right] \tag{5}$$

$$Depr_{i,s}(t) = K_{i,s}(t) \left[\frac{Depr_i(t)^{NIPA}}{K_i(t)^{NIPA} + Inv_i(t)^{NIPA}/2} \right] \tag{6}$$

2.3.1 Data sources

To our knowledge, ASM manufacturing data by industry and state are not available in electronic format, and so were digitalized from various Census Bureau publications.

2.4 Calculation of Tobin's Q

Calculation of the market valuation of all firms operating within an industry/state is not possible based stock market values, as these are reported only for companies that are publically traded. Rather than using a direct measure of market value, we impute firm market value based on a formula that depends on industry operating surplus and consumption of fixed capital. The formula that we use is:

$$Q_{i,s}(t) = \frac{GOS_{i,s}(t) - Depr_{i,s}(t)}{(r-g)K_{i,s}(t)} \tag{7}$$

where GOS is gross operating surplus, $Depr$ is consumption of fixed capital, r is the investors' expected return on capital, and g is a growth rate of profits. We selected a value for $r-g$ of 6% (0.06), in line with the existing literature. $Depr$ is depreciation (based on our estimated capital stocks and average industry-level depreciation rates). GOS is from BEA's GDP by state statistics, deflated using the industry-specific implicit value-added deflator also from BEA's GDP by state statistics.

3 Evaluating capital stock measures

The analysis of capital stocks draws from simple economic theory. A positive, industry-specific productivity shock in a given region would raise the marginal products of both capital and labor, lowers unit costs, and induces firms to expand output. With reasonably elastic local supplies of labor and capital, firms respond by scaling up both inputs, so employment and capital both rise. The precise magnitudes depend on local factor supply conditions, adjustment costs, and the tradability of output, but under most plausible settings the predicted signs remain clear: a productivity shock leads to higher employment and higher capital use. Only in extreme cases—such as highly inelastic local labor supply combined with strong substitutability—would

the response of one input be muted. Overall, standard production theory predicts that productivity shocks increase both employment and capital jointly, even if their timing differs.

A large body of regional economics research supports this joint response of labor and capital to localized shocks. Classic work by [2] shows that state-level labor markets adjust strongly to demand shocks, with employment initially falling or rising and migration and wages gradually restoring equilibrium. [7] extends this view, showing that productivity shocks in concentrated industries propagate to local labor markets, producing gains in both employment and complementary capital formation, as well as spillovers into local services. Empirical studies of specific investment booms reinforce this pattern: [3] documents substantial employment multipliers from pipeline construction in Alaska; [1] show asymmetric job effects from coal industry shocks; and Bound and Holzer (2000) demonstrate that metro-area labor demand shocks affect both employment and wages, with differential impacts across skill groups. More recent European evidence (e.g., [9]) confirms that capital inflows—whether from subsidies or foreign direct investment—reliably generate local job growth. Taken together, this literature highlights that regional labor markets respond strongly to capital-linked shocks, and that productivity or investment shifts tend to raise both employment and capital at the local level.

While the relationship between capital stocks and labor inputs may be insightful, it is difficult to use for forming conclusions about different capital stock measures, because the timing of the responses and the sources of variation in economic conditions are not explicitly known. On the other hand, Tobin's Q provides a clear forward-looking relationship that can be tested directly. Tobin's Q is the ratio of a firm's market value to the replacement cost of its assets. Intuitively, it measures the expected profitability of capital: a Q above 1 indicates that the market values a firm's assets more than their cost, signaling attractive returns on new investment; this links a high value of Q to stronger future growth [6]. Empirical research generally supports this connection: Tobin's Q is widely used as a forward-looking indicator of growth opportunities. For example, [10] argue that average Tobin's Q is a strong predictor of *future* growth prospects, even more so than marginal Q measures. In practice, periods of elevated Q have often coincided with surges in investment, a classic case being the late 1990s stock market boom that spurred a spike in business capital expenditures (especially in tech equipment).

While typically Q is viewed as a predictor of future investment, we will focus on employment and total compensation. Even though the relationship between Q and investment has a firmer basis, we eschew such tests because our measures of investment and Q are changing between methods. We wish to compare our capital stocks to identical measures of future growth. The intuition is similar: if financial markets value a firm or sector much above the cost of its assets, it suggests optimism about future earnings and expansion, which may include workforce expansion. One illustrative study examines U.S. companies that implemented broad-based employee stock option plans—these firms, which gave stock options to many employees, tended to have significantly higher Tobin's Q and also faster employment and sales growth than otherwise similar firms[11]. In fact, companies with high-Q valuations and broad employee ownership saw their headcounts expand more rapidly, indicating that strong market valuations went hand-in-hand with job growth in these firms[11]. More broadly, periods of booming stock market valuations in the U.S. have often coincided with falling unemployment and rising employment. For example, the late 1990s saw tech companies' Q ratios skyrocket, and those firms aggressively hired—contributing to rapid job creation and a nationally falling unemployment rate. Similarly, by the late 2010s, U.S. corporate$Q$ values were very high and the labor market was historically tight (unemployment at record lows), indicating how strong financial valuations can correlate with broad-based hiring.

