TAX POLICY REFORM UNDER THE CONTEMPORARY ECONOMIC CONDITIONS

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Abstract

The aim of this article is to evaluate the tax effects of the transition to Industry 4.0 and to find out whether the tax mix is optimally prepared for these – now also in connection with the pandemic – accelerating changes. For this purpose, the dynamic stochastic general equilibrium model (DSGE) with the shadow economy is used, adjusted to consider the real tax mix in the Czech Republic and similar countries. Based on our results, we recommend in particular i) to subject the revenues from the social security and health care insurance system to a deeper review and to link it directly to other revenues of the tax mix, if necessary, ii) to further review the approach to the ratio of the direct and the indirect tax and, if necessary, to particularly review the proportion of the tax burden of corporations and the tax burden through VAT. It also seems appropriate iii) to review the tax mix in general and, in addition to the already announced cancellation of real estate transfer tax, to open a discussion on digital tax or robot tax, as an alternative to the simulated changes in the tax mix structure.

Keywords

Industry 4.0, Tax Policy, Shadow Economy, DSGE Modelling

I. Introduction

The coronavirus pandemic is not only a stimulator of healthcare reforms, but also an accelerator of economic policy changes, especially as regards the transition to Industry 4.0. Economic policymakers respond much more actively than in the case of the recent global financial and economic crisis. There are massive interventions in national economies, and not just within the European Union. At any rate, the tax burden on all segments of the economy is declining in the short term, which, especially together with the sharp increase in government spending, has a significant impact on public budgets. The government analysts are therefore examining short-term and long-term impacts on public budgets. It should be noted that all the processes then usually occur only within the existing paradigm or the economic-political framework. In the fiscal area, only parametric changes are announced, i.e. changes responding to shortfalls in public budgets.

The central authorities do not pay much attention to changes in the set-up of the fiscal system and the tax system as such. Practical tax policy and tax theory do not de facto systemically reflect the fact that there are changes made in economic fundamentals and that these changes would accelerate sharply in the coming decades, even if there were no changes related to the coronavirus pandemic. Instead, issues of tax elasticity, tax revenue rate and tax justice are addressed, as well as the effects of taxation on tax evasion and the size of the shadow economy. Similarly, it is possible to identify the analysis of the link between tax revenues or budget deficits and the size of government spending, their effectiveness or the level of provision of public goods and services among the popular topics. These are all legitimate issues in the long run. However, if the structure of the economy and society is completely or partially changed within a few decades and if Industrial Revolution 4.0 becomes a reality, then not just the change

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of economic, fiscal and its included tax policy seems to be absolutely crucial. Many studies and statements of politicians show that lessons can be learned from the changes and mistakes that occurred after the previous industrial revolutions, yet we believe that nothing of the sort occurs in tax policy. Indeed, expert discussions on the link between the pandemic, robotic automation and related changes in the structure of the economy and the state of public budgets, or especially the adjustment of their revenue structure, stay behind.

We believe that the effects of taxation on individual production factors, on the production function and on the size of the official and the shadow economy need to be thoroughly addressed with regard to the changes that will undoubtedly take place after the Industry 4.0, not only because its arrival does not have to be a surge but rather a gradual curve. The Industry 4.0 will affect the adjustment of social security and pension systems, migration and the functioning of the economy as a whole. From the perspective of tax mix adjustment, it is particularly desirable to abandon traditional and conservative thinking and ask new questions instead.

In this regard, taxes of the tax mix, especially personal and corporate pension scheme taxes, and alternatively taxes on dividends on the direct tax side, or the value added tax and the excise tax as indirect taxes then affect two main production factors, labour and capital – which are the subject of the most fundamental changes with the transition to Industry 4.0 – in a different way. Their proportion and structure will undoubtedly change.

The aim of this article is to evaluate the tax effects of the transition to Industry 4.0 and to find out whether the tax mix is optimally prepared for these – now also in connection with the pandemic – accelerating changes. For this purpose, the dynamic stochastic general equilibrium model (DSGE) with the shadow economy will be used, adjusted to consider the real tax mix in the Czech Republic and similar countries. The conclusions drawn from this comprehensive model can be subsequently generalised to other Central European economies or similar countries. If necessary, frameworks for potential economic and tax policy reforms will be proposed.

