

# Income Inequality

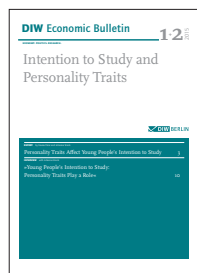


**REPORT** by Hanne Albig, Marius Clemens, Ferdinand Fichtner, Stefan Gebauer, Simon Junker, and Konstantin Kholodilin

How rising income inequality influenced  
economic growth in Germany 113

**INTERVIEW** with Ferdinand Fichtner

»Rising income inequality inhibits consumer demand« 122



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DIW Berlin  
ISSN 2192-7219

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# How rising income inequality influenced economic growth in Germany

By Hanne Albig, Marius Clemens, Ferdinand Fichtner, Stefan Gebauer, Simon Junker, and Konstantin Kholodilin

The cumulative growth rate of the German economy since reunification would have been around two percentage points higher if income inequality had remained constant. This is what simulations using the DIW Macroeconomic Model have shown. They were made under the assumption that the income distribution dynamics would not be influenced by any feedback effects of economic growth. In 2015, Germany's real GDP should have been 40 billion euros higher than it actually was. Private consumer demand, investment, and exports would all have risen faster if inequality—here measured by the Gini index of net household income—had remained at its 1991 level. At the same time, the trade surplus would not have grown as quickly. In fact, it curbed the effect of income inequality on GDP. The finding is not only relevant given the debate over imbalances in the euro area. It also clearly indicates that the discussion about the macroeconomic consequences of rising income inequality has excessively focused on its negative effects on GDP. Private consumption, infinitely more important to the German population's quality of life, will decline more sharply in the long run.<sup>1</sup>

The consequences of rising income inequality for economic growth have been in the center of a lively policy and public debate in recent years. The discussion is also driven by several international academic studies<sup>2</sup> that found evidence of a negative relationship between a more unequal income distribution and overall national economic growth.

The present report contributes to the discussion by approximating the consequences of income inequality specifically for the German economy. In contrast to many other studies, this one not only examines the effects of inequality on the growth of GDP, but also considers the impact they have on its composition based on its expenditure-side components. For analytical reasons following the literature (Box 1), instead of analyzing the *causes* of rising income inequality, our study focuses only on the *consequences* of a change in income inequality caused by the “typical” reasons.

The discussion in the literature on consequences of income inequality for economic growth basically focuses on three transmission channels. In the short run, rising income inequality can increase productivity, since a larger personal effort leads to a higher relative individual income and, thus, creates an incentive to work more productively (*incentive channel*).<sup>3</sup> In the long run, however, a higher level of social inequality—along with many other factors—will have a negative impact on productivity. Due to their lack of financing resources, households with low incomes ultimately invest less in longer-term or higher-quality education (*human capital channel*).<sup>4</sup> Finally, households with low incomes can only save a small amount.

<sup>1</sup> The present *Economic Bulletin* report is based on a DIW Berlin study commissioned by the Friedrich Ebert Foundation, a political foundation whose mission is political education and consulting. See Hanne Albig et al., “Zunehmende Ungleichheit verringert langfristig Wachstum,” Project report for the Friedrich Ebert Foundation (2016) (available online).

<sup>2</sup> See OECD, *In It Together: Why Less Inequality Benefits All* (Paris: OECD Publishing, 2015) and Jonathan D. Ostry et al., “Redistribution, Inequality, and Growth,” *IMF Staff Discussion Note* no. 14/2 (2014).

<sup>3</sup> Peter Hoeller et al., “Less Income Inequality and More Growth—Are They Compatible?” *OECD Economics Department Working Paper* no. 924 (2012).

<sup>4</sup> This argument is often used in the case of emerging markets, but a relationship can also be shown for highly developed national economies. See Joseph E. Stiglitz, “Macroeconomic Fluctuations, Inequality and Human Development,” *Journal of Human Development and Capabilities* 13 (1) (2012): 31–58.

## Box 1

**The relationship between income inequality and economic growth: an overview of the literature**

A number of empirical studies have addressed the effects of income inequality on economic growth. They often estimate regressions in reduced form, using income inequality as an explanatory variable for economic growth—typically measured by the growth rate of GDP. The relationships they determine depend on a range of real factors: the quality of the underlying data set (cross-sectional or panel data; whether industrialized or emerging market countries are being studied, etc.), the estimation methodology used, and how the inequality measure is defined.<sup>1</sup>

Based on national cross-sectional data, earlier studies suggested that rising income inequality has a negative influence on eco-

nomical growth.<sup>2</sup> Recent analyses are able to consider influences over time for specific countries with the help of newly available panel data sets (comparable time series data for individual countries) and the use of adequate estimation methods.<sup>3</sup> But ultimately, these studies have made inconclusive statements with regard to the direction and significance of the effect of income inequality on growth.

For example, some studies find a positive relationship between income inequality and growth,<sup>4</sup> while others identify a negative effect. Of course, the results are highly dependent on the design

<sup>1</sup> The endogeneity of income inequality presents a methodological problem in these approaches: changes in GDP go hand in hand with changes in income distribution. To circumvent the issue, as a means of adjusting for the reciprocal effects most studies use interaction terms or lagged values as instrument variables. See Laura De Dominicis et al., "A Meta-Analysis on the Relationship between Income Inequality and Economic Growth," *Scottish Journal of Political Economy* 55(5) (2008): 654–82 and Pedro C. Neves et al., "A Meta-Analytic Reassessment of the Effects of Inequality on Growth," *World Development* 78 (2016): 386–400.

