

Econ UH 1112: Introduction to Macroeconomics

Economic Growth Report: Germany

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I am studying Germany. For this problem, I found data from multiple sources, including the German Federal Statistical Office Website (destatis), accessible at <https://destatis.de>; the World Bank Data Bank, accessible at <https://data.worldbank.org>; and St. Louis Fed Website, accessible at <https://research.stlouisfed.org/fred> between 1995 and 2023. Data on nominal GDP, compensation of Employees, persons in Employment, and Employees were downloaded from destatis. Data on real GDP was downloaded from World Bank Data Bank. Data on capital stock was downloaded from St. Louis Fed Website. The precise labels of all downloaded data are provided in Table 1.

Table 1: Description of Data Series

Description	Identifier	Units	Frequency
nominal GDP	81000-0001	billions of Euro	annual
real GDP	NY.GDP.MKTP.KN?locations=DE	billions of Euro	annual
compensation of Employees	81000-0015	billions of Euro	annual
persons in Employment	81000-0015	millions of Hours	annual
Employees	81000-0015	millions of Hours	annual
capital Stock	RKNANPDEA666NRUG	millions of 2021 USD	annual

Part 1.1

Data on compensation of employees provided by destatis does not include self-employed individuals. Hence, the total compensation of employees is less than actual. Therefore, I calculate the total compensation to labor using the following equation:

$$\text{Total Compensation to Labor} = \text{compensation of Employees} \cdot \frac{\text{persons in Employment}}{\text{Employees}} \quad (1)$$

I use the following formula to compute the labor share of GDP:

$$\text{Labor share of GDP}_t = \frac{\text{Total Compensation to Labor}_t}{\text{Nominal GDP}_t} \in [0, 1] \quad (2)$$

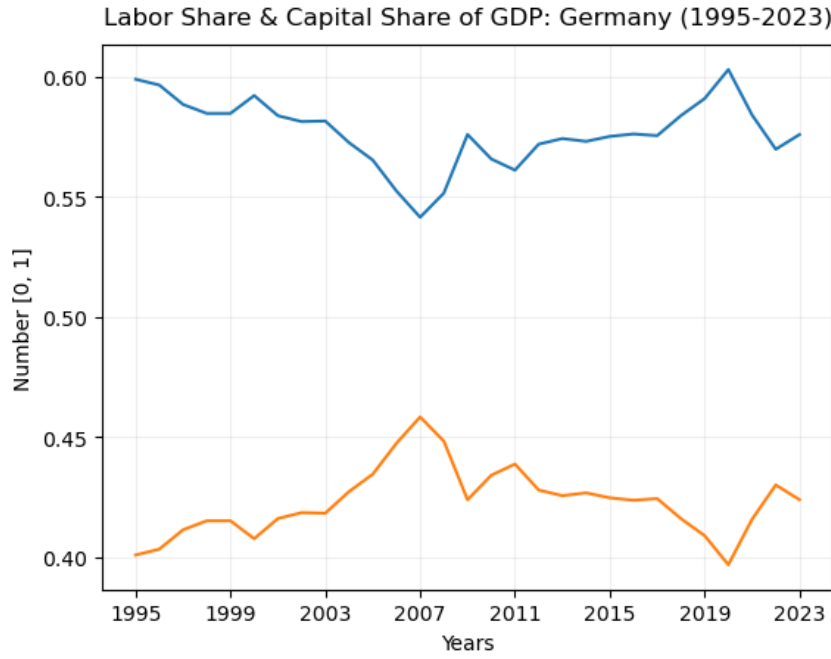
Assuming constant returns to scale, I calculate the capital share, α of GDP as:

$$\alpha_t = 1 - \text{Labor share of GDP}_t \in [0, 1] \quad (3)$$

Table 2: Statistics of Labor Share and Capital Share of GDP, Germany (1995 - 2023)

measure	mean	standard deviation	maximum	minimum
$1 - \alpha$	0.577	0.014	0.542	0.603
α	0.423	0.014	0.397	0.458

Figure 1: Labor Share & Capital Share of GDP: Germany (1995-2023)



Part 1.2

To compute the real growth of my employment measure, I calculate the real annual growth rate of total hours worked by persons in Employment to eliminate any influence of prices on growth. I use the following year-on-year growth formula to compute the real annual growth rate for my employment measure (g_N), capital stock (g_K), and GDP (g_y):

$$\gamma = \left(\frac{y_t}{y_{t-1}} - 1 \right) \cdot 100 \quad (4)$$

The descriptive statistics of each dataset is tabulated in Table 3.

