

Gerhard Streicher

Using the FIDELIO Model to Estimate the Effects of the Tax Reform 2015-16 on Net Output

Using the FIDELIO Model to Estimate the Effects of the Tax Reform 2015-16 on Net Output

We estimate the effects of the Austrian tax reform of 2015-16 by using the econometric input-output model FIDELIO, which features an in-depth treatment of both private and public households' revenues, expenditures, budgets and consumption as well as price transmission. According to the simulations, the reform will, to some extent, succeed in boosting domestic demand, with private consumption rising by almost € 2.5 billion; both net output and GDP will rise perceptibly by € 290 million and € 1.35 billion, respectively. Among the sectors that profit most from the proposed changes in the tax regime are those with high income elasticities (and low import shares): real estate activities, (retail) trade, and financial services. The food production sector aside, manufacturing will experience very modest gains only, as a large share of its products is imported. High income elasticity, however, leads to moderate gains for hotels and restaurants, in spite of a higher value-added tax on hotel services and the upward pressure on prices due to fraud-preventing measures (especially the obligation to introduce cash registers).

Contact:

Gerhard Streicher: WIFO, 1030 Vienna, Arsenal, Objekt 20, Gerhard.Streicher@wifo.ac.at

JEL-Codes: C67, H29 • **Keywords:** Tax simulation, input-output model, net output

Referee(s): Josef Baumgartner

ISSN 1605-4709 • © Austrian Institute of Economic Research 2015

Impressum: Herausgeber: Karl Aiginger • Chefredakteur: Michael Böheim (Michael.Boeheim@wifo.ac.at) • Redaktionsteam: Tamara Fellingner, Ilse Schulz, Tatjana Weber • Medieninhaber (Verleger) und Redaktion: Österreichisches Institut für Wirtschaftsforschung • 1030 Wien, Arsenal, Objekt 20 • Tel. (+43 1) 798 26 01-0 • Fax (+43 1) 798 93 86 • <http://bulletin.wifo.ac.at> • Verlags- und Herstellungsort: Wien

1. Simulation assumptions

The basic assumptions underlying the model simulation¹ follow the scenarios outlined in *Baumgartner – Kaniovski (2015)*. A simulation of the 2016-2019 time path is omitted here, since the model-endogenous dynamics would completely dominate the time path. Instead, in carrying out a mainly comparative-static analysis those effects are estimated which take effect within a new equilibrium model under the assumptions about the incidence of the tax reform explained below. This in large part also explains differences with respect to the estimates by *Baumgartner – Kaniovski (2015)*, which explicitly take the time path of the effects into account. However, not all long-term effects are included in the reported four-year period. After five years, about three quarters of the (hypothetical) total effect on private consumption is realised (Figure 1 and Table 2 in *Baumgartner – Kaniovski, 2015*).

1.1 Tax reductions

The planned tax relief amounts to a total of € 5.19 billion, of which € 4.97 billion can be attributed to private households (as a reduction of the wage and income tax burden, particularly through a lowering of the entry rate, the negative tax for em-

¹ The data basis used in the simulations described here differs slightly from that of other contributions in the special issue of WIFO-Monatsberichte (5/2015) on the tax reform 2015-16, as the final changes made between Council of Ministers' draft submitted on 17 March and the draft legislation submitted for review on 20 May, 2015, could not be taken into consideration. However, the differences are relatively small (the most important point likely being the higher estimated revenues from compulsory receipts and cash registers – an estimated € 1,080 million instead of € 900 million) and thus not much deviation would be expected in the simulation results.

employees and pensioners with low incomes, the increase in the family allowance and the commuter tax allowance). A total of € 0.22 billion is conceived as an "economic package" (increase in the research premium, negative tax for self-employed persons and farmers with low incomes, the introduction of financing companies for the SME sector; *Schatzenstaller, 2015*).

The FIDELIO model

The FIDELIO econometric input-output model (Fully Interregional Dynamic Econometric Long-term Input-Output Model for the EU 27) covers the EU 27 and 7 additional countries (Brasil, China, India, Japan, Russia, Turkey, USA)¹. The core of the model consists of revenue and usage tables based on 59 sectors and goods (2-digit NACE Rev. 1), 6 final demand categories (private consumption, public consumption, private services without profit, investments, change in inventories, exports) as well as a trade matrix, which connects the model regions at the goods level. Significant behavioural equations are econometrically estimated: the demand factor in production is determined together with output prices using a translog model; wage-setting follows a wage bargaining approach. In private consumer demand, two durable (vehicles, living space) and 13 non-durable consumer goods (determined in an AIDS model) are distinguished. The export streams of the 59 goods are partly model-endogenous (from mirrored imports of other model regions) and partly model-exogenous (exports to the "rest of the world").