<sup>2</sup> See Alberto Alesina and Dani Rodrik, "Distributive Politics and Economic Growth," *The Quarterly Journal of Economics* 109 (2) (1994): 465–90, Torsten Persson and Guido Tabellini, "Is Inequality Harmful for Growth," *The American Economic Review* 84(3) (1994): 600–21 and Robert Perotti, "Growth, Income Distribution, and Democracy: What the Data Say," *Journal of Economic Growth* 1 (1996): 149–87.

<sup>3</sup> See Klaus Deininger and Lyn Squire, "A New Dataset Measuring Income Inequality," *World Bank Economic Review* 10 (3) (1996): 565–91.

<sup>4</sup> See Kristin Forbes, "A Reassessment of the Relationship between Inequality and Growth," *The American Economic Review* 90 (2000): 869–87 and Hongyi Li and Heng-Fu Zou, "Income Inequality is not Harmful for Growth: Theory and Evidence," *Review of Development Economics* 2 (3) (1998): 318–84.

Therefore, redistribution to the benefit of higher income households will directly boost the savings rate and inhibit consumer demand (*savings rate channel*).<sup>5</sup>

In order to assess opposing effects, DIW Berlin developed a structural macroeconomic model that is able to reflect the functioning of the main channels discussed in the literature in a consistent and plausible way (Box 2).

To measure inequality, we use the Gini index of equivalized net household income from Socio-Economic Panel (SOEP) data.<sup>6</sup> In 1991, it was 24.8 points, that is, almost four points below its 2015 value (Figure 1).

<sup>5</sup> See Nicholas Kaldor, "A Model of Economic Growth," *The Economic Journal* 67 (268) (1957): 1591–624.

<sup>6</sup> To provide a sensitivity analysis, the model was also estimated and simulated based on alternative measures of income inequality. We chose a Theil index of net household income and the income portion of the top decile of the workforce (top ten percent of income). The comparison showed that in quantitative terms, real GDP's reaction to an increase in income inequality is very similar for all measures. The relative importance of individual transmission channels varies slightly. See Albig et al., "Zunehmende Ungleichheit," section 4.2.

**Inequality inhibits growth somewhat—with considerable delay**

Using the model we conduct an historical decomposition to analyze the changes of economic growth that could have been expected in Germany if income distribution as measured by the Gini index for net household income had remained at its 1991 level—all other things being equal. This counterfactual approach allows us to ignore the impact of other factors on growth. Of course, this does not mean that increasing inequality of income is the only explanatory factor for the growth in Germany from 1991 to 2015. It is one factor among many, and we have quantified its impact on economic growth here.

We found that during the period under inspection, that real GDP in Germany would have risen somewhat faster if income inequality had remained at its 1991 level (Figure 2). In 2015, it would have been 40 billion euros higher.<sup>7</sup> Over 24 years the cumulative growth rate would have

<sup>7</sup> The estimate for different starting years from 1991 to 2000 did not show any significant qualitative or quantitative changes.

of the analysis. The group of countries studied plays a key role: a rise in income inequality appears to hurt growth in less developed countries in particular. A weakly negative and sometimes positive relationship is observed for developed economies.<sup>5</sup>

The use of nonlinear estimation methods also suggests that the relationship between income inequality and growth is dependent on the economy's level of development.<sup>6</sup> In addition, the temporal dimension of the relationship is an important aspect.<sup>7</sup> Accordingly, we must differentiate between the short- and long-run effects of rising income inequality on growth. Studies show that positive effects dominate in the short run.<sup>8</sup> The authors' explanation is that high investment follows increasing

household savings activity. However, in the long run the effects are negative as a result of decreasing human capital accumulation, sociopolitical instability, or an increasing tax burden from the redistribution measures that are a consequence of income inequality.

Ultimately, the character of the relationship identified depends to a great extent on the income inequality measure being used. While most studies use the Gini coefficient as the relevant variable for income inequality, an increasing number of researchers are considering alternative measures (e.g., ratios between different income percentiles).<sup>9</sup> They often find that depending on the underlying measure for income inequality, the effects on growth vary significantly. And some studies use wealth inequality as a suitable measure alongside income equality.<sup>10</sup> Overall, the negative effect of increasing wealth inequality on economic growth seems to be a more clear-cut than that of income inequality.

<sup>5</sup> See Robert Barro, "Inequality and Growth in a Panel of Countries," *Journal of Economic Growth* 5 (2000): 5–32, Dierk Herzer and Sebastian Vollmer, "Inequality and Growth: Evidence from Panel Cointegration," *Journal of Economic Inequality* 10(4) (2012): 489–503, German Council of Economic Experts, eds., "Focus on Future Viability," Box 17, and Neves et al. "A Meta-Analytic Reassessment."

<sup>6</sup> See Been-Lon Chen, "An inverted-U relationship between Inequality and Long-Run Growth," *Economic Letters* 79(2) (2003): 205–12.

