Macroeconomic Effects of the German Government's Building Rehabilitation Program

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Abstract

The German government maintains programs providing financial support for the rehabilitation of buildings with the aim of reducing energy consumption and greenhouse gas emissions in the building sector. Lately, these programs have received additional attention for three reasons: First, the government's new Energy Concept from 2010 incorporates a substantial expansion of building rehabilitation activities. Second, the programs have been used as a tool for macroeconomic stabilization in the wake of the 2008/2009 financial crisis. Third, the government is concerned about the public deficit and all kinds of public expenditure are coming under increasing scrutiny.

The aim of our paper is to contribute to a fact-based discussion of the costs and benefits of the building rehabilitation program. We develop an extended input-output model (STEIN) to estimate the macroeconomic effects of the rehabilitation measures that received funding and how they affect the public deficit, focusing on the revenue from income taxes and social security contributions (SSC) as well as taxes on products and production. Our findings indicate that the programs induce substantial public revenue mainly through income taxes and SSC which have to be weighed against the program cost. We also estimate the distribution of public cost and public revenue between different levels of government (national level, federal state level and municipality level). If the rehabilitation measures do not crowd out other investment projects, the net effect on the public deficit turns out to be positive.

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1 Introduction

Measures for the reduction of energy consumption and the associated CO_2 emissions in the building sector have been on the political agenda for a number of years. In order to support efforts of private and public building owners, KfW Bankengruppe (a state-owned banking group, henceforth simply "KfW") has been promoting investment projects that contribute to energy saving and CO_2 reduction. These activities aim at a crucial element of the Federal Government's energy strategy announced in the fall of 2010 [BMWi, 2010]. With the decision to speed up the pace of nuclear energy phase-out, the contribution of the building sector to further energy efficiency and climate protection has gained additional importance [BMWi, 2011]. The efficiency standards for buildings are to be increased further, and by means of the *Energieeinsparverordnung* (energy saving directive, henceforth "EnEV") the standards for new buildings are to approach gradually the future European standard of "lowest energy buildings" until 2020, taking into consideration the economic burdens imposed on building owners and tenants. Funding for the energetic rehabilitation of buildings is to be increased by 1.5 billion EUR per year for 2012 to 2014, and the scope of the allowance for depreciation in the building sector is to be increased as well. Furthermore, the government will try to find by 2015 a solution that does not burden the public budgets through promotional programs, for example environmental economic instruments like "white certificates" [BMWi, 2011].

The evaluations of the KfW programs in this area for the years 2005 to 2009 have come up with positive results with respect to investment stimulation, energy saving, CO_2 reduction and employment effects [Clausnitzer et al., 2010, Clausnitzer et al., 2007, Clausnitzer et al., 2008, Gabriel & Balmert, 2007], but also with regard to the effects on the public budgets [Kuckshinrichs et al., 2010b, Kuckshinrichs et al., 2010a]. For the years 2008 to 2010, KfW has adjusted its promotion policy to the altered framework conditions, for example by procuring funding support for the construction of new buildings. The evaluation of the adjusted programs and their effects on the public budgets is yet forthcoming.