Most studies of Tobin's Q and growth have been conducted at the national or firm level, but the core insights extend to regional and industry contexts. In principle, a state-industry with a higher Tobin's Q (i.e. firms in that location and sector valued highly relative to their assets) should experience stronger subsequent growth in jobs and pay than a state-industry with a low Q. If investors believe a particular industry in a given state has bright prospects – say, Texas's energy sector during an oil boom or California's tech industry during an internet boom – that optimism is reflected in a higher Q for firms in that sector. Those firms are then likely to increase investment in that state and hire more workers, driving up total compensation in the region. Indeed, anecdotal evidence abounds: regions dominated by high-Q industries often see faster growth. For example, the surge of tech valuations in the late 1990s translated into rapid employment and income growth in tech hubs like Silicon Valley and Seattle. Conversely, regions concentrated in low-Q industries (e.g. declining manufacturing in the 1980s Midwest) struggled with slower job and wage growth.

While formal studies explicitly linking state-level Q to future state-industry growth are limited, related research on regional booms is consistent with Q-theory dynamics. Regional economists often find that local labor markets respond strongly to industry investment shocks; a high Q is precisely a signal of such impending shocks. [7] shows that localized productivity or demand shocks propagate to employment, wages, and migration flows, with substantial in-migration following positive shocks and out-migration following negative shocks. Thus, our expectation is that the Tobin's Q would be predictive of that state-industry's future growth in employment and compensation. If one version of Q more accurately reflects the capital base (perhaps by better accounting for intangible or locally specific assets), it should better foresee growth in that context.

4 Results

We first discuss the an analysis of the correlation between labor market conditions (employment, real compensation) and capital stocks based on the three methods, in both levels and growth rates. We then discuss the relationship between Tobin's Q based on the three methods and subsequent labor market conditions.

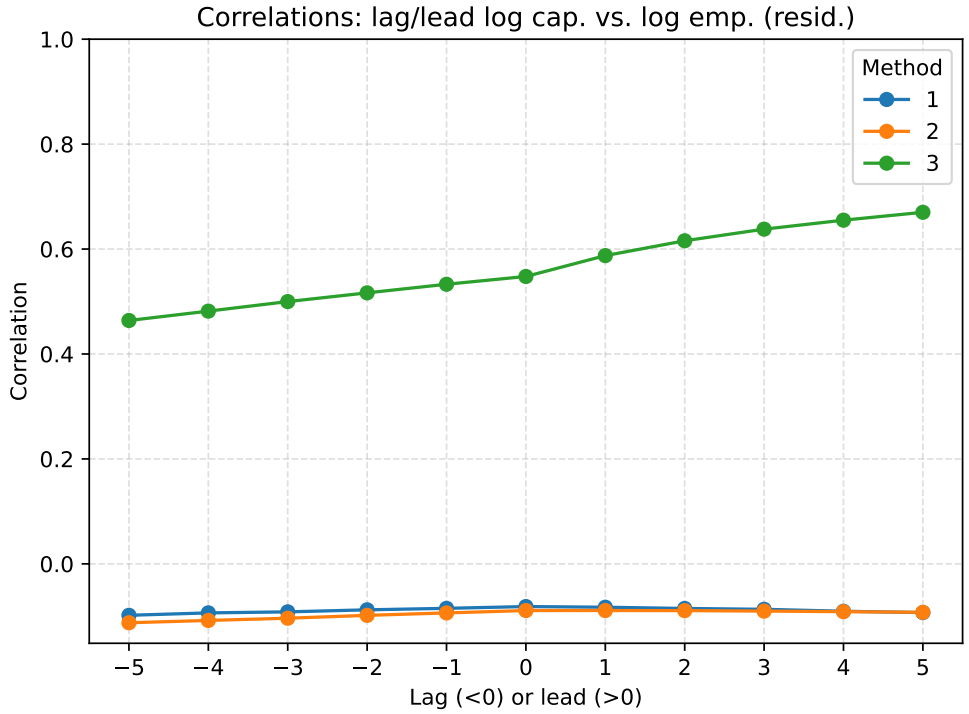
4.1 Correlation analysis

Figure 1 plots correlations between log employment and log capital, conditional on state, industry, and year fixed effects, across a range of capital leads and lags. Methods 1 and 2 display consistently negative correlations, indicating little evidence that higher capital stocks are followed by subsequent gains in employment. In both cases, the correlations remain below zero across all horizons, suggesting that the measured association between capital and employment is weak or even inverse once fixed effects are accounted for. Method 3, however, stands out. Here the correlations are positive and sizeable at short lags, peaking around one to two years, and remain elevated relative to the other specifications. This pattern implies that under the assumptions of method 3, capital stocks are more tightly linked to subsequent employment levels than in the alternative specifications.