<sup>7</sup> Daniel Halter, Manuel Oechslein, and Josef Zweimüller, "Inequality and growth: The neglected time dimension," *Journal of Economic Growth* 19 (1) (2014): 81–84.

<sup>8</sup> See Stephen Knowles, "Inequality and Economic Growth: The Empirical Relationship Reconsidered in the Light of Comparable Data," *Journal of Development Studies* 41(1) (2005): 135–39 and Daniel Halter et al., "Inequality and growth."

<sup>9</sup> See Sarah Voitchovsky, "Does the Profile of Economic Inequality Matter for Economic Growth? Distinguishing between the Effects of Inequality in Different Parts of the Income Distribution," *Journal of Economic Growth* 10 (2005): 273–96.

<sup>10</sup> Klaus Deininger and Pedro Olinto, "Asset Distribution, Inequality, and Growth," *World Bank Policy Research Paper* 2375 (2000) and Amparo Castello-Climent and Rafael Domenech, "Human Capital Inequality and Economic Growth: Some New Evidence," *The Economic Journal* 112 (2002): 187–200.

been around two percentage points higher.<sup>8</sup> Per year, the effect on growth is on average one-twentieth of a percentage point.<sup>9</sup> In other words, instead of a growth rate of 1.3 percent between 1991 and 2015, the German economy would have achieved an average calendar-adjusted growth rate of 1.37 percent if income inequality had remained at its 1991 level, all else equal.

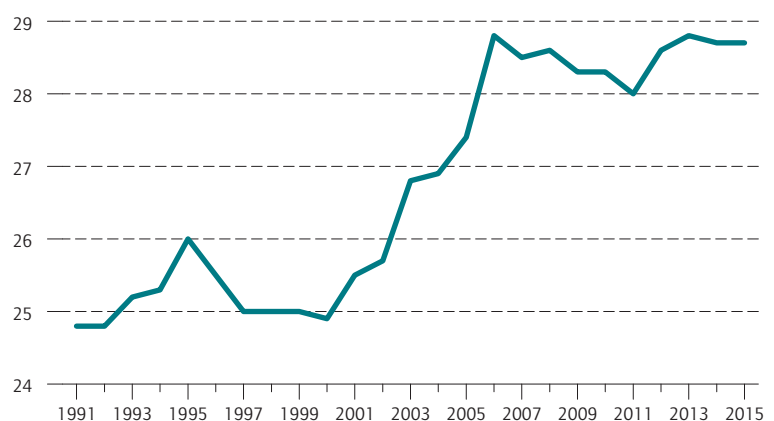
However, when the focus is on deriving economic policy implications, reducing the consequences of inequality solely to its impact on the growth of GDP might be unsatisfactory. It is more important to understand the processes that influence this result. Figure 2 depicts the importance of the individual channels of impact.

<sup>8</sup> The difference in the cumulated growth rate is calculated as the difference of the levels in 2015, compared to the level in 1991.

<sup>9</sup> The effects of a rise in income inequality on real GDP as determined using our model are smaller than those found in other studies (Ostry et al., "Redistribution, Inequality, and Growth" and OECD, "In It Together."). The German Council of Economic Experts has explicitly emphasized the reduced effect of income inequality on growth in high-income countries. Our model should also reflect this phenomenon, because unlike the estimation approach used in earlier studies it is based solely on German data. See German Council of Economic Experts, eds., "Focus on Future Viability," *Annual Report 2015/2016* (2015) (available online).

Figure 1

### Gini coefficient of net household income, 1991–2015



Source: Socio-Economic Panel (SOEP) at DIW Berlin.

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The turn of the millennium was characterized by a major increase in income inequality.

## Box 2

**Structural macroeconomic model**

A model must be comprehensive enough to reflect the most important macroeconomic mechanisms. However, it should not be too complex either. The empirical estimates it generates must be robust and the results must remain reproducible. For these reasons, we assume the influence of income equality on the modeled variables to be exogenous and do not take the endogenous feedback effects of economic growth on the distribution of household income into consideration. The model consciously excludes the macroeconomic causes of income inequality. Moreover, only a limited number of relationships to the financial markets are modeled. The model is based on the national accounts system and formulated and estimated on the quarterly basis.<sup>1</sup>

*Potential output*

The long-run growth of an economy is determined by its potential output. It depends on demographic factors, capital stock growth, and productivity, and indicates how high the output level would be if the factors of production were utilized at normal capacity.<sup>2</sup> Based on the trend of total factor productivity (TFP), the model calculates the structural growth of labor volume and the capital stock. The production process with which these factors of production are interconnected is described using a Cobb-Douglas production function.