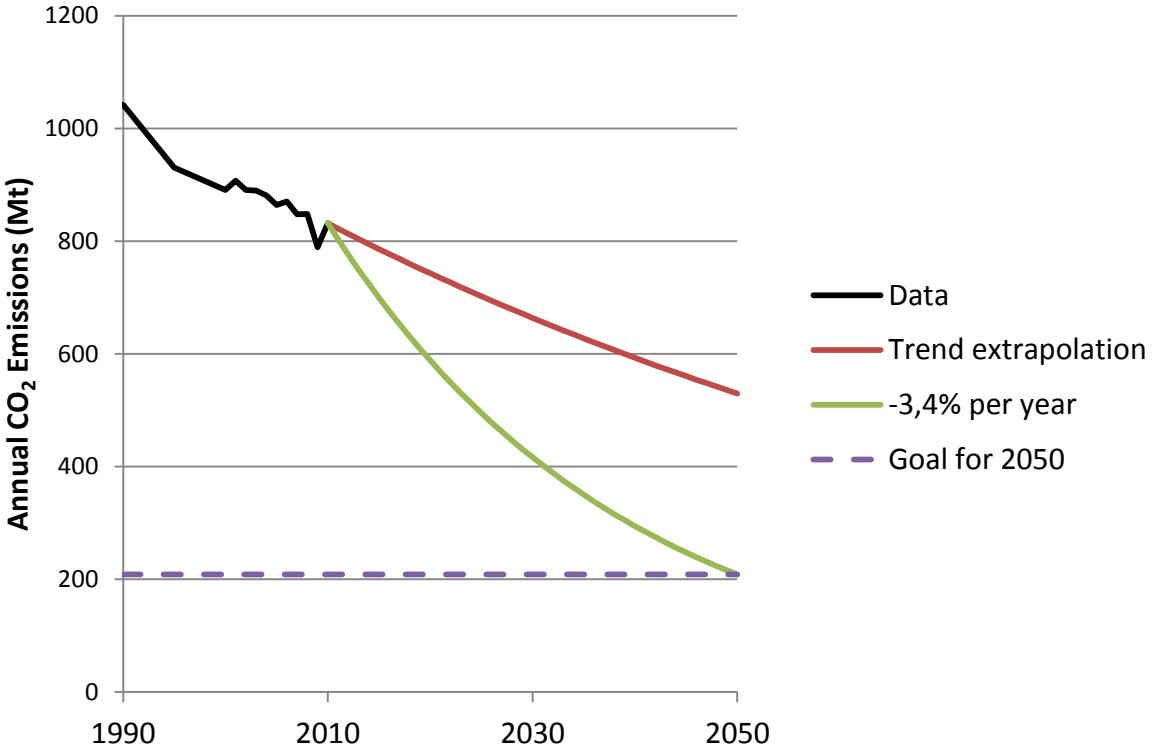
The goal of this study is to provide an analysis of the effects of KfW programs in the area of energy efficiency and CO_2 reduction on the public budgets for the years 2008 to 2010. The analysis focuses on the short-term effects, i.e. the effects taking place in the corresponding year. To this end, the program cost are reported in combination with the additional revenue (and avoided spending) for the various types of taxes and deductions, and are allocated to the various administrative levels (municipality, state, and federal level) as well as the social security systems. For the year 2008, the analysis covers the four programs "CO_2 building rehabilitation", "Ecological construction", "KfW municipal loans – energy-efficient rehabilitations" and "Social investment – energy-saving building rehabilitation". The analysis for the funding years 2009 and 2010 covers the following four KfW programs: "Energy-efficient construction", "Energy-efficient rehabilitation", "Energy-efficient rehabilitation – municipalities" and "Social investment– energy-saving building rehabilitation".

2 Motivation

The government of the Federal Republic of Germany has announced in its "Energy Concept" that it aims at reducing German CO_2 emissions by 80% in 2050, compared to the base year 1990. This is a highly ambitious goal. Between 1990 and 2010, annual CO_2 emissions have fallen from 1,042 Mt to 832 Mt, an average growth rate of -1.1% per year. If emissions continue to decline at this rate, they will reach a level of around 500 Mt in 2050, resulting in a reduction of about 50% compared to 1990.

In order to reach the goal of an 80% reduction, emissions must grow from now on at a rate of -3.4% per year. The different time paths of German CO_2 emissions are illustrated in Figure 1.

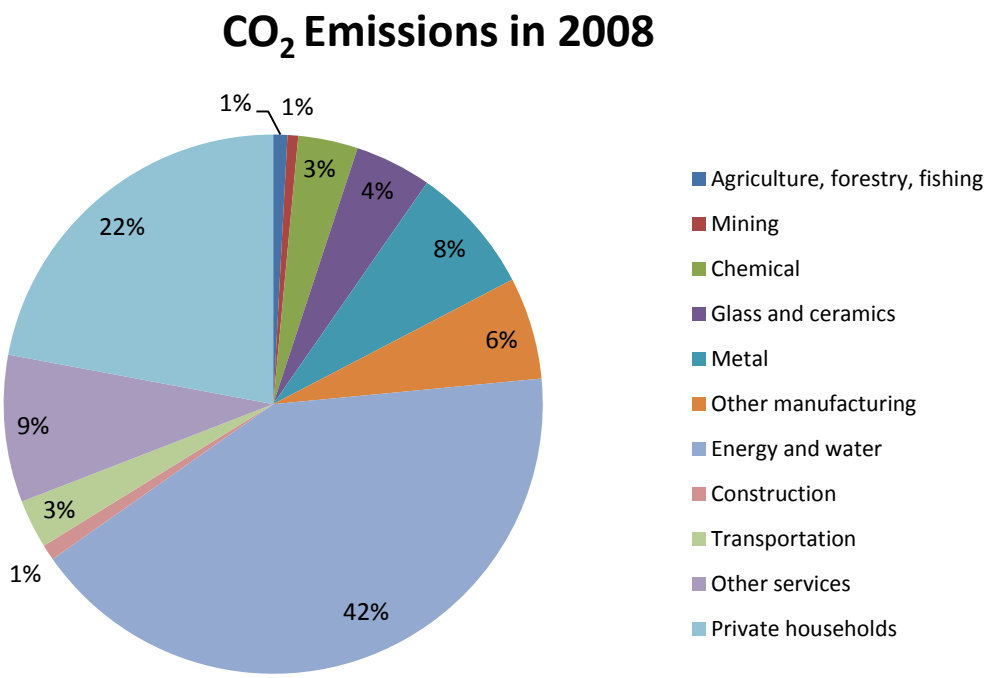
Figure 1: Past and future CO_2 emissions



Source: Destatis, authors' calculations

As evidenced in Figure 1, the task ahead is not easy. In order to increase the chances of achieving the stated objective, it makes sense to determine the areas where current emissions come from and how they can be reduced with the (now or soon) available technological options.