The annual growth of each of the above factors is shown in Figure 2.

Part 1.3

I use the following formula to obtain the growth rate of total factor productivity, g_A for Germany in year t :

$$g_A = g_y - \alpha \cdot g_K + (\alpha - 1) \cdot g_N \quad (5)$$

Table 3: Statistics of Growth Rates for labor compensation, g_y , g_N , and g_K , Germany (1995-2023)

sym.	average annual growth rate	minimum annual growth rate	maximum annual growth rate
labor compensation	2.76	-0.45	6.90
g_y	1.26	-5.54	4.13
g_N	0.68	-1.08	2.18
g_K	1.48	0.81	2.35

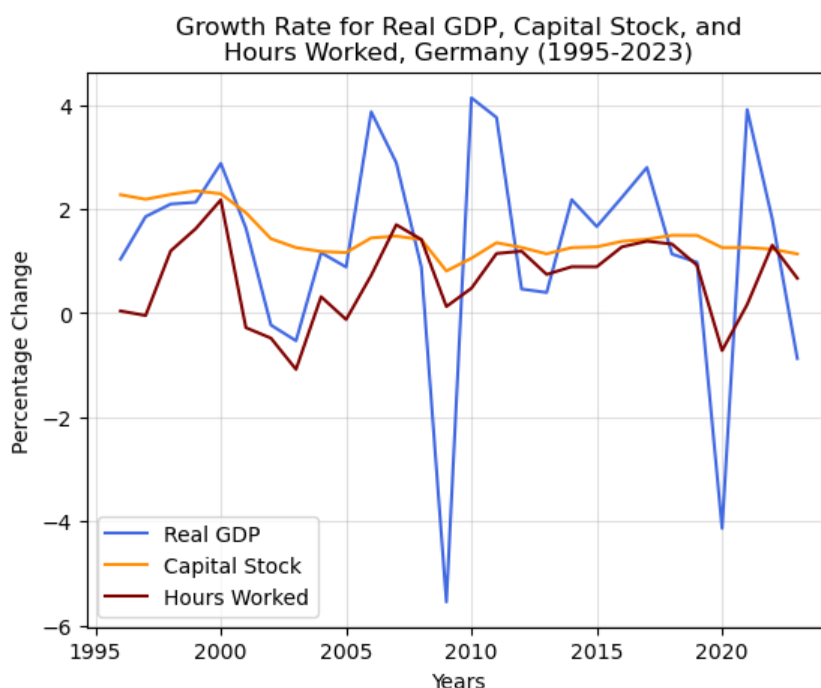


Figure 2: Growth Rates of Real GDP, Capital Stock, and Labor Compensation, Germany (1995-2023)

The statistical description of g_A is tabulated in Table :

Table 4: Statistics of Total Factor Productivity Growth, Germany (1995-2023)

average	standard deviation	minimum	maximum
0.25	1.91	-5.96	3.40

Part 1.4

For Germany, the main drivers/contributors of GDP growth are explained below:

Figure 3: Growth of Total Factor Productivity, Germany (1995-2023)



- **Total Factor Productivity (TFP):** TFP has acted as the primary driver of GDP growth in Germany. Comparing Figure 2 and Figure (3) shows that change in Germany's real GDP almost exactly mirrored the change in TFP. For example, the sharp contractions in 2009 and 2020 were driven by massive drops in productivity rather than changes in capital.
- **Stable Capital Stock:** The Capital Stock growth rate has remained stable over the studied period, hovering consistently between 1% and 2%.
- **Labor Share of GDP:** The total labor compensation has remained highly volatile in the German economy. Because the Labor Share remained relatively high, even small changes in labor inputs had a weighted impact on the overall output.

If additional factors like human capital or land were added to the production function, the importance of the current TFP measure would likely decrease. This is because of our current approach of measurement. We measure TFP as a residual of contributions of Labor Share and Capital Share to GDP. By adding atomic measure of growth like human capital and land would reduce this residual. Hence, it would reduce TFP.