The TFP trend is represented in logarithmic form by an equation according to which it is positively influenced by the mean investment expenditure on other capital assets to GDP ratio<sup>3</sup> over a

period of eight quarters ( $\text{avg}(\ln(I_{t,t-8}^{\text{OTHER}}))$ ) and the human capital stock<sup>4</sup> of the national economy ( $\text{avg}(\ln(HK_{t,t-8}))$ ):<sup>5</sup>

$$\ln(TFP_t^{\text{TREND}}) = -8.44*** + 0.087*** \cdot \text{avg}(\ln(HK_{t,t-8})) + 0.18*** \cdot \text{avg}(\ln(I_{t,t-8}^{\text{OTHER}}))$$

The growth of human capital stock between two generations, i.e., within 15 years, ( $\Delta^{15y}HK_t$ ), is positively influenced by the mean investment expenditure on education to GDP ratio ( $g_{t,t-15y}^{\text{EDUC}}$ ) in the period, but negatively by income inequality ( $DIST_{t,t-15y}$ ):

$$\Delta^{15y}HK_t = 14.54*** + 2.25*** \cdot \text{avg}(\ln(g_{t,t-15y}^{\text{EDUC}})) - 2.20*** \cdot \text{avg}(\ln(DIST_{t,t-15y}))$$

In the model, rising income inequality reduces the growth of human capital—with a delay. In turn, this leads to shrinking output. In this manner, the model maps the long-term effect of income inequality on productivity (human capital channel).

*Aggregate supply (output side)*

On the other hand, the actual level of output depends on the fluctuating utilization levels of the factors of production during the business cycle. It causes productivity and labor volume to deviate from their trends, in turn causing production-side GDP to deviate from the economy's potential output. This is why the model accounts for the direct influence of income equality on productivity—and not only its trend. The model's estimate confirmed our expectations about the incentive channel; namely,

<sup>1</sup> For the technical details of the model used here, see Albig et al., "Zunehmende Ungleichheit."

<sup>2</sup> See Karel Havik et al., "The Production Function Methodology for Calculating Potential Growth Rates & Output Gaps," *EC Economic Papers* 535 (2014).

<sup>3</sup> Investment in other capital assets in terms of the national accounts primarily includes corporate research and development expenditures.

<sup>4</sup> The human capital stock of an economy is measured as the proportion of the total workforce that completes at least secondary education.

<sup>5</sup> The other explanatory variables used in the equation are not significant.

It shows that initially—from 1991 through 2006—the savings rate channel may have had a negative influence on real GDP. Looking at this channel, it seems that GDP would have been higher if inequality had remained stable. The channel's negative effect became smaller over time and later on, it was even positive. Holding all other influences constant, falling interest rates favored investment as a result of an increase in savings. All in all, the savings rate channel's effect on real GDP was minimal. This also applies to the incentive channel, which had a consistently positive—although small—effect on GDP as a result of rising income inequality.

The human capital channel made a negative contribution to the growth of real GDP during the simulation period. Due to the rise in income inequality, the German population invested less in education than would have otherwise been expected. However, lower investment in education only had an impact on productivity and, in turn, economic growth after a delay of approximately one decade.<sup>10</sup> Because of this delay and the sharp rise in the

<sup>10</sup> The number of school years is usually used to measure human capital in panel studies. However, since education was compulsory in Germany during the entire period of the study, we had to use a different statistic. Based on the OECD's work (OECD, *In It Together*), we chose as our measurement the propor-

that rising income inequality could positively influence productivity in the short run:

$$TFP_t^{GAP} = -0.013 - 0.0033 \cdot INV_t^{STOCK} + 0.66*** \cdot TFP_{t-1}^{GAP} - 0.0029 \cdot \ln(HK_t) + 0.0014 \cdot \ln(I_t^{OTHER}) + 0.0062 \cdot \ln(DIST_t)$$

The cyclical percentage deviation of productivity from its trend ( $TFP_t^{GAP}$ ) is positively influenced by income inequality ( $DIST_t$ ). It is also affected by inventory levels ( $INV_t^{STOCK}$ ), expenditure for other investments ( $I_t^{OTHER}$ ) (e.g., investment in research and development) and the human capital ( $HK_t$ ) in the economy. Accordingly, higher other investments increase productivity in the short run. High inventory levels have an inhibiting effect on productivity until companies adjust per capita hours worked or the number of people they employ. According to our estimates, human capital reduces productivity's deviation from its trend. However, productivity experiences an overall increase as result of an expansion in human capital, since trend productivity is positively affected to a greater extent than the deviation is reduced (see the equation for  $TFP_t^{TREND}$ ). This reflects the fact that changes in human capital do not unfold their entire influence on productivity in the short run.

As income inequality rises, productivity increases and real GDP expands beyond the economy's potential output. However, employment and hours worked will also exceed their natural values and as a result, wages rise more quickly. Companies counter the situation by adjusting hours worked and employment levels, leading the economy to gradually converge on its production possibilities curve.

#### Aggregate demand (expenditure side)

On the expenditure side, price-adjusted GDP is the sum of net exports, private and public consumer demand, and investment. Exports depend on the developments on the international markets, with price competitiveness and foreign demand being the principal determinants. Domestic demand (that is, private con-

sumption plus investment) and exports both determine import growth. Furthermore, the relative prices of imported goods also play a role. A relative rise in import prices has a negative effect on import demand, since domestic households and companies increasingly substitute foreign goods for domestic ones.

