SOPRONI EGYETEM

LÁMFALUSSY SÁNDOR KÖZGAZDASÁGTUDOMÁNYI KAR

KONFERENCIAKÖTET

Conference Proceedings

Nemzetközi tudományos konferencia
a Magyar Tudomány Ünnepe alkalmából
International Scientific Conference
on the Occasion of the Hungarian Science Festival

Sopron, 2023. november 23.
23 November 2023, Sopron

FENNTARTHATÓSÁGI ÁTMENET: KIHÍVÁSOK ÉS INNOVATÍV MEGOLDÁSOK

SUSTAINABILITY TRANSITIONS: CHALLENGES AND INNOVATIVE SOLUTIONS

Szerkesztők / Editors:
OBÁDOVICS Csilla, RESPERGER Richárd, SZÉLES Zsuzsanna, TÓTH Balázs István

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SOPRONI EGYETEM KIADÓ

UNIVERSITY OF SOPRON PRESS

SOPRON, 2024

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A MAGYAR TUDOMÁNY ÜNNEPE

HUNGARIAN SCIENCE FESTIVAL

A konferencia támogatói / Sponsors of the Conference:

ALTEO | BÉRES

Felelős kiadó / Executive Publisher**: Prof. Dr. FÁBIÁN Attila**
a Soproni Egyetem rektora / Rector of the University of Sopron

ISBN 978-963-334-499-6 (pdf)

DOI: 10.35511/978-963-334-499-6

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DOI: 10.35511/978-963-334-499-6-Sahin

Artificial Intelligence with an Economic Growth Perspective

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Abstract:
Technology has been in human life for centuries. If artificial intelligence is considered as a development in the same direction of this technologic evolution, it can provide advantages to the people via industrial and/or home appliances creating productivity in the economy and social life. Besides its potential advantages, some disadvantages may also occur such as unemployment caused by uneven establishment of AI. Taxation mechanism and new prospective industries and business units to occur in the economy can be solutions for potential unemployment. In this paper the possible solution for potential unemployment is evaluated and results of taxation as a possible solution is illustrated via a micro scale business model. It can be stated after the analysis that the unemployment can be compensated without increasing tax rates and the financial burden undertaken by the customers can also be reduced without long term differences via proportionally increased incomes and applied tax incentives in an economic growth environment.

Keywords: artificial intelligence, economic growth, taxation, production economy, sustainability
JEL Codes: C20, F43, G30, H20, M10, Q56

1. Introduction

Since early history, from its basic to complex forms the technology provided significant contribution to shape the economic activities and human life. For instance; from basic plant cultivation operations to green biotechnology applications, from simple agricultural and production equipments to machinery agriculture and production technics, the technology have developed progressively over time. And followingly, telecommunication technologies, computer science, digital technology and machine learning technologies have been also integrated to the economy and human life. Thus technology applications facilitating production activities have started to be seen in business life in an increasing extent over time to reach better results in economy. It can be stated that manufacturer and inventor have similar motivations towards development in productivity perspective. „Typically the inventor seeks a method of improving on past and present practice and this is the first step in the process of moving forward to a new solution" (McNeil, 2002).

In the future, as a unique form of technology, the artificial intelligence potentially may create transition in the economy both with its advantages and also with some disadvantages of it such as temporary unemployment. „Traditional economic theory revolves around the magnitude of the substitution effect between workers and machine" (Craglia et al., 2018). In this paper, solutions for potential unemployment and methods of sustaining the living standards of unemployed/partially unemployed people are aimed to be researched. Notwithstanding the taxation is an important instrument, mainly the sustainable economic growth can be the key factor of the solution for potential unemployment. Additional taxes should not be seen as a solution, instead, increased income can directly contribute to demand level in the economy following the

productive operations driven by technology investments. „As technology improves exogenously, through innovations, the labor made redundant does not become permanently unemployed but finds its place in the economy" (Arrow, 1974).

2. Role of Artificial Intelligence in the Economy

While new technologies contribute to productivity and quality which also make human life easier, with some of its forms, it can also support environmental sustainability in the economy. For instance, natural energy-based facilities such as solar energy facilities (Gualteros & Rousse, 2021), or wind energy facilities are renewable facility sources. Besides advantages of technology based economic growth, some disadvantages in employment may also occur temporarily, which can not be disregarded. In contemporary world, beyond being an object, the technology started to become a subject of economic and social life of human. This can be called artificial intelligence. The European countries have already reported their status and implementations of AI strategies (Van Roy et al., 2021). There are already existing AI technologies developed for agriculture applications as well (Han, et al., 2015).

„Economists see human labour, (AI) machines, and innovative ideas as production factors in the growth equation" (Aghion et al., 2017; Craglia et al., 2018). Substitution of labour with technology is not a new situation for governments, companies and people indeed. Technology based capital and human based labour combinations have been applied in production operations for decades in the world in several forms. It might be stated that there are mainly three senarios of AI adoption in business life; substitution of routin tasks, substitution of sophisticated tasks performed based on intellectual capital or a substitution combination of these two type of tasks. „Economy history suggests that machines (including AI algorithms in computers) and human labour are not perfect substitudes" (Craglia et al., 2018). „Machines may replace workers but can not do entirely without them; they are to some extent complementary" (Craglia et al. 2018). Joseph Schumpeter's creative destruction is absolute considering artificial intelligence technology based potential new products' features and new markets, however artificial intelligence must not create a drastic negative effect in personal finance. The transformation can be reached to a reasonable solution. „Even an extreme scenario whereby nearly all human task would be carried out by AI yields a reassuring outcome and the labourshare in the volume of outcome will remain high because remaining human task become very productive and highly remunerated" (Craglia et al. 2018). This labourshare of outcome can be used for the purpose of redistribution of income between existing labour and partially/fully unemployed workers.