Figure 2: CO_2 emissions by industry and households, 2008



Source: Destatis, authors' calculations

Figure 2 shows the structure of (direct) CO_2 emissions in Germany by industry and private households. Clearly, the most important sector is the production and distribution of energy and water, which accounts for 42% of total CO_2 emissions. The second-most important sector is that of private households, which were responsible for 22% of total emissions. These figures refer to direct emissions of CO_2. In other words, the emissions allocated to private households are the emissions that are caused when consumers burn fossil fuels to heat their homes or drive their cars. The 42% of emissions allocated to "energy and water" are mostly caused by utilities burning fossil fuels to produce electricity and steam heat.

The Federal Government has deduced from these figures that a reduction of total CO_2 emissions by the desired magnitude must focus on two central issues: the use of energy for heating purposes in buildings and the shift from fossil fuels to renewable energy carriers in the electricity sector. These two pillars – increased energy efficiency and a larger share of renewable electricity – feature very prominently in the government's Energy Concept. For each of these pillars, appropriate policy instruments have to be implemented. The second pillar, the production of electricity, is targeted by the Renewable Energy Act (*Erneuerbare-Energien-Gesetz, EEG*), which promotes the installation of wind turbines and other renewable electricity installations by means of guaranteed feed-in tariffs. The first pillar, energy efficiency in buildings, is targeted by a variety of policy instruments. The Energy Saving Regulation (*Energieeinsparverordnung, EnEV*), for example, imposes technological standards which must be fulfilled by newly constructed buildings. However, many of the currently existing buildings will in all likelihood still be occupied in 2050, the target year of the Energy Concept. In order to ensure a reduction of energy consumption in those buildings, the government has decided to promote the rehabilitation of such buildings. A central instrument in this respect is the CO_2 rehabilitation program, on which we focus in this paper.

3 KfW Promotional Programs for CO_2 Reductions in Buildings

KfW programs designed to improve energy efficiency and reduce CO_2 emissions in the building sector promote investments in energy-saving measures and the reduction of CO_2, whether in the construction of new homes or in the refurbishment of housing and buildings that form part of the public and social infrastructure. The Federal Ministry of Transport, Building and Urban Development (BMVBS) provides budget resources to KfW for low interest loans and for investment grants. In April 2009 the "Energy-efficient refurbishment" program superseded the programs "CO_2 building rehabilitation program – loan and grant variants" and "Housing modernization – Eco-Plus variant". This program serves to promote comprehensive refurbishment into "KfW efficiency houses" or individual measures to improve energy efficiency. As well as repayment bonuses dependent on the primary energy consumption of the efficiency house, a special promotion is possible if construction is supervised by an external technical expert.

The former "Ecological construction" program was superseded by the "Energy-efficient construction" program in April 2009. This promotes the construction and initial purchase of "KfW efficiency houses". It can also be used to promote the conversion of existing buildings and replacing new buildings into energy-efficient new buildings. The KfW loan will assume 100 % of construction costs (without the costs of the property) up to a maximum of EUR 50,000 per housing unit.

As for non-residential housing, the KfW programs "Energy-efficient refurbishment – municipalities" and "Social investment program – energy-saving building refurbishment" promote measures to improve the energy-efficiency of buildings that form part of the municipal and social infrastructure. Since 2008, low-interest KfW loans have been available to municipalities and non-profit-making organizations for energy-efficient refurbishment.

Table 1 shows the basic data for the funding years 2008-2010 of the programs examined [IEK-STE (Forschungszentrum Jülich), 2011]. The program costs are covered by the federal government budget and, at around EUR 1,300 million in 2008 and almost EUR 1,400 million in 2010, are nearly the same amount in these two years. In 2009 approximately 50 % more was provided in federal funds, some EUR 2,000 million. As part of the federal government's economic stimulus package (Konjunkturpaket I), these funds were part of an economic policy designed to mitigate the downturn in the wake of the financial crisis [IEK-STE (Forschungszentrum Jülich), 2011].