Figure 2 presents the corresponding correlations for log real compensation, again conditional on state, industry, and year fixed effects. As with employment, methods 1 and 2 yield negative correlations across the entire range of lags and leads, pointing to a lack of systematic positive association between capital and compensation under those specifications. Method 3 once again departs from this pattern, with correlations that are clearly positive at short lags and more persistent across horizons. Compared with employment, the compensation correlations under method 3 are stronger and remain elevated for a longer span of lags, suggesting that capital accumulation is associated not only with higher employment but also with more durable increases in compensation. Together, the two figures highlight that the apparent relationship between capital and labor outcomes depends critically on the way capital is measured, with method 3 yielding the only specification in which positive short-lag correlations emerge.

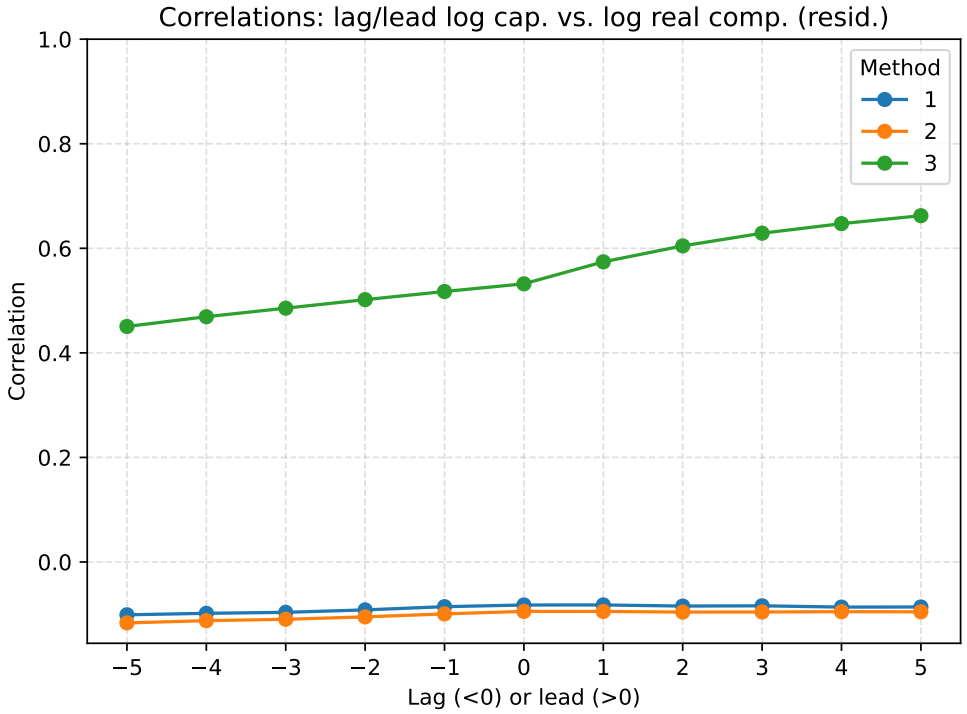
Figure 3 shows correlations between capital growth and employment growth, conditional on state, industry, and year fixed effects. In contrast to the level-on-level results, methods 1 and 2 here display a clearer pattern: the correlations are positive at short lags of capital, peaking around one to two years, and then taper off toward zero at longer horizons. This indicates that, when focusing on growth rates rather than levels, capital growth in these specifications is associated with subsequent employment growth, even outside of method 3. Method 3 also exhibits positive short-lag correlations, but the differences across methods are less pronounced than in the levels case, as all three specifications now produce a broadly similar short-run relationship between capital and employment growth.

Figure 4 presents the analogous results for capital growth and real compensation growth. Again, methods 1 and 2 yield positive correlations at short lags, with magnitudes comparable to or slightly stronger than those for employment growth. Method 3 continues to produce the highest and most persistent correlations, but the gap between it and the other specifications is narrower than in the levels analysis. Taken together, these growth-on-growth results suggest that the short-run link between capital and labor outcomes is robust across specifications, whereas the levels correlations were highly sensitive to method choice. In growth rates, even the more restrictive methods 1 and 2 point to a systematic positive association, with method 3 amplifying and extending the pattern.



