

# 17-30 Will Corporate Tax Cuts Cause a Large Increase in Wages?

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With Congress poised to take up tax reform, economists have opened a lively debate over the impact on wages of cutting corporate taxes, a major objective of the Trump administration and the Republican leadership on Capitol Hill. Proponents of lowering corporate taxes cite an estimate by the administration's Council of Economic Advisers (CEA 2017) that cutting the corporate tax rate from 35 to 20 percent would raise average annual household income by \$4,000 to \$9,000, corresponding to an increase in wages ranging from 6 to 14 percent, respectively.<sup>1</sup> The council's conclusion was based on cross-country and cross-state statistical tests. Both Lawrence Summers and Jason Furman, who served as top economic advisers to President Barack Obama, have argued that the CEA estimate is highly implausible, because it implies national increases in wages amounting

1. The CEA report places average household income in 2016 at \$83,143 and attributes 78 percent of that amount to wage income.

to three to five times the magnitude of the tax revenue loss (some \$600 billion to \$1.5 trillion compared with static revenue loss of \$200 billion annually).<sup>2</sup>

In contrast, Gregory Mankiw, a top economic adviser to President George W. Bush (and like Furman and Summers, currently a professor at Harvard) pointed out that a simple aggregate production function approach could generate wage increases that substantially exceeded the tax revenue loss.<sup>3</sup> His argument lent qualitative support to the CEA estimates but did not explicitly support its large numbers.<sup>4</sup> A rejoinder by Summers addressed the Mankiw argument as seriously misleading for several reasons.<sup>5</sup> This Policy Brief examines the use of the production function approach and concludes that although it is a useful reminder that a corporate tax cut could raise worker productivity and wages through its potential for providing more capital for labor to work with, the likely magnitudes are far smaller than the range claimed by the CEA.

2. Lawrence Summers, "Trump's top economist's tax analysis isn't just wrong, it's dishonest," *Washington Post*, October 17, 2017; Jason Furman, "No, the GOP Tax Plan Won't Give You a \$9,000 Raise," *Wall Street Journal*, October 22, 2017.

3. Gregory Mankiw, "An Exercise for My Readers," October 18, 2017, <http://gregmankiw.blogspot.com/2017/10/an-exercise-for-my-readers.html>.

4. Mankiw's result for the ratio of wage increases to static revenue loss is  $1/[1 - t]$  when the tax is eliminated, or 1.54 using  $t = 0.35$ . This ratio is far smaller than the corresponding ratio in the CEA report, which ranges from 3 to 7.5 as pointed out by Summers and Furman and which is obtained from only a partial cut in the tax (from 35 to 20 percent).

5. Summers' arguments include: the presence of expensing of investment in the proposed tax reform means the tax rate has no effect on investment; the fixed interest rate in the Ramsey model requires infinitely elastic savings, a premise amply rejected by experience; Mankiw ignores the major increase in the trade deficit implied by his exercise; and the model ignores monopoly profits and other factors channeling tax cut benefits to shareholders without boosting investment. Lawrence Summers, "One last time on who benefits from corporate tax cuts," *Washington Post*, October 22, 2017.

## IMPACT ON MARGINAL PRODUCT OF LABOR IN A STANDARD OUTPUT MODEL

Applying the workhorse Cobb-Douglas production function, aggregate output ( $Q$ ) is a function of the amount of capital ( $K$ ) and labor ( $L$ ) at work in the economy:<sup>6</sup>

$$Q = K^\alpha L^{1-\alpha} \quad (1)$$

In this well-known production function, the exponent  $\alpha$  is the share of capital in factor payments and  $(1-\alpha)$  is the share of labor. Labor is paid its marginal product ( $MPL$ ), so the wage ( $w$ ) is the derivative of the production function with respect to the amount of labor applied, or

$$w = MPL = \frac{dQ}{dL} = (1-\alpha)K^\alpha L^{-\alpha} = (1-\alpha) \left[ \frac{K}{L} \right]^\alpha \quad (2)$$