Table 1: Basic data on KfW programs (Mio. €)

	2008				2009				2010			
	Credit Volume Million €	Induced* [Promoted*] Investment Million €	Induced* [Promoted*] Jobs	Program costs Million €	Credit Volume Million €	Induced* [Promoted*] Investment Million €	Induced* [Promoted*] Jobs	Program costs Million €	Credit Volume Million €	Induced* [Promoted*] Investment Million €	Induced* [Promoted*] Jobs	Program costs Million €
CO_2 building rehabilitation	3,104	3,394 [3,394]	51,000 [51,000]		-	-	-		-	-	-	
KfW municipal loans – refurb.	80	125 [125]	1,878[1)] [1878][1)]		-	-	-		-	-	-	
Social inv. – energy-saving refurbishment	10	14 [14]	210[1)] [210][1)]		-	-	-		-	-	-	
Energy-efficient refurbishment	-	-	-		5,769	7,761 [7,761]	124,000 [124,000]		5,092	7,042 [7,042]	113,000 [113,000]	
Energy-efficient infrastructures	-	-	-		152	229 [229]	4,000 [4,000]		114	205 [205]	3,000 [3,000]	
Total refurbishment	*3,194*	*3,533 [3,533]*	*53,089[1)] [53,089][1)]*		*5,921*	*7,990 [7,990]*	*128,000 [128,000]*		*5,206*	*7,247 [7,247]*	*116,000 [116,000]*	
Inv./Credit		*1,11*				*1,35*				*1,39*		
Ecological building	2,389	2,643[1)] [8,648]	39,708 [1)] [137,911][1)]		-	-	-		-	-	-	
Energy-efficient construction	-	-	-		3,094	4,175[1)] [10,607]	66,886[1)] [170,000]		3,654	5,087[1)] [14,288]	81,418[1)] [229,000]	
Inv./Credit		*1.11[1)] [3.62]*				*1.35[1)] [3.43]*				*1.39[1)] [3.91]*		
Total refurb. & construction	**5,583**	**6,176[1)] [12,181]**	**92,797[1)] [191,000]**	**1,293**	**9,015**	**12,165[1)] [18,597]**	**194,886[1)] [298,000]**	**2,035**	**8,860**	**12,334[1)] [21,535]**	**[197,418][1)] [345,000]**	**1,366**

*: promoted by provision of KfW funds; induced in the sense of directly initiated by KFW funds

1): Data adjusted by the authors

Source: [KfW, 2011a, KfW, 2011b, KfW, 2011c, Clausnitzer et al., 2009, Clausnitzer et al., 2010], own conversion

4 Modelling Approach

In order to estimate the macroeconomic impact of the investment projects that were undertaken with KfW support, we employ the STEIN model. An extensive description of STEIN can be found elsewhere [Kuckshinrichs et al., 2009, Kuckshinrichs et al., 2010b]. In the following, we provide merely a brief outline of the model's central features. For a general introduction to input-output modeling, we recommend the textbook by Miller and Blair [Miller & Blair, 2009].

The core of STEIN is a static open input-output quantity model. It is "static" in the sense that investment does not react to changes in demand, output, or capacity utilization, so the "accelerator mechanism", which arises when investment reacts to those variables, is not part of the model. It is also "open" in the sense that consumption expenditure by households is also treated as exogenous, so there is no "income multiplier". In other words, all components of final demand (consumption expenditure by households, consumption expenditure by government, investment, and exports) are considered exogenous variables ("autonomous demand", in Keynesian terms). Finally, it can be described as a "quantity" model because it measures all variables in "real" (i.e. price-adjusted) terms. For example, if the model reports a 10% increase in the production of coal, this means that the production of coal has in fact increased by 10% (measured in tons, cubic meters, or some other physical unit), and the model does not make any statements about the price of coal.

The reason for choosing a model without a multiplier-accelerator mechanism was that some participants in the policy arena doubt the existence of such mechanisms or claim that they are of negligible magnitude. Notwithstanding the existence of an enormous number of papers arguing that such effects do exist and are of significant magnitudes, it was decided to leave them outside the model at this stage. This means that the model results are on the "conservative" side in the sense that they represent a lower bound. If we included the multiplier-accelerator mechanism in the model, the estimated effects on sectoral production (and GDP, and employment, and public revenue) would be larger.

The core of the model is the well-known equation

$$\mathbf{x} = \mathbf{A}\mathbf{x} + \mathbf{f}, \tag{1}$$

where $\mathbf{x}$ denotes the vector of output by branch, $\mathbf{A}$ denotes the matrix of input-output coefficients, and $\mathbf{f}$ denotes the vector of final demand. Since STEIN is based on the latest input-output table provided by the Federal Statistical Office [Destatis, 2010], it distinguished 70 (groups of) products and 70 homogeneous branches. This means that $\mathbf{x}$ and $\mathbf{f}$ are column vectors of length 70, and $\mathbf{A}$ is a 70 x 70 matrix.