Source: Bureau of Economic Analysis

Figure 1: Employment correlation with real capital stocks (conditioned on state, industry, and time fixed effects)



Source: Bureau of Economic Analysis

Figure 2: Real compensation correlation with real capital stocks (conditioned onr state, industry, and time fixed effects)

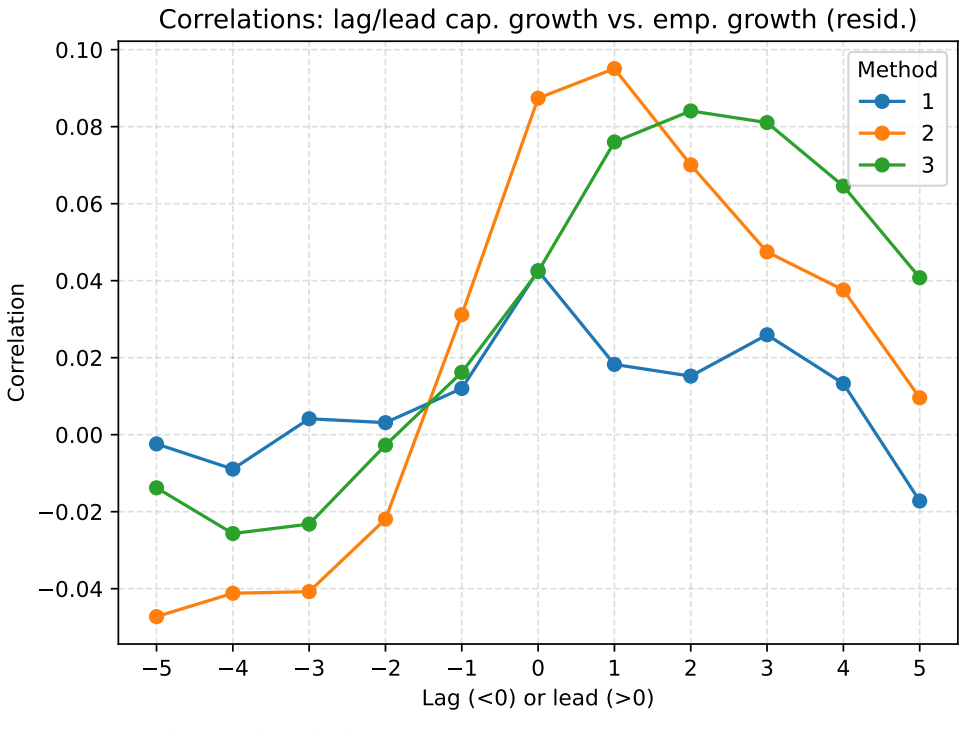


Figure 3: Employment growth correlation with real capital growth (conditioned on state, industry, and time fixed effects)