Mankiw assumes—unrealistically—that the unit cost of capital is an “exogenously given world interest rate  $r$ .” (Because instead interest rates are likely to rise if investment increases in response to tax cuts, the model’s calculations should be seen as upper-bound statements of wage effects.) Firms will use capital equipment up to the point where its marginal product ( $MPK$ ) is just equal to the borrowing cost plus the corporate profit tax (at rate  $t$ ) on the resulting increment in output. The marginal product of capital is the derivative of the production function with respect to capital. As a result,

$$\frac{r}{1-t} = MPK = \frac{dQ}{dK} = \alpha K^{\alpha-1} L^{1-\alpha} = \alpha \left[ \frac{K}{L} \right]^{\alpha-1} \quad (3)$$

Now consider the effect of cutting the corporate tax rate. In an economy already at full employment, there is no change in the amount of the labor input. With subscript “1” for the situation after the tax cut and subscript “0” for the situation before:

$$L_1 = L_0 \equiv L \quad (4)$$

Defining  $\theta$  ( $< 1$ ) as the ratio of the new tax to the previous tax,

$$t_1 = \theta t_0 \quad (5)$$

How much will the amount of capital firms desire change as a consequence of the lower tax rate? The answer can be found by first asking how much the marginal product of capital will have to fall in the new equilibrium, and then finding how much more capital would be required to bring

down the marginal product of capital that far. With the tax cut, the marginal product of capital in equation (3) becomes the amount shown in equation (6). The final term in equation (6) is the same as that in equation (3) except that the amount of capital is now “ $K_1$ ”.

$$\frac{r}{1-\theta t} = MPK_1 = \alpha \left[ \frac{K_1}{L} \right]^{\alpha-1} \quad (6)$$

The ratio of the new marginal product of capital to the previous level can be obtained by dividing equation (6) by equation (3). With the cancellation of the terms  $r$  and coefficients  $\alpha$ , this ratio simplifies to the final two terms of equation (7). The ratio will be less than unity, as can be seen by the following considerations. The final right-hand term in equation (7) must be less than unity, as is evident when considering that complete elimination of the tax ( $\theta = 0$ ) would leave the numerator unambiguously smaller than the denominator.<sup>7</sup>

$$\frac{MPK_1}{MPK_0} = \left[ \frac{K_1}{K_0} \right]^{\alpha-1} = \frac{1-t}{1-\theta t} \quad (7)$$

The corresponding ratio of the new stock of capital to the old stock of capital, which is useful to define as  $\psi$ , can then be found by taking the “ $\alpha - 1$ ” root of the final right-hand side of equation (7). This ratio must be greater than unity, because the final term inside the brackets is less than unity but it is taken to a negative power (with  $\alpha < 1$ ).

$$\left[ \frac{K_1}{K_0} \right] \equiv \psi = \left[ \frac{1-t}{1-\theta t} \right]^{1/(\alpha-1)} \quad (8)$$

With the ratio of new capital stock to old capital stock in hand, the ratio of the new marginal product of labor to the old marginal product of labor, and thus the ratio of the new wage to the old wage, can be calculated by dividing a version of equation (2) in which  $K = K_1$  by a version of equation (2) in which  $K = K_0$ . Again with cancellations, the result turns out to be that shown in equation (9).

$$\frac{w_1}{w_0} = \frac{MPL_1}{MPL_0} = \psi^\alpha \quad (9)$$

The ratio of the new wage to the old wage must be greater than unity, because it is a positive power ( $\alpha$ ) of a value ( $\psi$ ) that exceeds unity. The key question is how much greater than unity this ratio will be under plausible magnitudes of the various variables and parameters.

6. I omit the initial constant multiplying the right-hand side, as normalization of units can make this unity.

7. Somewhat counterintuitively, the second term in equation (7) must also be less than unity even though  $K_1$  in the numerator is greater than  $K_0$  in the denominator, because the exponent of the ratio is negative (with  $\alpha < 1$ ) so it is really the inverse of the ratio that is involved.