Taking the savings rate into consideration, private consumption depends on the disposable income of private households: wages and salaries, self-employment and investment income, and transfer income. The savings rate ( $s_t$ ) is determined by the general demographic conditions—measured by the dependency ratio ( $pop_t^{OLD}$ ,  $pop_t^{YOUNG}$ )—and short-term interest rates ( $r_t^{SHORT}$ ). Income inequality,  $DIST_t$  also plays a major role. The positive coefficient of inequality used in the equation for the savings rate reflects the savings rate channel: a rise in income inequality increases savings in the economy and reduces private consumption:

$$\ln(s_t) = -3.54 + 0.71*** \cdot \ln(s_{t-1}) + 0.51* \cdot \ln(pop_t^{OLD}) + 2.21** \cdot \ln(pop_t^{YOUNG}) + 0.81*** \cdot \ln(DIST_t) + 0.61 \cdot r_t^{SHORT}$$

The model explains investments based on its components, i.e., separate equations are estimated for investment in equipment, various construction investments, and other investments. In addition to aggregate demand, which has a positive influence on investment activity, the model considers the relationship to long-term real interest rates, i.e., the inflation-adjusted nominal interest rate. Rising interest rates go hand in hand with increases in financing costs, which causes a decline in investment. Long-term interest rates are influenced by the interest on short-term obligations and the savings rate. If the savings rate rises in comparison to the demand for investment project financing, interest rates decline. Interest rates for short-term obligations are determined by monetary policy conditions. They follow an interest rate rule that models interest rates as a function of the economy's capacity utilization and the inflation rate. The version of the model underlying this report assumes that the remaining policy conditions are exogenous. In particular, this applies to public consumption and public investment.

Gini index after the turn of the millennium, until 2010 the actual GDP in Germany hovered around the value it would have achieved without a rise in income inequality. Until the current decade, we did not observe output levels that were significantly lower than the model yielded for a scenario with constant income inequality.<sup>11</sup>

tion of the total workforce that has at least a high school diploma. Studies have shown that greater income inequality can translate into lower investment in childhood education. See Miles Corak, "Income Inequality, Equality of Opportunity, and Intergenerational Mobility," *Journal of Economic Perspectives* 27(3) (2013): 79–102. The model simulations confirmed that the delay does exist.

<sup>11</sup> Despite the fact that the Gini index has been stable in recent years, this should also lead to a continuation of the effects of rising income inequality this

## Income inequality hampers domestic consumer and investment demand

A look at the expenditure and output components of the national accounts showed that although rising income inequality in Germany only had a minor impact on total GDP, before the current decade began it apparently had a significant impact on some of its individual components (Figure 3).

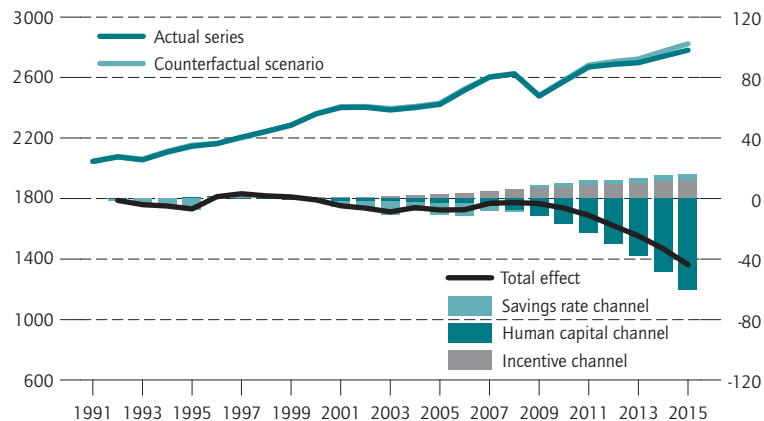
year and in future years, i.e., productivity will keep falling.



Figure 2

**Real GDP**

In billion euro, chain-linked—actual and counterfactual scenario (left-hand axis) and contributions of the channels (right-hand axis)



Source: Authors' own calculations.

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Real GDP in Germany would have risen somewhat faster if income inequality had stayed constant.

Since the turn of the millennium, private consumption in particular has been much lower than would have been expected if income inequality had not changed—and all other circumstances remained the same. This is because in reality, the savings rate was two percentage points higher than the model estimated for the scenario of a constant level of income inequality. In the years after 2000, companies did cap their price increases in reaction to the weaker demand caused by rising income inequality. Because the inhibitory effect of the human capital channel outweighed the productivity-raising influence of the incentive channel, increases in productivity were weaker than expected had income inequality remained constant. In the medium run, this counteracted the effect of lower price increases on consumer demand. Starting in 2005, this forced companies to raise prices more dramatically, reducing consumer demand even further. All in all, private consumption would have been significantly higher in each year from 2000 onward if the Gini index had remained at its 1991 value. In 2015 its value would have been 50 billion euros higher.

Rising income inequality also held real gross capital investment in check. To some extent the high savings rate probably stimulated investment demand as a result of falling interest rates. As a consequence, starting in 2007 the savings rate channel had a slightly positive effect on investment volume. However, according to the simulations, this effect was overcompensated due to a decrease

in investment returns caused by the weak demand as a result of rising income inequality.

### Weak import demand resulted in current account growth

Since 2000, imports have increased more slowly than they would have under the condition of constant income inequality. One reason is that weak domestic demand reduced the demand for imports. Another reason, as described above, is that rising income inequality reduced demand, which made firms temporarily cap their price increases in Germany. At the same time, income distribution had little impact on import prices. From an entrepreneurial perspective, imported inputs and raw materials were comparatively more expensive than if income distribution had remained unchanged. As a consequence, import demand was significantly weaker than otherwise expected. According to the simulations presented here, under constant income inequality and unchanging trends for all other factors, imports would have been higher by around 80 billion euros in 2015.