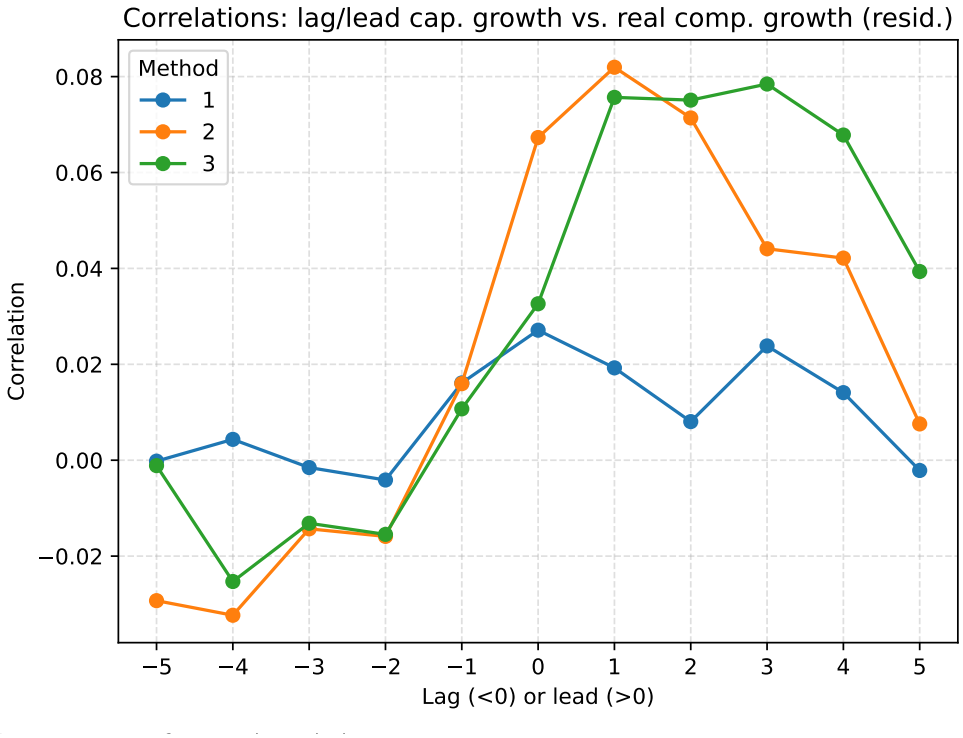


Figure 4: Real compensation growth correlation with real capital growth (conditioned on state, industry, and time fixed effects)

4.2 Short-Run Results - Tobin's Q

Table 1 presents the results analyzing the relationship between real compensation growth and various forward-looking and contemporaneous measures of capital dynamics. The findings are in line with the correlation patterns documented previously. In Panel A, the main variable of interest is lagged Tobin's Q. In Panel B, this is replaced with a dummy variable that is set to one when lagged Q exceeds one. Panel C builds on Panel A by including the lagged dependent variable, allowing for the assessment of Tobin's Q after accounting for the persistence in compensation growth. Finally, Panel D substitutes Tobin's Q with capital growth as the key variable of interest. Across all specifications, method 3 yields significant results. In Panels A and C, lagged Tobin's Q is shown to significantly predict higher compensation growth. The Q-dummy in Panel B also exhibits a positive coeffient under method 3 and method 2, though this association is not observed under method 1 and is significantly smaller under method 2. Meanwhile, capital growth in Panel D consistently shows positive results across all methods, with the largest magnitudes found under method 2 and method 3. These findings reinforce the correlation analysis by demonstrating that the capital stock measure based on the ASM and PIM (method 3) both aligns with compensation trends and allows for Tobin's Q to effectively forecast real compensation growth.

Table 2 reports regressions of real employment growth on alternative measures of Tobin's Q and capital growth, using the same panel structure as in Table 1. The results show that, consistent with the earlier correlation analysis, only method 3 generates consistently meaningful predictive content: lagged Q in Panel A significantly forecasts short-run increases in employment, and similar patterns hold in Panel B. When lagged employment growth is included (Panel C), the Q effect remains detectable under method 3 but not under the other methods. Capital growth in Panel D is positively related to employment across all methods. These findings echo the correlations: while capital accumulation and Q are linked to both wages and employment, the relationship with employment growth is smaller in magnitude.

Table 1: Regression Results for Real Compensation Growth

Panel A: Lagged TQ

	Spec 1	Spec 2	Spec 3
TQ1 lag	-0.0000		
	(-0.75)		
TQ2 lag		-0.0000	
		(-0.60)	
TQ3 lag			0.0004*
			(2.00)
R^2	0.224	0.223	0.223
N	17,851	17,859	17,860

Panel B: Lagged TQ dummy

	Spec 1	Spec 2	Spec 3
TQ1 lag dummy	-0.0001		
	(-0.04)		
TQ2 lag dummy		0.0001	
		(0.09)	
TQ3 lag dummy			0.0018
			(1.36)
R^2	0.211	0.211	0.211
N	19,696	19,696	19,696

Panel C: Lagged Employment Growth and TQ

	Spec 1	Spec 2	Spec 3
real comp growth lag (irpd)	-0.0001	-0.0003	-0.0001
	(-0.02)	(-0.04)	(-0.01)
TQ1 lag	-0.0000		
	(-0.74)		
TQ2 lag		-0.0000	
		(-0.60)	
TQ3 lag			0.0004**
			(2.09)
R^2	0.224	0.223	0.223
N	17,851	17,859	17,860

Panel D: Capital Growth

	Spec 1	Spec 2	Spec 3
Capital growth1	0.0126***		
	(3.09)		
Capital growth2		0.1546***	
		(6.60)	
Capital growth3			0.0265***
			(3.79)
R^2	0.212	0.217	0.215
N	19,307	19,309	19,321

Notes: All panels show Specs 1–3. Regressions include state and time fixed effects, robust/clustered SEs.