## BENCHMARK PARAMETERS AND IMPACT IMPLICATIONS

The long-term share of labor in the US economy has been on the order of 65 percent, although this share has declined to about 62 percent in recent years (Lawrence 2015, 30). A reasonable long-term share of capital is thus 35 percent ( $\alpha = 0.35$ ). The headline magnitudes for the old and new corporate tax rates are 35 and 20 percent ( $t_0 = 0.35$ ;  $t_1 = 0.20$ ) and the ratio of the new tax to old tax is  $\theta = 0.57$ . With these values, equation (8) yields the result that the ratio of the new capital stock to the old capital stock should equal 1.37.<sup>8</sup> The simple model thus states that *the corporate tax cut should boost capital stock by almost 40 percent*. One has to believe such an outcome to believe the wage increases the model generates. In the Cobb-Douglas model, raising capital by 37 percent with an elasticity (income share) of 0.35 would raise the capital/output ratio by 23 percent, or from its long-term plateau of 3 to 3.7.<sup>9</sup> As discussed below, the historical record in the 1980s does not support a large surge in the capital stock.

The model's increase in the ratio of capital to labor correspondingly implies a rise in the marginal product of labor, and thus the wage rate, by 11.6 percent.<sup>10</sup> Applying the CEA's numbers for average annual household income (about \$83,000 in 2016) and the wage portion of that income (78 percent), the corresponding increase in labor income would be \$7,500 per household per year. The simple model thus generates results similar to those of the CEA for wages—if the corporate tax applies to all capital in the economy. But the corporate tax rate does *not* apply to all or even most capital income in the economy.

## REAL-WORLD SHRINKAGE

Once one begins looking at the real-world version of the numbers, the estimates shrink rapidly. Consideration of national accounts magnitudes points to a much smaller relevant portion of the economy than the 100 percent assumed in the simple model. In 2016, corporate profits amounted to \$2.07 trillion, or 12.9 percent of national income (BEA 2017a). Considering that capital's share in national income is 35 percent, on this basis the corporate sector accounted for only 37 percent ( $0.129/0.35$ ) of the total capital income assumed in the simple model. Moreover, the Congressional Budget Office (CBO 2017, 1) estimates that the actual

8.  $\psi = [0.65/0.8]^{-1.538}$

9. Output will be  $1.37^{0.35} = 1.116$  times the original level (from equation 1 when  $K$  is 37 percent higher). The capital/output ratio rises by a factor of  $1.37/1.116 = 1.23$  times its previous level.

10. From equation (9),  $1.37^{0.35} = 1.116$ .

average corporate tax rate is only 29 percent.<sup>11</sup> The simple model results should thus be shrunk for two factors: first, because it applies only to considerably less than half of the economy (as gauged by capital income), and second, because the effective base tax rate is significantly lower than the 35 percent statutory rate.

Recalculation of the model for the second influence is straightforward. Placing  $t_0$  at 0.29 instead of 0.35, and placing  $t_1$  at 0.166 for a statutory rate of 20 percent (keeping the ratio of actual to statutory the same as before), equation (8) yields  $\psi = 1.28$  (capital stock rises 28 percent) and equation (9) yields  $w_1/w_0 = 1.09$ , so the wage rises 9 percent instead of 11.6 percent.

Recalculation for the first influence shrinks the estimate far more. If the wage impact would be 9 percent for an economy with all capital subject to the corporate tax rate, by implication the corresponding impact would be an increase of only 3.3 percent for the real economy in which only 37 percent of capital income is subject to the corporate rate.

Moreover, as Summers points out,<sup>12</sup> if the extra capital comes from the rest of the economy, both wages and output will go down there; indeed, if overall capital for the economy does not increase, there will be no wage gain or output gain at all because for the economy as a whole there will be no additional capital with which labor can work. If only half of the capital were to come from the rest of the economy, the capital stock there would decline by 8.2 percent.<sup>13</sup> Wages in that (larger) part of the economy would fall by 3 percent.<sup>14</sup> *The economywide change in wages would be +1.4 percent, or \$900 per household per year, less than one-fourth the lower bound in the CEA report.*<sup>15</sup>

## HISTORICAL EVIDENCE

US experience in previous decades does not support the view that corporate tax cuts would lead to large increases in capital stock and wages. Figure 1 shows the path of the statutory corporate tax rate, the observed effective average rate as measured by the ratio of federal corporate tax revenue to corporate profits, and gross business investment as a percent of GDP.<sup>16</sup>