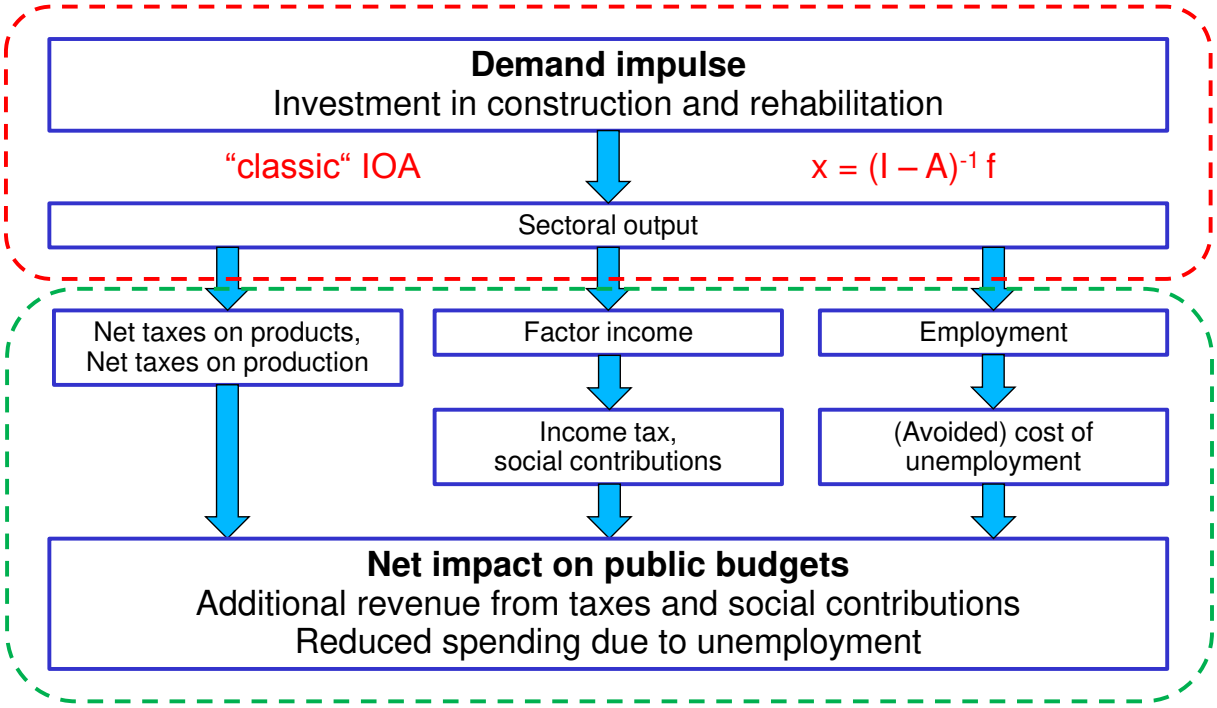
Solving (1) for $\mathbf{x}$ yields:

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1}\mathbf{f}. \tag{2}$$

The term $(\mathbf{I} - \mathbf{A})^{-1}$ is the "Leontief inverse". $\mathbf{A}$ can be computed from the official input-output tables and is henceforth assumed to be constant. Thus, (2) can be used to compute output by branch as a function of final demand by product.

As is common in the input-output approach, we consider the spending associated with the investment projects supported by the aforementioned KfW programs as an exogenous final demand impulse. That is, the vector $\mathbf{f}$ represents the demand for construction services for the completion of these projects. (2) can the then be used to estimate the effects of these projects on output $\mathbf{x}$. So far, this is a fairly common application of a simple input-output model.

Figure 3: Causal chains from demand impulse to public budgets



Source: authors' illustration

The more interesting part of the model deals with the effect of the investment projects on public revenue. Figure 3 shows how the causal chains from the demand impulse to the net effect on the public budgets are represented in the model. The first step is the calculation of sectoral output. This is the "classic" application of input-output analysis described by equation (2). The second step is the estimation of the amount of public revenue induced by the change in sectoral output. Net taxes on products and net taxes on production are modeled as constant proportions of output in each branch (the factors of proportion can be computed from the input-output table). With respect to factor income, a distinction is made between the compensation of employees (gross wages plus social contributions, which can be interpreted as the reward for labor services) and net operating surplus (profits, rents, and interest, which can be interpreted as the reward for capital services if land and other natural resources form a sub-category of "capital"). Using data from the public sector accounts published by Destatis, we computed the average tax rates on these two types of factor income and assumed that they remain constant. All in all, STEIN covers more 99% of all tax income (with the remainder consisting mostly of inheritance tax revenue). For more details, see Kuckshinrichs et al. [Kuckshinrichs et al., 2010b].