For private as well as public consumption, dynamic capital formation is applied, whereby an additional five income groups (quintiles) are distinguished in the case of private consumption. In simplified terms, the difference between current income and expenditures determines net debts (or savings), which together with the debts or assets of the previous year yield that of the current year; together with (positive or negative) interest payments, assets and liabilities are included in current income and expenses. Diverse connections exist between the financial management of private and public budgets: taxes on income and assets or social insurance contributions flow from the households to the state; monetary transfers (pension benefits, unemployment benefits, other transfers). Similarly, though to a lesser extent, there is a connection between the corporate sector and the state (via taxes on production, subsidies, corporate taxes, etc.).

Another characteristic that makes the FIDELIO model predestined for use in tax simulations is its consistent pricing mechanism: based on endogenous output prices by sector (which are determined together with the production factors), the prices of goods are determined at *basic prices* ("price at the factory gate"). Along with trade and transport margins and taxes on products (e.g., VAT), the *purchaser prices* (prices paid by the various consumers) are determined. In foreign trade, these price transmissions continue: exports rated at FOB prices ("free on board") at the border of the exporting country become CIF valued imports ("cost, insurance, freight") at the border of the importing country after the addition of the international trade and transport margin². Changes in (both national and international) trade and transport margins, as well as taxes on goods which may include customs taxes in foreign trade, can be implemented in a very direct (and accurate) way in the model.

¹ For a detailed description, see *Kratena et al. (2013)*; for a discussion of the philosophy of the model, see *Kratena – Streicher (2009, 2014)*. – ² The derivation of consistent export streams is described in *Streicher – Stehrer (2015)*.

In the FIDELIO model the tax relief of households is modelled as an exogenous reduction of tax liability (which is reflected as a decrease in fiscal tax revenue). The breakdown of the 5 income groups (see box) follows the distribution estimated using the WIFO microsimulation model (*Rocha-Akis, 2015*).

Various pragmatic allocation formulae are used for the "economic package":

- The research premium of € 80 million is spread across the 59 sectors based on the intermediate consumption of good 73 ("research and development").
- Half of the negative tax of € 60 million, which will take effect via a reduction in the social contributions of self-employed persons and farmers, will be allocated to the agricultural sector; the rest will be divided pro rata amongst the sectors based on the share of self-employed.
- The SME financing will benefit the sectors according to their share of income tax and corporate tax performance.

1.2 Counter-financing

The counter-financing of tax reductions amounts to € 5.14 billion. On the one hand it originates from an improvement in measures to prevent tax fraud (€ 1.9 billion), the deletion of exemptions in income tax, the increase in the reduced VAT rate for select products (€ 0.90 billion) and the increase in the taxation of higher incomes

(€ 0.39 billion). On the spending side, there is a target to save € 1.10 billion in the areas of subsidies and public administration.

In the reform proposals, € 0.85 billion is budgeted as self-financing through an increase in tax revenue as a result of the revitalising cyclical effect of the tax reform. Whether and to what extent this is compatible with the world of the FIDELIO model will be shown in the simulation result. In detail, the following assumptions are made:

- Improvement of measures against tax fraud (€ 1.9 billion):
 - The additionally documented revenues of € 900 million through new compulsory cash registers (plus € 100 million from measures against tax fraud in the areas of fuel trade and mail order trade) mainly apply to industries that do direct business with consumers (construction, trade, accommodation and food production services, housing, health, social and educational services, other personal services). The degree to which these industries are affected is a priori difficult to estimate; the "supplementary estimates for non-billed transactions" by Statistics Austria are used as a distribution key. These rates are used in the economic accounts to calculate the gross domestic product, in order to (partly) approximate the value of the shadow economy. According to these supplements, the previously mentioned € 900 million are distributed as follows: € 49 million in construction, € 214 million in trade and vehicle repairs, € 337 million in accommodation and food services, € 54 million in housing, € 76 million in health and education, € 131 million in other (personal) services (and € 39 million in other industries).
 - The introduction of compulsory cash registers increases sales tax revenue in these sectors, in addition to increasing taxable income (previously unknown revenues and incomes are documented); a 50 : 50 ratio distribution of these effects is assumed. On the part of the companies affected, a partial compensation of the revenue loss is assumed. They will raise prices to such an extent that the income losses are halved. Technically, this is implemented in the model by means of an increase in the trade margin.
 - Combatting social fraud primarily increases revenue from social contributions (€ 150 million), as well as wage and income tax revenues (€ 50 million). This results in an increase in the respective tax burdens and a corresponding reduction in disposable income. Similarly, the easing of banking secrecy brings in additional revenues of € 700 million, mainly in the area of income tax, but also in corporate and value added tax.
- The increase in the taxation of higher incomes is expected to raise revenues by € 0.39 million. This includes an increase in the social security contribution ceiling and the taxation of investment income from dividends and real estate sales. This additional burden only affects the upper income quintiles (raising the tax base in the 4th and 5th quintiles, distribution in a 20 : 80 ratio, other measures: distribution according to tax revenues in the 3rd to 5th quintiles).
- The increase in the VAT rate from 10 percent to 13 percent for select commodities is to be implemented for the planned amount of € 220 million.
- Savings in the area of subsidies (to the extent of € 200 million) are allocated to the sectors based on their "other production subsidies" according to the 2011 input-output table.
- The limitation of "other monetary transfers" is implemented as a reduction in subsidies for sectors 91 (clubs) and 92 (culture, sports, entertainment).
- Administrative savings totalling € 600 million are implemented as a reduction in public consumption relative to the baseline simulation.
- The total of € 850 million estimated under the header "self-financing through economic recovery" is not specified exogenously, but rather endogenously determined in the model, and is therefore a result of the simulation.