11. This level includes consideration of state taxes, which bring the total statutory rate to 39.1 percent.

12. Summers, "One last time on who benefits from corporate tax cuts."

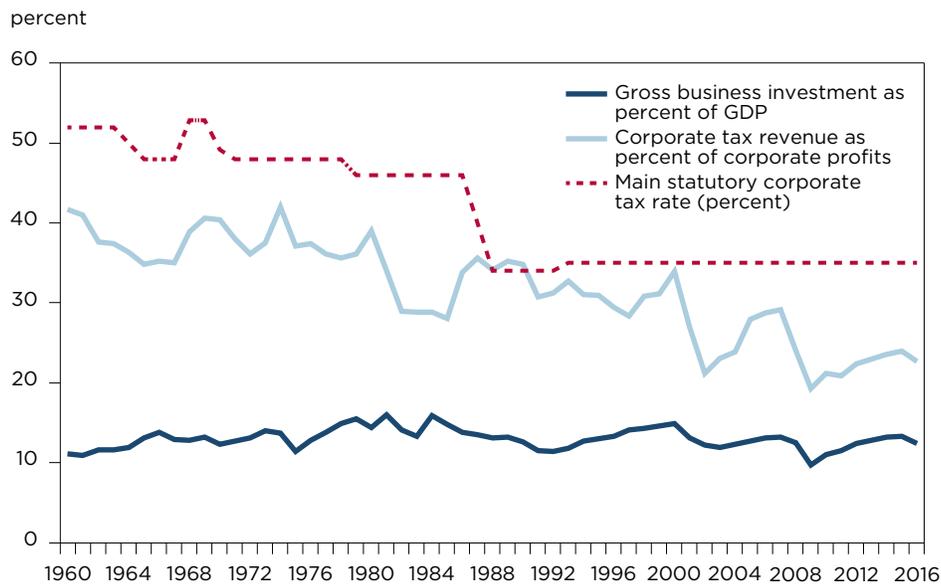
13. Thus, a 28 percent increase in capital for 37 percent of the economy would imply a  $28 \times (0.37/0.63) = 16.44$  percent reduction in capital available to the rest of the economy.

14. From equation (9),  $0.918^{0.35} = 0.97$ .

15. That is:  $(9 \times 0.37) - (3 \times 0.63) = 1.44$ .

16. The observed average federal rate of 22.7 percent in 2016

**Figure 1 Corporate tax rate and gross business investment, 1960-2016**



Sources: BEA (2017a, 2017b); Taylor (2002).

Although there was a large cut in the statutory corporate tax rate, from about 50 percent in the 1960s and 1970s to about 35 percent in 1988 and after, there was little, if any, evident response in the rate of business investment. Nor is a response evident if one instead considers the effective tax rate as measured by the ratio of revenue to profits. This ratio gradually declined over the full period, from about 40 percent to about 23 percent, but there was no corresponding time trend of rising investment. Simple statistical regressions incorporating a dummy variable for recession (with one year lag) do show a significant effect of recession on corporate investment, but the coefficient on the tax rate (whether statutory or actual average) is insignificant and has the wrong sign.<sup>17</sup>

If the simple model set forth above applied to the whole economy and the statutory tax rate, then when the rate was cut from 46 to 35 percent in the late 1980s, capital stock should have risen by 33 percent (equation 8). With a capital/output ratio of 3 for the economy and average capital

life at 10 years, and assuming the adjustment would have been spread over 10 years, the *annual investment rate should have risen by 9 percent of GDP* from the mid-1980s to the mid-1990s.<sup>18</sup> Instead, it fell.

Similarly, there was no acceleration in real wage growth after the mid-1980s corporate tax cut. Again applying the model to the full economy, real wages should have risen by 10.5 percent (equation 9, with  $\psi$  at 1.33). From 1982–86 (the last five years before the tax cut) to 1992–96 (allowing a decade for cumulative effects), real GDP per capita rose by 23 percent (BEA 2017c, IMF 2017). Adding the 10.5 percent wage boost predicted by the model, real wages should have risen by 36 percent. Instead, between these two periods median real wages for full-time workers rose by only 18.1 percent for males and 9.6 percent for females.<sup>19</sup> So the historical evidence does not provide support for a favorable impact of the corporate tax cut on wages any more than it does for a favorable impact on investment.

is considerably lower than the 29 percent average indicated in CBO (2017), a difference that is greater than state taxes not included, so the “actual” series in the figure may be somewhat understated—but should nonetheless indicate the trend over time.