A further objective of this study was to estimate the distribution of the additional revenue over the administrative levels and the social security system. In the German tax system, a distinction is made between federal taxes (*Bundessteuern*), Länder taxes (*Landessteuern*), and municipality taxes (*Gemeindesteuern*). The revenue from these taxes goes to the corresponding administrative layer.

Furthermore, there are "combined taxes" (*Gemeinschaftssteuern*). The revenue from those taxes is distributed over the administrative layers according to certain rules fixed by law. For example, a share of 42.5% of the revenue from income and wage taxes is distributed to the Federation, another 42.5% goes to the Land, and the remaining 15% benefit the municipality. Other examples of *Gemeinschaftssteuern* are the corporate income tax (Federation and Länder receive 50% of the revenue) and the value added tax (the Federation receives 53.9%, the Länder receive 44.1%, and the municipalities receive 2% of the revenue). The distribution of the various types of taxes was included in the STEIN model by means of a distribution matrix (Table 2).

Table 2: Distribution of revenue over administrative layers and social security

	Federation	Länder	Municipalities	Social security
Value added tax	0.514	0.464	0.022	
Net taxes on products	0.444	0.060	0.496	
Net taxes on production	0.444	0.060	0.496	
Taxes on income				
Payroll tax	0.425	0.425	0.150	
Other income taxes	0.425	0.425	0.150	
Capital returns tax	0.440	0.440	0.120	
Corporate income tax	0.500	0.500	0.000	
Solidarity surcharge	1.000			
Social contributions				1.000

Source: authors' calculations

Another potentially important channel works through the (avoided) cost of unemployment. If an investment project induces a certain demand for additional labor, it is not immediately clear how that demand will be satisfied. Depending on the overall macroeconomic environment and certain labor market characteristics, firms may decide to make their employees work longer hours, but they may also decide to hire additional workers. A mixture of longer hours and more employees is also possible (and perhaps the most likely case). A simple input-output model can compute the induced labor demand, but it cannot say whether this demand will be met by longer hours or additional employment.

In order to account for both possibilities, we compute two different scenarios. The first one, which we call "overtime", is based on the assumption that the demand impulse does not generate any additional jobs, and the induced labor demand is met entirely by workers working overtime. In the second scenario, which is labeled "jobs", the opposite is true – for each additional man-year of labor demand, an additional job is created. Naturally, this has a dramatic effect on public budgets. In the scenario "overtime", the state receives additional revenue from income taxes (assuming that the additional hours are paid) and social contributions (which are linked to gross income), but since the number of unemployed workers is unaffected, spending on unemployment benefit and other unemployment-related cost items is unaffected as well. In the scenario "jobs", by contrast, the number of unemployed persons decreased, and so does the cost of unemployment.

These additional effects are considered in the model by drawing on a related study by the Institute of Employment Research (*Institut für Arbeitsmarkt- und Berufsforschung, IAB*). The IAB concluded that, when all effects are considered, the "fiscal cost of unemployment" amounts to roughly 18.000 Euro per person and year, although this has fluctuated between the years [Bach & Spitznagel, 2008]. We

adopt that figure and, based on the employment figures (Table 1), compute the avoided cost of unemployment for the scenario "jobs".

5 Results

Table 3 reports the model results in terms of the effects on the (overall) public budgets. The first row shows the program cost, i.e. the opportunity cost of providing funds for the KfW promotional programs instead of using them elsewhere. The other rows show the estimated return in terms of tax revenue and SSC. For each of the two scenarios, the net total is displayed in bold type.

Table 3: Effects on public budgets induced by investment projects (million €)

	2008	2009	2010
Program cost	1,293	2,035	1,366
Value added tax paid by investors	1,173	2,313	2,343
	[2,314]	[3,536]	[4,091]
Net taxes on products	94	185	188
	[185]	[283]	[328]
Net taxes on production	76	149	151
	[150]	[228]	[264]
Payroll tax and SSC incl. solidarity surcharge	1,167	2,273	2,282
	[2,302]	[3,475]	[3,984]
Corporate income tax and other income taxes incl. solidarity surcharge	261	441	388
	[515]	[674]	[677]
Scenario "overtime": total	**1,478**	**3,326**	**3,987**
	[4,173]	**[6,161]**	**[7,978]**
Avoided cost of unemployment	857	1,800	1,823
	[1,764]	[2,752]	[3,186]
Scenario "jobs": total	**2,335**	**5,126**	**5,810**
	[5,937]	**[8,913]**	**[11,164]**