2. Results of the simulation

As explained above, the results are not presented as a time series, but rather as an "equilibrium solution" of the model. The monetary values are stated in real terms at prices for the year 2015 and as a percentage of the corresponding values of the year 2014 (current accounts).

Within this framework, private consumption increases to nearly € 2.5 billion (about 1.4 percent of the value of 2014) as a result of the tax reform, while public consumption decreases by about € 600 million (this corresponds to the assumption about planned savings). Exports decline slightly (€ –20 million), because the inflation rate is ½ percentage point higher than in the baseline scenario. Imports rise by € 560 million, primarily as a result of the significant expansion of (import-intensive) private consumption and secondarily due to the slight decrease in (relative) import prices, which tends to effect a substitution of domestic goods with imported ones.

The gross domestic product is estimated as increasing by € 1.4 billion as a result of tax reform. Compared to the baseline scenario, this represents an increase by +0.4 percent) which, however, is primarily due to revenues from taxes on products, whose growth is estimated at over € 1 billion. Domestic net output as the "second part" of the gross domestic product² increases by just under € 300 million (+0.1 percent).

Product tax revenues increase for several reasons: cancellation of tax exemptions (€ 250 million), measures to prevent fraud (€ 500 million); these were set in the simulation) and the increase in private consumption (€ 300 million; 13 percent of product taxes are on average attributable to private consumer expenditures). Together with the (slightly) expansionary effect of the reform (resulting in higher revenues from income and corporate taxes and lower expenditures in unemployment benefits), the estimated "self-financing the tax reform" is largely achieved.

Table 1: Main results of the simulation of the effects of the tax reform

Net effect from reduction of burden and counter-financing, 2015

	Deviations from the base scenario		
	Million €	In percent of 2014	
Private consumption	+ 2,460	+ 1.4	
Public consumption	– 600	– 0.9	
Investments	+ 80	+ 0.1	
Exports	– 20	+ 0.0	
Imports	+ 560	+ 0.3	
Total net output	+ 290	+ 0.1	
Taxes on goods	+ 1,060	+ 2.9	
GDP	+ 1,350	+ 0.4	
Budget balance	as a percentage of GDP	– 100	+ 0.0
Employees	+ 2,900	+ 0.1	
Inflation rate	percentage points		+ 0.5

Source: WIFO calculations using the FIDELIO model. Inflation is estimated as slightly higher than in the baseline scenario; the price level is ½ percentage point higher.

The list of sectors to benefit most from the tax reform is generally not surprising. The positive effects for real estate (demand for rental and owned property) as well as in part for the construction industry are due to the relatively high income elasticity of demand for housing (production in construction is also spurred on by the increase in

² By definition, the GNP is the sum of total net output and the balance of taxes on products and tax subsidies.

investments). Since a major chunk of additional private consumer spending is handled in the retail sector, a noticeable positive reform effect can be seen here, though it is somewhat attenuated by price increases (VAT rate, fraud prevention with cash registers). Possible shifts between retail types as a result of price adjustments (for example, from load-bound to mail order companies) can not be estimated in the model, because they take place within one model sector.