II. Industry 4.0, Shadow Economy and Challenges for the Tax System

The existence of fundamental changes in the structure of the economy in the 21st century is unquestionable, at least in advanced economies. There is a massive introduction of robotic automation as well as transition to smart factories and smart products. One of the reasons is also cost savings and reduced dependence on workforce, especially in the case of manual and routine jobs. In the marketing sense, the term of Industry 4.0 may be perceived as a somewhat European label, especially a German one, for the above changes. It is an academic, but also a practical (industrial) approach to the categorisation and integration of effects and activities that are undoubtedly taking place. This unified approach has been treated especially in the last ten years and is associated with the German academics Kagermann, Wahlster and Lukas (2013); in practical economic policy then with German Chancellor Merkel (European Commission 2017).

Not only the European economy but also other important players have already joined the ongoing fourth industrial revolution – the USA, China as well as some Middle East countries such as Israel or Saudi Arabia. Correspondingly, many large, medium and small-sized businesses have already become involved, whether in the actual implementation of the mentioned technologies or in the adjustment of changed economic processes. However, systematic preparation for possible tax implications and tax optimisation seem rather marginal at the business level. Reference may be made, for example, to a study carried out by Deloitte (2015) dealing with the challenges of Industry 4.0, the change in the business model of companies and the possible tax consequences. At the level of economic policy or national and European central authorities, the economic impacts are mentioned rather generally, without in-depth analyses. The focus of scientific studies is similar in that they concentrate on certain

specific aspects. For instance, they involve disputations over the sustainability of the social security and health care system or the impacts on the tax revenue rate. Or, in connection with the possible massive increase in the unemployed, especially with low-skilled jobs, the effects of a possible guaranteed uniform minimum income are estimated. Additionally, the crucial importance of consumption and excise taxes for the future adjustment of sustainable tax systems is widely addressed, as is the issue of minimum wage and tax burden on labour with low-skilled jobs, particularly with regard to these jobs competing with robots.

Notably, the effects of the extent of the shadow economy on the change in the economy structure in connection with the Industry 4.0 are not discussed at all, and the possible impact of this transition on the shadow economy is examined in a very limited way. Yet, the shadow economy may have a significant impact both ex-ante and ex-post. The large scale of the shadow economy undoubtedly and predominantly slows down the transition to Industry 4.0. If there is a part of unofficial production which is produced by workers outside the employment relationship where the employer and the employee do not participate in the tax, social and health care systems and do not participate in their contributions, the company has lower motivation to reduce labour costs in order to implement robotic automation and smart factories. Any tax changes that are introduced by central authorities, if they led to the growth of the unofficial economy, even in order to support technological change and robotic automation, may then prove counterproductive.

The ex-post causality of the link between the industrial revolution and the size of the shadow economy may then be the opposite. With a suboptimal adjustment of labour taxation, the massive robotic automation and replacement of unskilled workforce will then lead to the growth of the unofficial economy because labour costs including not only the actual wages but also natural person income tax, social security and health care contributions will not be competitive against the capital costs of automated production.

III. Methodology and data

For the purposes of this article, the definition of shadow economy by Feld and Schneider (2010) or Schneider and Buehn (2018) will be used. This definition includes all legal production of goods and services traded on the market which is hidden from government authorities, whether in order to evade income taxes, value added taxes, any other taxes, social security contributions, or for reasons involving attempts to avoid compliance with legal standards on the labour market (minimum wage, maximum number of hours worked, safety requirements).

A structural approach based on dynamic stochastic models of general equilibrium is relatively more recent and not explicitly mentioned in previous papers. This approach, presented e.g. in the paper of Orsi et al. (2014), is also based on the interconnection of observed and non-observed macroeconomic variables. This relationship is parameterised through logical structural relationships based on the optimisation behaviour of households and businesses or other economic entities.