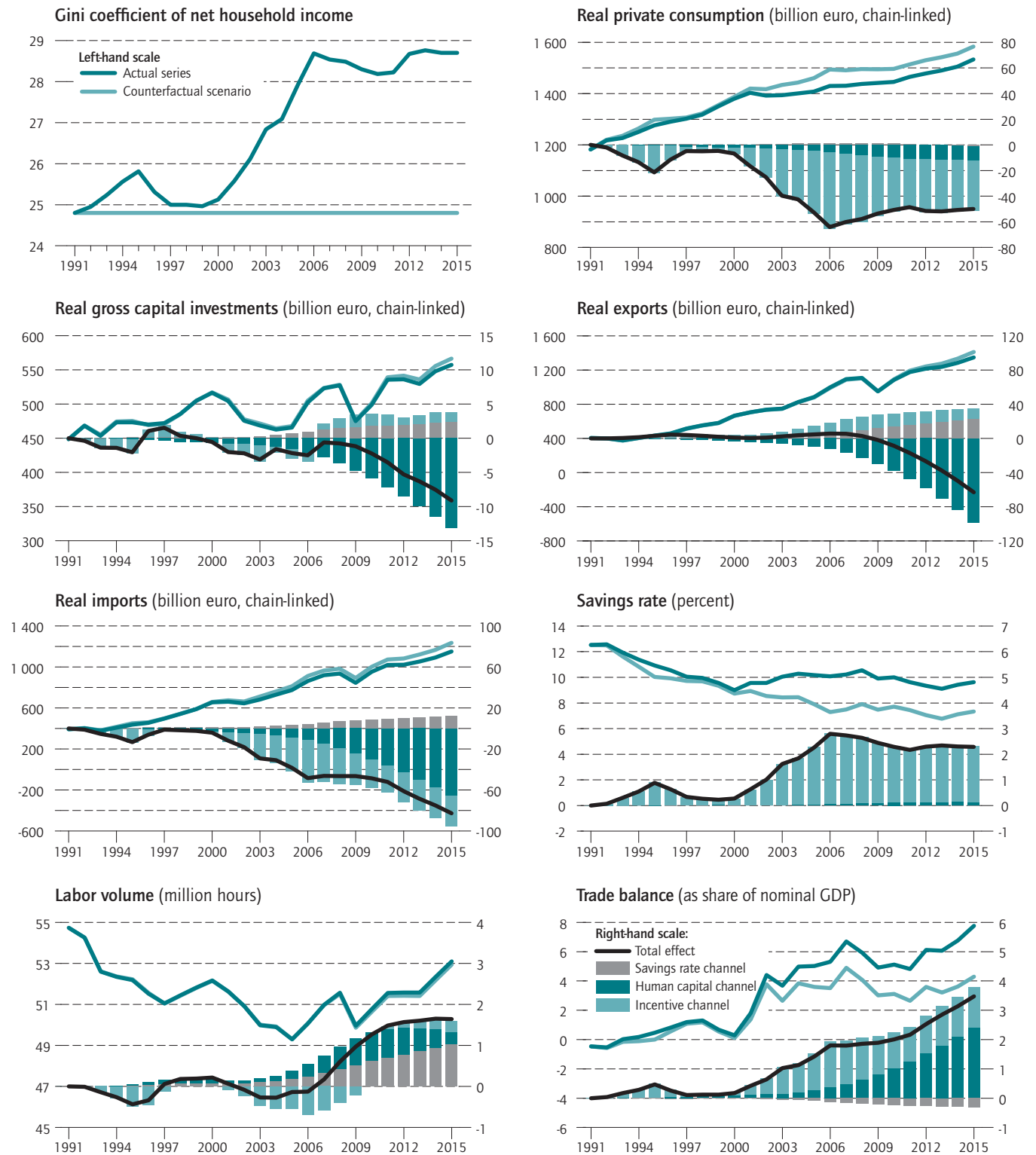
Unlike imports, the simulation did not show exports deviating substantially from their actual trend until 2010. Exports were affected by rising inequality in household income with a delay through changes in prices and productivity. The rather weak upward trend of domestic prices from 2000 onward initially gave Germany a greater competitive edge in export markets than it would have had under constant income inequality. The situation stimulated worldwide demand for German products. In the medium run, however, weaker growth in productivity due to rising income inequality generated upward pressure on export prices. German companies' competitiveness is likely to have grown more slowly than it would have under constant income inequality. According to the simulations, in the past five years in particular exports have grown more slowly as a consequence of the rise in income inequality since 2000 than they would have in the counterfactual scenario of constant income inequality. In 2015, for example, Germany's exports could have been worth 60 billion euros more.

Rising income inequality potentially led to an expansion of the balance of trade. Germany's import volume expanded less quickly, while the export volume initially grew faster than would have otherwise been expected. The rise in income inequality has put downward pressure on the export volume in recent years, but not as much as on import volume. For this reason, the trade surplus in real terms was probably higher every year after 2000 than it was in the scenario of constant income distribution. In relation to GDP, the trade surplus in nominal terms—and the current account balance as well—was around



Figure 3

**Expenditure and output components of the GDP – actual and counterfactual simulation**



Source: Authors' own calculations.