17. Using the average rate yields:  $inv = 12.16 (13.9) + 0.032 (1.2) t - 0.78 (-1.9) D_L$ ; adj.  $R^2 = 0.058$ , where  $inv$  is gross business investment as a percent of GDP,  $t$  is the tax rate, and  $D_L$  has a value of 1 if there was a recession the year before and zero otherwise, with T-statistics in parentheses. The corresponding result for the statutory tax rate is:  $inv = 12.06 (12.3) + 0.027 (1.2) t - 0.88 (-2.1) D_L$ ; adj.  $R^2 = 0.057$ .

18. In order to raise the capital/output ratio from 3 to 4 over 10 years, the extra investment each year would need to be 3 percent of the capital stock each year, or 9 percent of GDP each year.

19. Calculated from US Census Bureau (2017). Note further that because of an increase in females from 37.7 to 39.9 percent of full-time workers, and because females’ median wages were only two-thirds as high as those of males, there was virtually no change in real median wages overall from their base level of about \$44,000 in the first period (2016 dollars deflated by the Consumer Price Index Research Series Using Current Methods [CPI-U-RS]).

## FURTHER CONSIDERATIONS

Unfortunately, the CEA does not consider these historical data for the United States itself, nor does it apply a production function model. Instead, its estimates are based on cross-country and cross-state regressions and are subject to weaknesses pointed out by Summers and Furman as well as others.<sup>20</sup>

The CEA report also invokes a completely different (or supplementary) line of argument that involves tax incidence rather than capital-labor complementarity. It cites some recent studies finding that, contrary to the traditional view that owners of capital bear the incidence of corporate taxes, somewhere in the range of one-half of the burden may fall on workers. The report cites as intuition the fact that capital is mobile and labor is not. A more recent study by the Joint Committee on Taxation (2013) found instead that in the long run owners of capital bear 75 percent of the corporate income tax (and 95 percent of tax on passthrough business income).

Furman has emphasized that the questionable analytical slide from marginal product impact to tax incidence on capital versus labor is central to doubts about the outsized ratio of wage increases to tax revenue cost implied by the CEA report.<sup>21</sup> Tax incidence by definition can range only from 0 to 100 percent. Wage gains a few hundred percent higher than revenue losses cannot be obtained from incidence models.<sup>22</sup> Such results would require optimistic macroeconomic models in which everything works ideally, for example, the taxes levied to cover the revenue loss have no distorting effects (a “lump-sum” tax such as a wealth tax that cannot be evaded), and there are large induced growth effects. In contrast, the Trump administration has not proposed a wealth tax, and one leading research center calculates that there would be virtually no offset to medium-term revenue losses from induced growth effects of the tax plan (Tax Policy Center 2017).

Focusing on incidence rather than underlying productive potential also begs the question of where the redistributive transfer really comes from. Eventually the fiscal shortfall will need to be made whole, suggesting that any transfer to labor because of incidence considerations will be only temporary and over time workers’ personal taxes will need to rise to recover the revenue.

Another important consideration concerns the impact of expensing rather than depreciating capital goods. The view that expensing turns the marginal rate to zero might seem to imply an even larger wage increase than calculated here, because the relevant tax would disappear entirely rather than being cut only partially. However, in this approach the relevant tax rate before the reform would not be either the statutory 35 percent or the average effective 29 percent, but an even lower rate that captures the marginal rate on investment after taking account of depreciation allowances. Under the Modified Accelerated Cost Recovery System (MACRS) currently applied in US taxation, there is a combination of declining balance depreciation over the first part of the life of the equipment and straight-line depreciation over the remainder. For equipment with a recovery period of 7 years (such as equipment in the automotive industry), the present discounted value of depreciation amounts to about half of face value, so the effective rate prior to the cut would be 29 percent  $\times$  0.5 = 14.5 percent.<sup>23</sup> On this basis shifting from current depreciation to expensing capital goods would cut the effective marginal tax from 14.5 percent to zero in the expensing-focused framework. From equations (8) and (9) such a shift would cause an increase of 27.2 percent in the capital stock and an increase of 8.8 percent in the wage, almost the same as in the central case considered for the corporate sector and a reduction of the effective average rate from 29 to 16.6 percent discussed above. So a focus on expensing does not change the main results here.