An overview of methods and results for estimating the size of the shadow economy can be found in the papers by Schneider and Enste (2000), Schneider and Williams (2013), Buehn and Schneider (2016), Schneider and Buehn (2018), Enste (2018) or Medina and Schneider (2018). Evaluating tax and fiscal policy by using the model approach, especially the DSGE, has been a very current topic for the past ten years. Busato and Chiarini (2004) are among the pioneers of formal economy modelling with the shadow economy sector, using the calibrated RBC model. Lisi and Pugno (2015) in their theoretical (calibrated) RBC model with endogenous growth and shadow economy simulate the positive effects of strict monitoring of activities of businesses within the shadow economy sector.

According to Lindé (2018), the DSGE models are an extremely suitable tool to analyse fiscal and monetary policy despite their weaknesses – mainly due to the use of forward-looking expectations (making them robust against the so-called Lucas critique) and also due to their relative simplicity, transparency and flexibility in their specification. Orsi et al. (2014) is one of the few DSGEs that model both the size and the dynamics of the shadow economy development, in this case Italy. The importance of the shadow economy's model inclusion is emphasised by Dellas et al. (2017). In their work, they refer to the systematic error rate in predicting the effects of fiscal and tax policy if the shadow economy sector is neglected.

The starting point for the modelling of possible impacts of the transition to Industry 4.0 is the DSGE model with shadow economy proposed by Orsi et al. (2014). That being said, the original model is significantly enriched by a tax system corresponding to the basic tax structure of the Czech Republic. One of the extensions is the implementation of the excise tax, which only levies taxes on certain goods. The resulting model is a two-sector model of firms that produce goods which are subject only to the value added tax (VAT) and goods which are also subject to the excise tax. This aspect has also been represented in the modified consumption function, which includes both mentioned types of goods. In contrast to the paper by Kotlán et al. (2019), a non-linear form of the model is used without considering the aspect of tax uncertainty.

As regards the data, annual data for the Czech Republic covering the period from 2002 to 2019 has been used to calibrate the parameters, the steady states of exogenous variables and to adjust the algorithm's initial conditions for calculating the steady states of endogenous variables of the non-linear model. The time series used are as follows: gross fixed capital formation (CNB, 2020), personal income tax revenues (CNB, 2020), corporate income tax revenues (CNB, 2020), personal income tax revenues (CNB, 2020), social security and health care insurance revenues (CNB, 2020), value added tax, revenues (CNB, 2020), excise taxes revenues (CNB, 2020), production at constant prices according to the NACE codes (CSO, 2020), hours worked according to the NACE codes (CSO, 2020), number of inspections and inspected entities for VAT and corporation tax (FACR, 2020).

Since further details of the model calibration (including calibrated parameter values) go far beyond the scope of the conference paper, they are available at the authors or at https://www.eaco.eu/about-eaco/research/. In following part of the paper, we sum up the main results of our estimations.

IV. Results

We simulate the impacts of changes in the effects of the capital and labour ratio, reflecting the change in the structure of the economy within the transition to Industry 4.0. through the changes in the structural parameters of the model or the steady-state values of exogenous variables. The following scenarios come to mind:

- change (growth) of technology or overall productivity of production factors,
- change in the parameters of the Cobb-Douglas production functions,
- change in the growth parameter of the permanent technological shock.

For the purposes of this paper, the change in the parameters of the Cobb-Douglas function is addressed. The effects of the decrease in the labour share of the production functions in individual industries by 0.05 is simulated. The results are shown in Table 1. Absolute and relative changes are related to the benchmark model.