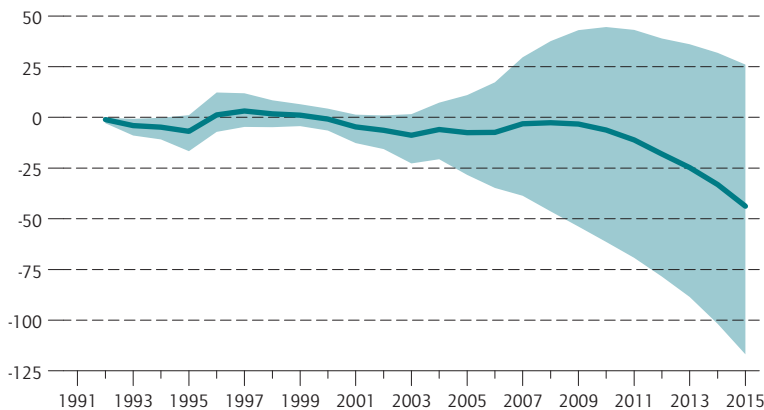
Since the turn of the millennium, private consumption and investment have been lower, while the trade surplus was probably higher than in the counterfactual scenario.

Figure 4

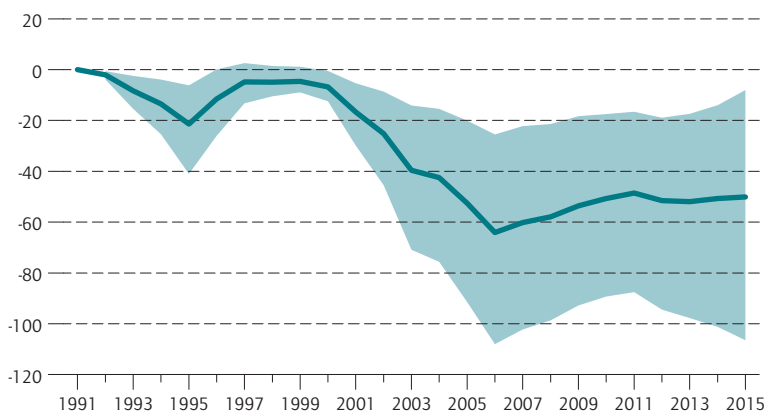
**Significance of results**

Point estimation and 95-percent confidence interval

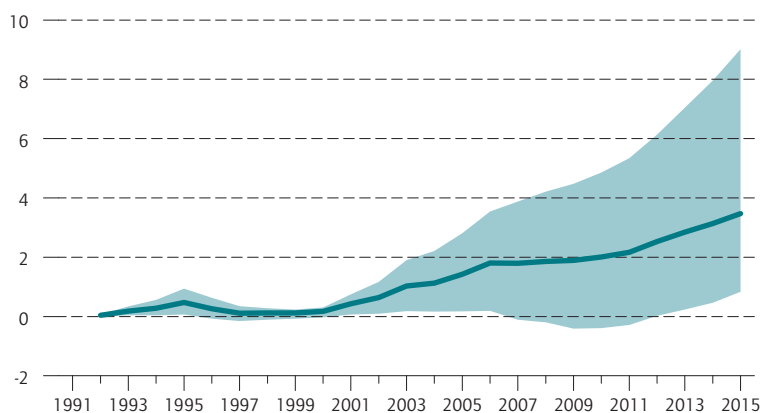
Real GDP (in billion euro, chain-linked)



Real private consumption (in billion euro, chain-linked)



Trade balance (as share of nominal GDP)



Source: Authors' own calculations.

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Significant results for private consumption and the trade balance.

three percentage points higher than it would have been had income inequality remained constant since 1991.

**Interpret the findings with care**

The findings presented here must be interpreted with care. Because most of the coefficients of inequality in the estimating equations are significant, the general direction taken by the effects of inequality on productivity or the savings rate should be quite robust. However, in other places the model equations are subject to considerable uncertainty that renders the extent of the effects of changes in income distribution on economic growth uncertain.

In order to consider the consequences of parameter and model uncertainty, we ran a Monte Carlo simulation for our model, with 10 000 repetitions for different parameter specifications drawn from a normal distribution. The 95-percent confidence interval determined this way showed that the decline in GDP established in the model's basic specification was not significant: we were not able to assume with at least 95 percent probability that the effect actually did exhibit the negative sign indicated (Figure 4).<sup>12</sup> However, the findings are significant for private consumption and the balance of trade. Despite the uncertainty of the model's estimates, we were able to conclusively determine that the rise in income inequality reduced consumption and expanded the balance of trade.

When evaluating the findings presented here, note that income distribution was modeled as a purely exogenous variable. From the econometric point of view the assumption of income distribution being exogenous in our model should be reasonable.<sup>13</sup> But the lack of the feedback effects that economic growth trends could have on income distribution in our model complicates interpretation of the findings. The simulations involving a rise in inequality in household income presented here entail a shift in functional income distribution from wage income to corporate income; under otherwise constant conditions, the wage share declines as a consequence of increasing income inequality. Generally speaking, this should bring about a change in income distribution to the disadvantage of households with low incomes and trigger renewed macroeconomic adjustment—which the model did not

<sup>12</sup> Since some parameters—such as the central bank's response elasticity to the inflation rate (Taylor principle)—are prone to theoretically founded upper and lower limits that the Monte Carlo simulation cannot take into account, parameter uncertainty was probably overestimated.