At first sight, the positive effect on the hotel and restaurant industry appears surprising: rather, a contractionary effect is feared through the increase in VAT on overnight accommodations and measures to prevent fraud. According to the simulation, however, a positive overall effect is to be expected in this sector, as the increase in disposable income causes an increase in the demand, which more than offsets the negative price pressure of the VAT increase. With an income elasticity of 1.3, restaurants are among those consumer goods which respond most sensitively to changes in income. At the same time, they display a relatively low price elasticity – the demand for such services therefore only weakly responds to price changes.

Also, the assumed price changes are rather small in this sector. The model sector consists of hotels and restaurants, and the input data for the simulation and model results are not divisible³. The increase in the VAT rate on accommodation from 10 percent to 13 percent therefore does not amount to a 30 percent VAT increase for this aggregate, but rather only about 6 percent, so total prices increase by less than 1 percent on average. The price increase assumed to compensate for income losses as a result of fraud prevention is about 2 percent.

The determining factor for the effect of demand changes on the domestic economy is not least the origin of the goods in demand. If these are imported, the effect on the domestic economy is small (essentially, only transport and trade margins and taxes on products are relevant). While services are only (and can only be) imported to a small extent, this to a large extent applies to material goods. Therefore, an increase in demand for "furniture and consumer electronics", which has a high income elasticity per se, only weakly translates to an increase in domestic net output (in particular, for devices in consumer electronics the import ratio is close to 100 percent). Despite their rather low income elasticity, the food industry (with an import share of only one third) and the "other manufactured goods" sectors, which has the highest effects, therefore benefit most from an increase in income due to the tax reform.

Net output losses as a result of the tax reform only arise in a few sectors (education, government, healthcare). They are the direct result of assumptions about counterfinancing measures under the header "savings in administration" (€ 600 million). These have been implemented in the simulation as a reduction in public consumption. The decline in these sectors reflects the commodity structure of public consumption. If the savings were, for example, focused on public administration, then education and health care would show fewer negative effects. The estimated overall effects on GDP and net output, however, would be relatively unaffected, as the three sectors of public administration, education and health care all exert similar effects on the domestic economy.

The significant effect of public consumption on the domestic economy arises through a large share of value added (especially wages and salaries) and a low direct import propensity (government services cannot be imported per se, just as education and healthcare services can hardly be imported from abroad). This is also a reason why, despite an increase in private consumption of almost € 2.5 billion as a result of the tax reform, the tax reform has a positive effect on net output of only € 300 million: the reduction in public consumption has a comparatively stronger dampening impact on the domestic economy than the expansionary effect of – clearly more import-intensive – private consumption (additionally, revenues from

³ Foreign tourism is also not handled separately in the model – a possible negative effect, in particular with respect to foreign travellers, can therefore not be quantified here.

taxes on products increase, which in part compensates for overspending in private consumption).