Source: Authors' calculations

The results of our calculations clearly show that the public revenue resulting from the investment projects is substantial. In 2008, for example, the program cost amount to 1,293 million €, which were employed to pay out a credit volume amount to 5,583 million € (cf. Table 1), which in turn was used to finance investment projects worth 12,181 million € (of which 6,176 million € were "induced" in our terminology). In the scenario "overtime", the "induced" investment projects generated 1,173 million € of revenue from VAT, 94 million € of revenue from net taxes on products, 76 million € of revenue from net taxes in production, 1,167 million € of revenue from payroll tax and SSC (including solidarity surcharge) and 261 million € of revenue from corporate income tax and other income taxes (including solidarity surcharge). The "net effect" (public revenue minus program cost) was 1,478 million €. In the scenario "jobs", the avoided cost of unemployment amounts to 857 million €, so the net effect on the public budget is 2,335 million €. When all investments are considered, the corresponding figures are significantly larger (but again, we emphasize that those investments which fell outside the promotional range cannot be considered "induced").

For the year 2009, all figures are substantially higher, because that is precisely the year of the "Great Recession" when the KfW promotional programs were specifically used as a means to increase

aggregate demand. For 2010, the public revenue figures are similar in magnitude to those for 2009, whereas the program cost is significantly lower. We suspect that this has to do with the reduced cost of borrowing from the government's point of view, which means that the opportunity cost of providing funds for the programs was lower in 2010 than in earlier years.

Another point of interest is the distribution of additional revenue over the different administrative levels and the social security system. This is shown in Table 4. The program cost is a cost item from the Federation's point of view. This means that even after taking account of all the revenue effects, the net effect on the federal budget is negative in many cases. Exceptions are the year 2010 (when the ratio of program cost to credit volume and induced investment fell significantly) and the optimistic "jobs" scenario for 2009. For the other administrative levels, the effect on their budgets is clearly positive, as they do not have to bear the program cost while receiving part of the induced revenue. The Länder benefit tremendously from the induced VAT revenue (they receive almost 50% of total VAT revenue); roughly two thirds of their additional revenue comes from this source. From the municipalities' point of view, all tax channels are important. The social security system, naturally, benefits mostly from additional SSC. For social security, the difference between the two scenarios is striking: the net effect in the "jobs" scenario is almost twice as large as in the "overtime" scenario. The reason for this is that the avoided cost of unemployment – in the case of unemployed workers getting employed due to the investment spending – consists to a large extent of avoided payments of unemployment benefit.

Table 4: Effect on the budgets of different administrative layers and social security (million €)

	2008					2009					2010				
	F	L	M	S	Total	F	L	M	S	Total	F	L	M	S	Total
Program cost	1,293	0	0	0	*1,293*	2,035	0	0	0	*2,035*	1,366	0	0	0	*1,366*
Value added tax	603	544	26	0	*1,173*	1,188	1072	52	0	*2,312*	1,204	1,087	52	0	*2,343*
	[1,189]	[1,073]	[51]	[0]	*[2,313]*	[1,816]	[1,639]	[79]	[0]	*[3,534]*	[2,102]	[1,898]	[91]	[0]	*[4,091]*
Net taxes on products	50	11	34	0	*94*	84	15	87	0	*186*	83	11	93	0	*188*
	[99]	[22]	[67]	[0]	*[188]*	[128]	[23]	[133]	[0]	*[284]*	[145]	[19]	[162]	[0]	*[326]*
Net taxes on production	40	9	27	0	*76*	68	12	69	0	*149*	67	9	75	0	*151*
	[79]	[18]	[53]	[0]	*[150]*	[104]	[18]	[105]	[0]	*[227]*	[117]	[16]	[131]	[0]	*[264]*
Payroll tax and SSC incl. solidarity surcharge	143	126	45	853	*1,167*	268	236	84	1,685	*2,274*	263	233	82	1.704	*2,282*
	[282]	[248]	[89]	[1,682]	*[2,301]*	[410]	[361]	[128]	[2,576]	*[3,475]*	[459]	[407]	[143]	[2.975]	*[3,984]*
Corporate income tax and other income taxes incl. solidarity surcharge	123	110	28	0	*261*	208	181	52	0	*441*	181	161	46	0	*388*
	[243]	[217]	[55]	[0]	*[515]*	[318]	[277]	[79]	[0]	*[674]*	[316]	[281]	[80]	[0]	*[677]*
Scenario "overtime": total	**-335**	**800**	**159**	**853**	***1,478***	**-219**	**1,517**	**344**	**1,685**	***3,328***	**433**	**1,501**	**348**	**1,704**	***3,987***
	[599]	**[1,578]**	**[315]**	**[1,682]**	***[4,174]***	**[741]**	**[2,318]**	**[524]**	**[2,576]**	***[6,159]***	**[1,773]**	**[2,621]**	**[607]**	**[2,975]**	***[7,976]***
Avoided cost of unemployment	139	0	139	579	*857*	292	0	292	1,216	*1,800*	296	0	296	1,232	*1,824*
	[286]	[0]	[286]	[1,192]	*[1,764]*	[446]	[0]	[446]	[1,859]	*[2,751]*	[517]	[0]	[517]	[2,153]	*[3,187]*
Scenario "jobs": total	**-196**	**800**	**298**	**1,432**	***2,335***	**73**	**1,517**	**633**	**2,901**	***5,125***	**729**	**1,501**	**644**	**2,936**	***5,811***
	[885]	**[1,578]**	**[601]**	**[2,874]**	***[5,938]***	**[1,187]**	**[2,318]**	**[970]**	**[4,435]**	***[8,910]***	**[2,290]**	**[2,621]**	**[1,124]**	**[5,128]**	***[11,163]***