Finally, this Policy Brief does not address the question of international distortions caused by the fact that the US corpo-

20. See Frank Lysy, “Lower Corporate Taxes Have Not Led to Higher Real Wages,” *aneconomicssense.org*, October 18, 2017; and Kimberly Clausing and Edward Kleinbard, “Trump’s economists say a corporate tax cut will raise wages by \$4,000. It doesn’t add up,” *Vox*, October 20, 2017. For the cross-country estimates, critics point out that the observations of low corporate taxes are primarily from Eastern European economies and may not be reliable guides to US effects.

21. See his comments at <https://twitter.com/jasonfurman/status/921393732959784960>.

22. On the same grounds, Mihir A. Desai criticizes the CEA report for this conflation of alternative approaches in misinterpreting his empirical estimates of the incidence of corporate taxes. See the discussion at <https://twitter.com/desaijihira/status/920306122506096646>.

23. For the schedule of depreciation for 150 percent declining balance method under MACRS, see IRS (2017, 85). The 50 percent result assumes inflation of 2 percent and real interest rates in a range of 3 to 5 percent. For the recovery period for the automobile sector, see Thomson Reuters (2017). Note further that an alternative approach generates a similar estimate. The Tax Policy Center (2017) estimates that expensing new capital equipment would reduce corporate taxes by \$130 billion in the first year and an average of \$110 billion annually over five years. Gross business investment in the national accounts was \$2.32 trillion in 2016 (BEA 2017b). Applying the 37 percent portion of economywide capital identified earlier as being located in the corporate sector, the relevant base for corporate investment would be \$859 billion (= 0.37  $\times$  \$2.32 trillion). If only \$130 billion in taxes would be lost from complete expensing, then in (= 130/859), approximately the same as the 14.5 percent rate estimated in the text applying a present value approach.

rate tax is higher than that in most other major economies. Thus, whereas the actual US rate (including state corporate taxes) is estimated by the Congressional Budget Office at 29 percent, the corresponding estimate for other G-7 economies is somewhat lower.<sup>24</sup> At a general level, nonetheless, it seems questionable that the solution to this problem is for the largest economy to join the race to the bottom.

## CONCLUSION

The tax model shootout triggered by the CEA's new report has illuminated several key issues. Mankiw provided a useful reminder that fundamental production function analysis supports the notion of higher wages resulting from greater capital formation in response to higher after-tax returns.<sup>25</sup> This Policy Brief confirms the underlying analytics of this production function approach but rejects the proposition

24. The Congressional Budget Office (CBO, 2017, 7) estimates the average rate at 27.9 percent for Japan, 26.8 percent for Italy, but only 20 percent for France, 14.5 percent for Germany, and 10.1 percent for the United Kingdom.

25. Mankiw, "An Exercise for My Readers."

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that it can justify the extremely high CEA estimates of wage gains from a corporate tax cut. It is necessary to take account of the limited portion of the economy to which the corporate tax applies, the fact that the actual corporate tax rate is lower than the 35 percent statutory rate once tax preferences and other leakages are taken into account, and the likelihood that some portion of capital attracted to the relevant corporate sector would come at the expense of capital formation in the rest of the economy. When adjustments for these considerations are made, the wage gains from cutting the corporate tax to 20 percent are only about one-fourth as large as even the lower end of the range estimated by the CEA. Moreover, the failure of investment and wages to rise after the last major episode of corporate tax cuts in the late 1980s suggests the wage gains could be even lower. Overall, the analysis here suggests that the wage-boost argument based on the production function approach is insufficient to reverse the dominant diagnosis that, given the concentration of ownership of capital, the corporate tax cut would be regressive.<sup>26</sup>

26. See, for example, Tax Policy Center (2017).

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