Table 1 Effects of the decrease in the share of labour in the total product

Category	Indicator	Benchmark	Simulation
Labour market	Relative change in the volume of the workforce in the official economy		3.42 %
	Relative change in the volume of the workforce in the unofficial economy		-61.50 %
	Share of the shadow economy workforce in the official workforce	4.79 %	1.78 %
	Change in the share of the workforce in the shadow economy		-3.01 %
	Relative change in the amount of wages in the official economy		35.35 %
	Wage ratio of the official sector to the unofficial sector	112.02 %	115.42 %
	Change in the wage ratio of the official sector to the unofficial sector		3.41 %
Capital	Relative change in the volume of capital in the official economy		73.15 %
	Capital share in the shadow economy to the official volume of capital	3.11 %	1.12 %
	Change in the share of capital in the shadow economy		-1.98 %
	Share of investments in the total product of the official economy	20.85 %	23.50 %
	Change of the share of investments in the total product of the official economy		2.64 %
	Relative change in the volume of investments		69.82 %
Shadow economy	Relative change in the size of the official economy		51.70 %
	Share of the shadow economy in the official economy	4.09 %	1.47 %
	Change in the share of the shadow economy		-2.62 %
Government revenues	Share of government revenues in the total (official) product	53.88 %	51.79 %
	Share of personal income tax revenues in total revenues	18.03 %	19.28 %
	Share of corporation tax revenues in total revenues	9.30 %	8.96 %
	Share of withholding tax revenues in total revenues	0.89 %	0.86 %
	Share of social security and health care contribution revenues in total revenues	28.89 %	27.83 %
	Share of VAT revenues in total revenues	25.63 %	26.51 %
	Share of excise tax revenues in total revenues	17.25 %	16.56 %
	Change of share of government revenues in the total (official) product		-2.10 %
	Change of share of personal income tax revenues in total revenues		1.25 %
	Change of share of corporation income tax revenues in total revenues		-0.34 %
	Change of share of withholding tax revenues in total revenues		-0.03 %
	Change of share of social security and health care contribution revenues in total revenues		-1.06 %
	Change of share of VAT revenues in total revenues		0.88 %
	Change of share of excise tax revenues in total revenues		-0.69 %
	Relative change in government revenues		44.85 %
	Relative change of personal income tax revenues in total revenues		55.43 %

Relative change of corporation income tax revenues in total revenues	39.97 %
Relative change of withholding tax revenues in total revenues	39.98 %
Relative change of social security and health care contribution revenues in total revenues	39.98 %
Relative change of VAT revenues in total revenues	50.31 %
Relative change of excise tax revenues in total revenues	39.47 %

Source: own calculations

It may be observed that the increase in the capital share has led to a significant increase in the total product and a decrease in the share of the shadow economy, which is fully in line with the recommendations of most studies, which see economic growth as a significant factor in reducing the extent of the shadow economy (Enste, 2018).

V. Discussion: Effects of the introduction of Industry 4.0 on the size of the shadow economy and the tax mix

As mentioned above, robotic automation and the transition to Industry 4.0 can be simulated in several possible scenarios that influence the effects on the capital-labour ratio. Given that capital and labour are endogenous quantities in the presented model, these processes were simulated by changing the share of labour (parameter of the Cobb-Douglas production function with constant returns to scale) from 0.65 to 0.6 in the case of standard goods and from 0.6 to 0.55 in the case of the production function of goods that are subject to the excise tax. The total share of the marginal product of labour thus fell by 5 percent, and by contrast it increased by 5 percent in capital. These changes, consisting in a relative increase in the marginal product of capital, then affect the shifts that the introduction of Industry 4.0 will cause.

A higher marginal product and higher marginal returns on capital will lead to positive changes in the structure of the economy. As it is evident from Table 1, robotic automation leads to a significant increase in the official economy (by 51.7 percent) and to a reduction in the share of the shadow economy in the size of the official economy by 2.62 percent. (from 4.09 percent to 1.47 percent). This is also related to an increase in capital in the official economy by 73.15 percent and a decrease in the share of capital in the shadow economy by more than a half (from the original 3.11 percent to 1.12 percent). In line with some theoretical approaches, robotic automation also led to a decrease in the share of the workforce in the shadow economy by almost two-thirds (from 4.79 percent to 1.78 percent). Similarly, the structural changes in the capital-labour ratio resulting from robotic automation of production have a positive effect on wages in the official and the shadow economy. Wages in the official economy increased by 35.5 percent and the ratio of wages in the official and the unofficial sectors increased by 3.41 percent. The relative change in the volume of the workforce in the economy increased by 3.42 percent and decreased by 61.5 percent in the unofficial economy.