<sup>13</sup> From a theoretical perspective, there is no close, contemporaneous relationship between productivity and income distribution, and we can exclude reverse causation as an explanation for the delayed effect of income distribution on the stock of human capital.

take into consideration.<sup>14</sup> Not taking this second-round effect into account could lead to the model underestimating the impact of income inequality on economic growth.

## Conclusion

The cumulative growth rate of the German economy since reunification would be around two percentage points higher if income inequality had remained constant. The DIW Macroeconomic Model indicates this finding as shown in the simulation calculations presented here. In 2015, Germany's real GDP should have been a good 40 billion euros higher than its actual value. Private consumer demand and investment, exports and imports would all have grown faster. At the same time, the trade surplus would not have grown as quickly.

Despite the limitations mentioned in this report, the results permit several conclusions relevant to economic policy. First and foremost: according to the estimates presented here, changes in income distribution affect economic growth only after a perceptible delay. Therefore, despite the very low changes in income distribution in Germany as measured by the Gini index for net

household income, economic growth will probably still be inhibited in the current year and years to come as a result of the significant rise in income inequality seen in the last decade. Our simulations indicate that from the quantitative viewpoint, the human capital channel is the mechanism through which income inequality most significantly affects economic growth. Its impact is considerably delayed though.

The findings presented here also show that the change in income distribution observed in Germany probably also contributed to the surge in the trade surplus. In particular, imports apparently declined in reaction to the weaker domestic demand resulting from rising income inequality. This finding is not only relevant given the debate over imbalances in the euro area. It also clearly shows that the focus of the discussion on the macroeconomic consequences of rising income inequality should not be restricted to its negative effects on GDP. They will be minimized anyway, as a result of the weakening domestic economy being countered by the expansion of the trade surplus. Private consumption should be used as the standard in looking at social prosperity and the quality of life of people in Germany. As a result of rising income inequality, private consumption will probably be significantly lower in the long run.

<sup>14</sup> See Ferdinand Fichtner, Simon Junker, and Carsten Schwäbe, "Income Distribution: An Important Factor for Economic Forecasts," *DIW Economic Bulletin* 7 (2012): 3–10.

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JEL: D31, E27, O15

**Keywords:** income distribution, economic growth, macroeconomic imbalances



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## FIVE QUESTIONS FOR FERDINAND FICHTNER

# »Rising income inequality inhibits consumer demand«

1. Mr. Fichtner, DIW Berlin examined the relationship between rising income inequality and economic growth. Would Germany have higher growth if income inequality had not risen in recent years? *Yes, Germany's economic growth would actually have been somewhat higher if income inequality had not sharply increased between 1991 and 2015. The German economy showed an unrealized growth potential of around two percentage points due to the rise in income inequality in the period under inspection (1991 to 2015). This corresponds to a good one-twentieth of a percentage point of a lost growth per year.*
2. How do you explain the negative impact of income inequality on economic growth? *There are three main transmission channels between income inequality and economic growth. The first channel is the classical economic channel. Rising income inequality generally leads to income flowing to the part of the population with a relatively high savings rate. Part of the income disappears into these people's savings accounts and does not show up as consumer demand. Our estimates showed that rising income inequality inhibits growth in this way. There is also a relationship between income inequality and productivity. In the short run, we generally assume that income inequality should boost productivity to some extent because people see an incentive in the ability to increase their personal income faster by doubling their effort on the job. We call this the "incentive channel". The human capital channel has a counteractive effect. High income inequality generally leads to low wage earners being unable to afford to go to school longer or invest in apprenticeships. In the long run, this leads to a decline in the productivity. According to our estimates, this overcompensated for the incentive channel with the effect of higher income inequality leading to stronger growth in productivity in the short run.*
3. Which channel has the greatest impact? *In the short run, the savings rate channel has a relatively strong effect. This means that coupled with a rise in the savings rate, a rise in income inequality inhibits demand relatively quickly – for consumer goods in particular – and in turn hinders economic growth. But in the longer run, the human capital channel is the dominant mechanism: people invest less in education, which triggers a decline in productivity. Again, our estimates showed that a delay of at least ten years is to be expected. For example, the rise in income inequality that we observed after 2000 in Germany is only now affecting economic growth.*
4. How does income inequality affect Germany's imports and exports? *According to our simulation, the rise in economic inequality has resulted in weaker export and import figures for the German economy. However, imports are more strongly affected, which means that the trade balance (the difference between exports and imports) has also increased.*
5. What are the consequences of that? *A rising trade positive balance can compensate somewhat for income inequality's highly inhibitory effect on domestic demand. This means that GDP does not decline to the same extent as domestic demand. Given this relationship, our most important finding is: when discussing the consequences of income inequality the focus should not be GDP. Private consumer demand is a much more important factor. It declines much more powerfully than GDP. Ultimately, private consumer demand is what counts when assessing quality of life in Germany.*

Interview by Erich Wittenberg

To hear the recorded interview in German, visit [www.diw.de/interview](http://www.diw.de/interview)