Table 2: Simulation of the effects of the tax reform by sector

Net output, 2015

NACE		Deviations from the baseline scenario	
		Million €	In percent of 2014
70	Real estate	+ 110	+ 0.5
52	Retail trade; repair of household goods	+ 55	+ 0.5
65	Banking and loans	+ 45	+ 0.5
45	Construction	+ 45	+ 0.3
66	Insurance	+ 45	+ 1.4
15	Manufacture of food, beverages and tobacco	+ 40	+ 0.8
64	Communications	+ 40	+ 0.9
63	Supporting and auxiliary transport activities; travel agencies	+ 35	+ 0.9
60	Land transport, transport via pipelines	+ 35	+ 0.6
55	Accommodation and food production	+ 35	+ 0.3
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	+ 35	+ 0.2
74	Business services	+ 30	+ 0.2
50	Sale, maintenance and repair of motor vehicles and motorcycles; petrol stations	+ 25	+ 0.6
01	Agriculture and forestry	+ 25	+ 0.8
40	Energy supply	+ 20	+ 0.4
93	Other service activities	+ 15	+ 0.8
67	Activities connected to credit and insurance	+ 10	+ 1.0
36	Manufacture of other goods	+ 10	+ 0.5
02	Forestry	+ 5	+ 0.4
62	Aviation	+ 5	+ 0.5
22	Publishing, printing, digital data reproduction	+ 5	+ 0.3
71	Renting of machinery and equipment without operator	+ 5	+ 0.1
90	Sewage and refuse disposal, sanitation and similar activities	+ 5	+ 0.2
28	Manufacture of fabricated metal products	+ 5	+ 0.1
72	Computers and related activities	+ 5	+ 0.1
26	Manufacture and processing of glass, manufacture of products from stones and earth	+ 5	+ 0.2
29	Machine building	+ 5	+ 0.1
20	Processing of wood (without the manufacture of furniture)	+ 5	+ 0.2
24	Manufacture of chemicals and chemical products	+ 0	+ 0.0
31	Manufacture of devices to produce and distribute electricity	+ 0	+ 0.0
23	Manufacture of coke, petroleum processing	+ 0	+ 0.0
25	Manufacture of rubber and plastic products	+ 0	+ 0.0
11	Extraction of crude petroleum and natural gas and related services	+ 0	+ 0.0
95	Private Households	+ 0	+ 0.0
27	Manufacture and processing of metals	+ 0	+ 0.0
21	Manufacture and processing of paper and pulp	+ 0	+ 0.0
32	Broadcasting and new technologies	+ 0	+ 0.0
41	Water supply	+ 0	+ 0.0
16	Tobacco processing	+ 0	+ 0.0
34	Manufacture of trucks and truck parts	+ 0	+ 0.0
14	Mining of ores and soils, other mining	+ 0	+ 0.0
17	Manufacture of textiles and textile products (without apparel)	+ 0	+ 0.0
19	Leather manufacture and processing	+ 0	+ 0.0
35	Manufacture of other vehicles	+ 0	+ 0.0
18	Manufacture of apparel	+ 0	+ 0.0
61	Shipping	+ 0	+ 0.0
05	Fishing and fish farming	+ 0	+ 0.0
37	Recycling	+ 0	+ 0.0
30	Manufacture of office machines, data processing devices and facilities	+ 0	+ 0.0
10	Coal mining, peat extraction	+ 0	+ 0.0
73	Research and development	+ 0	+ 0.0
33	Technology for medicine, measuring, control and regulation, optics	+ 0	+ 0.0
91	Interest groups, religious associations, other associations	- 5	- 0.3
85	Health, veterinary and social systems	- 70	- 0.5
92	Culture, sports and entertainment	- 70	- 1.8
80	Education	- 145	- 1.1
75	Public administration, domestic defense, social insurance	- 150	- 1.1

Source: WIFO calculations using the FIDELIO model.

Net output is only attenuated by the tax reform in the sector "culture, sports and entertainment" as a result of the price effect of the increase in VAT; the simulation yields a decline in net output of around € 70 million.

3. Conclusions

The simulation of the basic parameters of the 2015-16 tax reform using the econometric input-output model FIDELIO shows a moderately positive effect on the domestic economy: private consumption increases by around € 2.5 billion due to the increase in disposable income. Along with an increase in investments (€ +70 million) and a muted effect on the foreign trade balance (exports € –20 million, imports € +560 million), domestic net output increases by € 0.3 billion and the gross domestic product by € 1.4 billion. The difference between these two values corresponds to the increase in the volume of taxes on products (more than € +1 billion, in particular value added tax).

An important consequence of the tax reform and proposed counter-financing is a change in the domestic demand structure – namely the expansion of private consumption to the detriment of public consumption. Due to the increase in private consumption of € 2.5 billion, the share of public consumption in final consumption declines by about 1 percentage point.

4. References

- Baumgartner, J., Kaniovski, S., "The Tax Reform 2015-16 – Macroeconomic Effects up to 2019", WIFO Bulletin, 2015, 20(22), pp. 250-265, <http://bulletin.wifo.ac.at/58374>.
- Kratena, K., Streicher, G., "Macroeconomic Input-Output modelling – structures, functional forms and closure rules", International Input-Output Association, Working Paper, 2009, (WPIOX 09-009).
- Kratena, K., Streicher, G., "FIDELIO'S ADAGIO – A family of regional econometric input output models", in Schmid, E., Vogel, St. (Eds.), *The Common Agricultural Policy in the 21st Century. Festschrift für Markus F. Hofreither*, Vienna, 2014.
- Kratena, K., Streicher, G., Temurshoev, U., Amores, A. F., Arto, I., Mongelli, I., Neuwahl, F., Rueda-Cantuche, J.M., Andreoni, V., FIDELIO – Fully Interregional Dynamic Econometric Long-term Input-Output Model for the EU27, JRC81864, Sevilla, 2013.
- Rocha-Akis, S., "The Distributional Effects of the 2015-16 Tax Reform", WIFO Bulletin, 2015, 20(21), pp. 238-249, <http://bulletin.wifo.ac.at/58373>.
- Schatzenstaller, M., "The Tax Reform 2015-16 – Measures and Overall Assessment", WIFO Bulletin, 2015, 20(20), pp. 222-237, <http://bulletin.wifo.ac.at/58372>.
- Streicher, G., Stehrer, R., "Whither Panama? Constructing a consistent and balanced world SUT system including international trade and transport margins", *Economic Systems Research*, 2015, 27.