As a consequence, the first research question from the introduction can undoubtedly be answered in the affirmative way. If it is assumed that the aim is to set economic policy measures and especially the legal system in order to eliminate the shadow economy, then the changes that robotic automation leads to undoubtedly bring a positive effect. The introduction of new technologies into production, artificial intelligence, digitisation or robotics clearly leads to an increase in the official economy and to a decrease in its shadow component. There is an increase in investments in the official economy, an increase in the volume of capital and, generally, an increase in investments in the total product of the official economy. The number of workers in the official economy is growing, while it is declining significantly in the unofficial economy. This rectifies the distorted market and legal environment. Robotic automation also leads to an

increase in wages in absolute terms, even in relation to the wage level in the shadow economy. It should be noted, however, that the transition to Industry 4.0 is strongly determined by the initial level and size of the shadow economy. If a large part of the economy is situated in the shadow economy, then no spontaneous pressure to introduce technologies into production occurs. We believe, however, that the current pandemic may be a stimulus for the introduction of robotics and technology, even in countries in which the transition to Industry 4.0 is still lagging behind.

If the second research question is examined in more detail, then it must be unequivocally concluded that robotic automation and the associated increase in the marginal product of capital will lead to significant additional tax revenues. The government tax revenues will increase significantly, and the tax quota will account for more than a half of GDP (51.79 percent). In the case of a simulated growth of the economy by 51.70 percent, this generates more than a quarter increase in tax revenues, including income from social security and health care insurance. Nonetheless, in general, the development of the economy and particularly the development of society is likely to lead to the constitution of new public services and the stimulation of a changed approach to the role of the state. The establishment of a minimum guaranteed income will also probably be put through or the increased demands on investment in education will be accelerated, often as a public service. Pension policy will change, and other challenges related to longer life expectancy will arise. The current pandemic has already motivated some countries to make these changes. It is therefore necessary to ask the question whether the tax mix, or the social and health care insurance system, is ready for them.

The first somewhat alarming figure, which results from the performed simulations, is the decrease of the tax quota by 2.1 percent from the original 53.89 percent to 51.79 percent.[4] This fact then postulates – ceteris paribus – that the tax mix does not generate such a level of relative revenues as in the period before the transition to Industry 4.0. This in itself could also be a positive message, as a high tax quota is often a subject of much criticism. However, this applies only if the additionally generated public budget revenue, which can be obtained from the increased extent of the official economy, is sufficient for new challenges in the provision of public and social services. This fact should still at least be analysed and taken into account by central authorities.

Another important result of the simulation performed on real data is the fact that all taxes of the current Czech tax mix do not contribute to the tax revenue to the same extent. A larger slice of the tax revenue rate is undoubtedly taken by employment income tax and VAT. By contrast, the excise tax and the corporate income tax, and by extension the withholding tax, will fall sharply in respect to the share of the overall tax mix after the transition to Industry 4.0. The largest relative decline in income will thus occur in the collection of social security and health care insurance.

This in itself may not be a negative thing in all cases, though economic and fiscal policymakers should become aware of these facts in the present time. Individual taxes and similar levies have different budgetary allocations within public budgets. Although the budgetary allocation of taxes has already been partially unified, some differences still remain. For example, in the case of personal income tax from employment, municipalities receive a 1.5 percent more at the expense of the government than e.g. in the case of corporate income tax or VAT. Similarly, the personal income tax from self-employment is, on the other hand, paid to the budgets of local governments (municipalities and regions) only at 60 percent. The excise tax is then not reflected

[4] The tax quota in the simulated model is overestimated, though here it is necessary to bear in mind that it is a model of a closed economy and also that the transfers are not considered herein (a part of government consumption would in reality correspond to private consumption). This fact has no significant effect on the results and interpretations.

in the budget of local governments at all and is the revenue of the government or its agencies. Therefore, if the relative share of these taxes in the tax mix changes, it will have a real impact on the finances of governments and municipalities. Given the fact that municipalities will slightly benefit only from the employment income tax, the transition to Industry 4.0 with the current adjustment of the tax mix will favour the government over local governments and will bolster centralisation.