F: Federation, L: Länder, M: Municipalities, S: Social security

[ ]: due to promoted investment (not only induced) spending

Due to rounding errors, column sums may deviate from figures in Table 3.

Source: authors' calculations

6 Discussion

Table 4 shows that the net effect – induced revenue minus program cost – is generally positive, in some cases even at the federal level. However, one should not interpret these findings in such a way as to conclude that the programs are self-financing. Under certain conditions, they may be. However, this depends very much on the macroeconomic environment, which may change considerably especially in highly uncertain times like, for example, 2008 and 2009. The model framework adopted in this study is basically a rather simple input-output model which takes final demand as an exogenous "trigger". It does not consider possible crowding-out effects between the investment projects promoted by KfW and other investment projects. Furthermore, as a pure quantity model, it does not consider the possible effects of increased demand on commodity prices.

On the other hand, we would argue that under the special conditions prevailing in 2008 to 2010, the KfW promotional programs were not likely to exhibit significant crowding-out or price effects. In those years, the macroeconomic problem was an oversupply of savings and a shortage of (safe) investment projects, not the other way around. This is evidenced by the development of real interest rates, which plunged to historically low levels (and, by the way, are still extremely low at the time of writing). Furthermore, the German economy of the 21st century is integrated into the capital markets of the Eurozone, the European Union, and the world as a whole. It is hard to imagine how investment spending of less than 10,000 million € per year could exert a significant effect on the real interest rates prevailing in those markets, so crowing-out via higher interest rates is simply not likely.

Another question is that of windfall gains. Some investors may have been planning to undertake investment projects independently from KfW programs, and the additional spending on those projects may have formed a windfall gain for those investors without triggering any new investment spending. The extent of such effects is very hard to verify empirically, but their existence cannot be denied. This neglect could mean that our estimates are biased upward. On the other hand, we did not include macroeconomic feedback loops in the form of income multipliers or accelerator effects. Incorporating such effects would have led to higher results. Although ultimate proof is lacking, we would argue on the basis of economic intuition that the various upward and downward biases should cancel out each other on the whole, and the results presented in Table 3 and Table 4 are of a realistic magnitude.

7 Conclusion

The findings presented above show that the KfW promotional programs for CO_2 reduction may contribute to more than one policy objective. Firstly, they result in significant reductions in energy use and emissions. This is beneficial from an environmental point of view, and it also helps to reduce the import dependence of an economy which is heavily dependent on manufacturing and relatively poor in domestic energy sources. Secondly, they strengthen the demand for labor-intensive activities such as construction services. Especially in times of economic crisis, this effect may generate or save a significant number of jobs in an economy which is still suffering from mass unemployment. Thirdly, the effect on the public budget is more complex than a superficial glance at the program cost figures may suggest. Clearly, the program cost cannot be ignored; as an opportunity cost it has to be taken under consideration by the corresponding authorities. However, it has to be juxtaposed against the

significant revenue in form of taxes and SSC as well as the avoided cost of unemployment that emerge from the increase in demand.

This paper has focused on the case of Germany over the years 2008 to 2010. The question is what can be learned from this experience, especially upon consideration of the current economic climate in the European Union. We would argue that if European governments decide to shift away from fiscal austerity toward promoting growth from the demand side, they should consider implementing programs like those described in this paper. Especially the refurbishment of existing buildings might provide relief to troubled economies like Spain and Ireland because the multiplier effects are likely to be larger than for most other sectors, and because of this multiplier the net cost of such programs is significantly lower than some may think when looking only at the program cost. Aside from that, there is the environmental dividend in the form of reduced energy consumption and emissions, which may not be the case for many other investment projects.

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