Table 2: Regression Results for Employment Growth

Panel A: Lagged TQ

	Spec 1	Spec 2	Spec 3
TQ1 lag	-0.0001		
	(-1.32)		
TQ2 lag		-0.0001	
		(-1.31)	
TQ3 lag			0.0003**
			(2.06)
R^2	0.302	0.301	0.301
N	18,617	18,626	18,630

Panel B: Lagged TQ dummy

	Spec 1	Spec 2	Spec 3
TQ1 lag dummy	0.0006		
	(0.54)		
TQ2 lag dummy		0.0007	
		(0.64)	
TQ3 lag dummy			0.0020*
			(1.97)
R^2	0.291	0.291	0.292
N	19,889	19,889	19,889

Panel C: Lagged Employment Growth and TQ

	Spec 1	Spec 2	Spec 3
employment lag (growth)	0.0141	0.0139	0.0136
	(0.72)	(0.72)	(0.74)
TQ1 lag	-0.0001		
	(-1.36)		
TQ2 lag		-0.0001	
		(-1.35)	
TQ3 lag			0.0003*
			(1.96)
R^2	0.303	0.302	0.303
N	18,617	18,626	18,630

Panel D: Capital Growth

	Spec 1	Spec 2	Spec 3
Capital growth1	0.0180***		
	(6.01)		
Capital growth2		0.1756***	
		(9.38)	
Capital growth3			0.0292***
			(4.58)
R^2	0.293	0.300	0.296
N	19,495	19,498	19,515

Notes: All panels show Specs 1–3. Regressions include state and time fixed effects, robust/clustered SEs.

4.3 Tobin's Q Over Time

Figure 5 and Figure 6 examine the predictive relationship between Tobin's Q and subsequent labor market outcomes, measured respectively by real compensation growth and employment growth across state-industries. Both figures report regression coefficients at forecast horizons ranging from one to eight years, with state, industry, and year fixed effects included to absorb persistent heterogeneity. Error bands are clustered at the state level.

Figure 5 shows the effect of Q on real compensation growth. Across the three capital stock estimation methods, the estimated coefficients are similar to one another but quite small after year 2. At shorter horizons, the coefficient is largest for method 3, diminishing over time. This pattern suggests that while Tobin's Q may contain some information about near-term compensation growth when computed using method 3, it does not appear to be a robust or persistent predictor using capital from methods 1 or 2.

Figure 6 reports the analogous results for employment growth. Here the coefficients are also small and typically negative, especially when Q is computed using methods 1 and 2. At a horizon of one year, method 3 produces a positive and significant coefficient, implying that higher Q values may signal modest increases in employment growth in the near term. However, the effect fades quickly and the coefficient for method three becomes large and negative.

Taken together, Figure 5 and Figure 6 indicate that when using method 3 to construct capital, a high Tobin's Q suggets an initial surge in employment and compensation, but a long-run reduction in employment (noting that the sum of the negative coefficients in years 2-8 are substantially larger than the positive coefficient in year 1). This is coupled, however, with a long-run leveling off of total real compensation above its prior level.