It is also necessary to realise that each tax has a different role within the tax mix. If we abstract from the fiscal function of taxes, then especially the regulatory or fair consequences of individual taxes are different. After the transition to robotic automation, the importance of the general excise tax – VAT will noticeably increase, which can be perceived as unfair, especially by interventionist and left-wing actors. Conversely, a decrease in the relative share of a selective excise tax, i.e. a tax treated as the tax acting against harmful effects such as smoking or environmental damage, may be perceived negatively by society and may have negative impacts on, e.g., the health care system. If we are to answer the second research question from the introduction, it must be stated that the transition to Industry 4.0 will lead to significant changes in the structure of revenues from each type of tax. This may not be harmful in itself, but if it is assumed that the currently adjusted tax mix should reflect the priorities and objectives of central authorities, and assuming that this tax mix is an expression and reflection of the current consensus in society, then there will be a shift of significance for individual taxes after the transition to Industry 4.0. A rational economic policymaker has only two options: either to change the current tax mix or to propose its gradualist changes in the future, alternatively change the priorities and goals in the area.

A very debated potential impact of introducing robotic automation in all industrial revolutions – also in the past – has been the impact on employment, wage levels, social security and public services. There has always been room for concern, even though very often not reflected in actual reality. As it has been pointed out above, the transition to Industry 4.0 has clearly positive effects on both employment in the official economy and the wage level in the simulated model on real data, undoubtedly leading to a decline in the shadow economy. However, it is necessary to take into account the conclusion of the model, which concerns the effect on the collection of social security and health care insurance. As it is apparent from Table 3, the change in the share of revenues from social security and health care insurance is very prominent. There is a decrease of 1.06 percent, which is several times more than for other taxes in the tax mix. Based on the current budgetary determination of these types of payments, which are specific payments to the budgets of insurance companies or to the retirement fund, then there can be serious concerns about the sustainability of the currently set social security system and the pension policy on the one hand, and the sustainability of the health care system on the other. Again, it is necessary to emphasise the fact that robotic automation will lead to the growth of all kinds of these revenues in absolute figures, but serious anomalies can already be identified when relativising them to GDP or total revenues. Similarly, it is possible to assume an increase in the expenditure side of these systems. In our opinion, the revenue side of the social security and health care system is therefore significantly unprepared for the changes related to the transition to Industry 4.0.

VI. Conclusion

The aim of the presented article has been to evaluate the tax effects of the transition to Industry 4.0 and to find out whether the tax mix, including the social security and health care system, is prepared for the changes relating to the introduction of Industry 4.0, examining inter alia the effects on the size of the shadow economy. We proceeded from the premise that especially those countries which are already at a certain level of transition to robotic automation will be forced to use or will voluntarily use the context of the current pandemic to accelerate the changes. Our ambition within the three research questions and on the basis of the simulation of

the modified DSGE model with shadow economy on real data of the Czech Republic has been to evaluate whether there are real concerns about the state of optimisation of the set parameters of economic policy, especially from the perspective of its revenue as well as from the perspective of the consensus of priorities and objectives of economic policy, allowing to consider the real implications not only for the Czech Republic but also for other comparable countries.

As part of the objective specification from the research question perspective, it must be stated that the Czech Republic is not institutionally prepared for the impacts resulting from the transition to Industry 4.0. We believe that the current coronavirus pandemic not only accelerates the introduction of robotic automation, as these effects can already be seen, but is also a great opportunity at a moment when there are also significant drops in public finances to make a larger and more comprehensive change in economic and tax policy, including changes in social security and health care insurance policy. It is worth noting that in its deliberations, the current Pension Scheme Committee and the National Government Budget Council do not mention the impacts presented in this article as regards the size of the structure of the official and the shadow economy, the decrease in the tax quota or the representation of individual taxes in the tax mix. The revenue side of the social security and health care insurance system is not reflected from this point of view either. Moreover, expert discussion on this topic in other member states of the European Union is rather absent, too. In accordance with the above, it is recommended in particular: i) to subject the revenues from the social security and health care insurance system to a deeper review and to link it directly to other revenues of the tax mix, if necessary. It is recommended ii) to further review the approach to the ratio of the direct and the indirect tax and, if necessary, to particularly review the proportion of the tax burden of corporations and the tax burden through VAT. It also seems appropriate iii) to review the tax mix in general and, in addition to the already announced cancellation of real estate transfer tax, to open a discussion on digital tax or robot tax, as an alternative to the simulated changes in the tax mix structure.

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