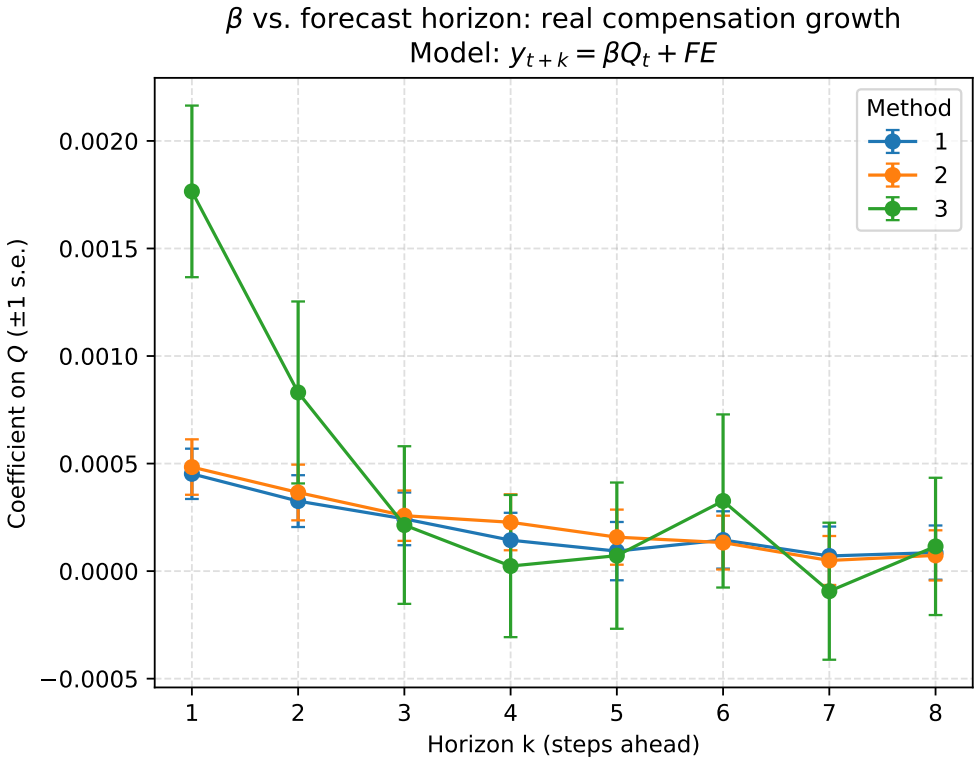
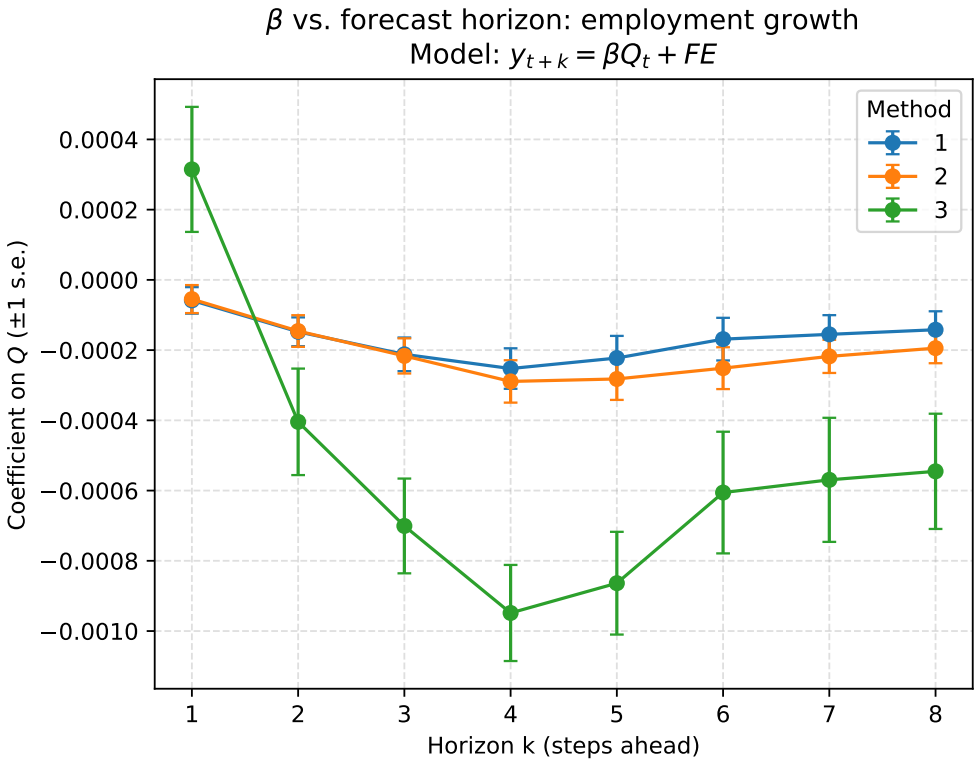


Figure 5: Coefficient (β) from regression on Tobin's Q on k-lagged real compensation growth (conditioned on state, industry, and time fixed effects). k is the forecast horizon, direct forecast. 1 s.e. error bands are shown, clustered by state.



Source: Bureau of Economic Analysis

Figure 6: Coefficient (β) from regression on Tobin's Q on k-lagged employment growth (conditioned on state, industry, and time fixed effects). k is the forecast horizon; direct forecast; 1 s.e. error bands are shown, clustered by state.

4.4 Discussion

The comparative evidence across methods reveals several important patterns. In terms of correlations between capital stocks and labor market outcomes, method 3 stands out most clearly. While methods 1 and 2 yield consistently negative or near-zero correlations between capital levels and subsequent employment or compensation, method 3 shows positive and sizeable associations at short lags, with effects persisting more strongly for compensation than for employment. This suggests that the capital stock series constructed with manufacturing-based data (method 3) captures dynamics that align more closely with theoretical expectations of joint capital–labor adjustment [2, 7].

When the analysis turns to growth rates rather than levels, the picture shifts somewhat. Here, the evidence shows that both methods 2 and 3 generate positive short-run correlations between capital growth and subsequent growth in employment and compensation. The differences between specifications are less stark in this setting, as even the more restrictive methods 1 and 2 show systematic short-run associations. Nonetheless, method 3 again produces the strongest and most persistent correlations, reinforcing the view that its construction more faithfully tracks capital–labor comovements [3, 1, 9].

The regression analysis on Tobin's Q adds a forward-looking dimension to the evaluation. At first glance, the results are most consistent with method 3: high Q values are associated with subsequent growth, particularly in compensation, where the effects taper off only gradually. Yet the relationship with employment is more nuanced. While elevated Q initially predicts stronger job growth, the effect diminishes over longer horizons, with employment ultimately declining even as compensation levels remain higher. These results cannot be taken as causal, but they suggest an intriguing divergence: investor optimism reflected in high Q appears to translate into durable compensation gains, while employment responses may be more transitory, perhaps reflecting efficiency gains, automation, or other adjustments [10, 11, 6].

Taken together, the findings underscore both the importance of measurement choice and the interpretive value of Tobin's Q. The evidence suggests that method 3 provides the most reliable capital stock series for capturing near-term capital–labor linkages, and that Q contains information not only about investment prospects but also about how the benefits of capital deepening are distributed between employment and compensation over time. While further work is needed to establish causality, these results highlight important implications for understanding how capital accumulation interacts with labor markets at the regional level.

5 Conclusions

The evidence presented here offers a mixed verdict on the performance of alternative methods for constructing state-level capital stock measures. Each approach has advantages and limitations, and no single method can be said to dominate across all criteria. Nevertheless, method 3 appears to check the most boxes. By incorporating information on manufacturing investment from the Annual Survey of Manufactures, it produces capital stock estimates that align more closely with theoretical expectations and yield stronger empirical associations with subsequent labor market outcomes.

At the same time, the results highlight an unresolved puzzle. While high Tobin's Q is associated with rising compensation, the corresponding employment response is less persistent and even turns negative at longer horizons. This divergence between employment and compensation could be spurious, reflecting the limits of our measures, or it could emerge from the interplay of shocks from multiple sources, including supply and demand forces that are not separately identified in our analysis. Either way, the finding warrants further research into the mechanisms linking productivity, capital accumulation, and labor market dynamics for states and manufacturing industries.

In the end, the results hint at the importance of drawing on data that directly relate to the purchase or accumulation of capital goods when constructing state-level capital stock measures. Methods that incorporate such information appear better suited to capturing the economic forces at work, even as important questions remain about how these capital stock series interact with employment and compensation over time.

References

[1] Dan A. Black, Terra McKinnish, and Seth Sanders, *The economic impact of the coal boom and bust*, Economic Journal **115** (2005), no. 503, 449–476.

[2] Olivier J. Blanchard and Lawrence F. Katz, *Regional evolutions*, Brookings Papers on Economic Activity **1992** (1992), no. 1, 1–75.

[3] William J. Carrington, *The alaskan labor market during the pipeline era*, Journal of Political Economy **104** (1996), no. 1, 186–218.

[4] Gasper A. Garofalo and Steven Yamarik, *Regional convergence: Evidence from a new state-by-state capital stock series*, Review of Economics and Statistics **84** (2002), no. 2, 316–323.

[5] Sebnem Kalemli-Özcan, Ariell Reshef, Bent E. Sø rensen, and Oved Yosha, *Why does capital flow to rich states?*, Review of Economics and Statistics **92** (2010), no. 4, 769–783, NBER Working Paper No. 11301 (2005).

[6] Jacob A. Kerspien and Jakob B. Madsen, *Markups, tobin's q, and the increasing capital share*, Journal of Money, Credit and Banking **56** (2024), no. 2–3, 569–587, Early view first published March 23, 2023.

[7] Enrico Moretti, *Local labor markets*, Handbook of Labor Economics (Orley Ashenfelter and David Card, eds.), vol. 4B, Elsevier, Amsterdam, 2011, pp. 1237–1313.

[8] Giovanni Peri, *The effect of immigration on productivity: Evidence from u.s. states*, Review of Economics and Statistics **94** (2012), no. 1, 348–358.

[9] Marjan Petreski and Magdalena Olczyk, *Foreign direct investment and regional employment in the eu: A spatial econometric analysis*, Working paper, 2025, Available at SSRN or arXiv.

[10] Richard Roll and J. Fred Weston, *Average and marginal tobin's q as indicators of future growth opportunities, expected return, and risk*, Finance Working Paper 10-08, UCLA Anderson Graduate School of Management, 2008.

[11] James C. Sesil, Maya K. Kroumova, Douglas L. Kruse, and Joseph R. Blasi, *Broad-based employee stock options in the u.s.*, Management Revue **18** (2007), no. 1, 5–23, Available online via econstor: https://www.econstor.eu/bitstream/10419/78958/1/756696453.pdf.

[12] Chad Turner, Robert Tamura, Todd Schoellman, and Sean Mulholland, *Estimating physical capital and land for states and sectors of the united states, 1850–2000*, Tech. Report 32847, Munich Personal RePEc Archive (MPRA), June 2011, MPRA Paper No. 32847.

[13] Steven Yamarik, *State-level capital and investment: Updates and implications*, Contemporary Economic Policy **31** (2013), no. 1, 62–72.