During the transition period of integrating artificial intelligence to the economy, the potential unemployment issue might be resolved/compensated via taxation mechanism. This idea might be seen as disadvantageous for the customers or for the companies who develop and/or invest in new technologies considering tax and unemployment burden. however it won't be create such a solution if the adaption is stated proportionally along with incentives. Here, the plan is not, to increase existing tax ratios or to regulate new taxes but compensating the temporary unemployment via existing taxes. Based on the results of the research done by Zirgulis and Šarapovas (2017) via dynamic panel covering 41 country over 11 years, „a rise in the effective average corporate tax rate significantly increases unemployment levels". The research also implies that „international tax competition is affecting unemployment, presumably through its effects on international capital investment". According to the research realised by Böhringer et al. (2005) via applied general equilibrium model to assess the quantitative effects of tax policy shifts in various OECD economies featuring decentralised wage bargening, and „illustrative policy simulations for Germany show that the reduction in unemployment that can be achieved by tax reforms is rather moderate". And according to another research realised by Hummel (2021), through optimal income taxation in a directed search model where matching frictions

generate unemployment risk. Analysing the consumption *X* leisure trade-off and high wages *X* low unemployment risk trade-off where both trade-offs and unemployment are effected by altering (via tax and social security mechanisms) costs and benefits of job searching in US Economy (Hummel, 2021): „A higher marginal tax rate shifts the trade-off in favor of low unemployment risk, whereas a higher tax burden or unemployment benefit has the opposite effect". „The optimal provision of unemployment insurance (UI) justifies a positive marginal tax rate even without heterogeneity in labor income". „As a result, financing UI payments through lump-sum or proportional taxes on labor income, as is commonly assumed in the literature, is generally sub-optimal".

Considering the equilibrium from economic growth perspective, AI as a productive factor agent has potential to create surplus via new applications and generate new employment thus a labour displacement can be followed by reinstatement. For instance, new technology provides larger scale of product and lower costs and/or expenses (depending on the nature of business and AI technology adoption), both conditions support operations resulting in larger profits, larger profits provide larger tax amount for funding unemployment and larger salaries to correspond to the increased production. In the meantime potential new markets to be emerged can also provide new employment opportunities for the labour forces. „AI is a general-purpose technology that fits a wide range of applications and spreads rapidly across many sectors and industries" (Cockburn et al., 2018; Craglia et al., 2018). „This could accelerate the productivity and growth effect" (Craglia et al., 2018).

3. Material and Method

The model example in this paper is created in accordance with cash-based approach only, via converging financial analysis (breakeven point investment analysis) and cash-based accounting method. The company in the model is subjecting to agriculture and brewery operations.

It is considered that the operations are starting with production which is initiated after gethering the production factors such as; machinery, labour, materials, entrepreneurship, organisation and other relevant factors. The mentioned variable expenditures are determined by prospective analysis of total cost of final product. And total sales quantity is equal to production quantity.

The model is a projection of cash-based transactions to be realised on a yearly basis only, summarised in main category of parameters. For example: the payments to be realised in next year or following years after the next are not included in each current year calculations. The indirect tax is not included in the sales price. Some of utility and administrative expenditures include sales taxes (considering the company as a final consumer of this portion). Excise taxes paid for some of materials are included in the cost of these materials.

In the model, CIT (corporate income tax) is calculated with cash-based approach only at the end of the year over positive cash amount generated in one year period.

The analysis have been realised with two different approach: first: with variable expenditures including SG&A portion(by considering close relation with sales and production quantities) and second: with variable expenditures without SG&A portion. First analysis has been initiated with 64% variable and 36%, fixed expenditure structure by transfering net 7% SG&A portion from fixed expenditures to variable expenditures, and second analysis have been initiated with 57% variable and 43% fixed expenditure structure without any SG&A portion included in the variable expenditures. The expenditure structures are reached through via financial parameters of one of the global beer producer. The reason why the two different combinations of these expenditures are used in the analysis is to test the model via the operating leverage effect and present the possible different expenditure combination pottentially to be seen in the industry. The elesticity parameteres are stated at the end of the analysis.

The model requires prospective analysis for a foreseeable period. In the example a high level integrated (from direct material to final product) producer is modelled based on approximately 50% and 55% cash-based gross profit margin level target and, cost and expense structures, referring to the 2018 financial data of one of the global brewery producer and current market data. The production level in the example is kept relatively smaller to simplify the analysis.

4. A Model as an Example

Case 1:

We assume a producer in brewery industry performing its operations by growing it's agricultural materials, besides the outsourced ones, via its own plot/s with own personnel and outsourced services, packaging materials are subject to circular and recycle system. Production and sales are realised in regular form with equal batches without significant time differences and their quantities have been equal in recent years. Payment terms for sales and procurement are closed to advance payment. Stock quantities are kept in minimum level and sales are mainly realised with EXW (Ex Works, as incoterm) conditions. Majority of the clients are distributors. The company doesn't have financial liability from external finance resources and utilises from its own solar energy and water facilities besides outsourced energy and water resources.

With the following assumptions of profit function parameters at the beginning of the year. All assumed cash-based parameters according to budget plan are as follows (amortisation and depreciation and their cash saving effects are not considered in the model. Other accrual base transactions and cash out effect of accrual-based transactions such as income accrual and revaluation transactions, realised through taxation are considered as negligible in the model (actual tax rate ~ effective tax rate) and salaries and wages include income taxes and social security premiums):

m	: direct material expenditures	= 0.5301$/litre
l	: direct labour	= 0.3456$/litre
p	: indirect production expenditures	= 0.4602$/litre
s	: SG&A expenditures variable portion	= 0.1641$/litre
a	: SG&A expenditures fixed portion and other fixed expenditures	= 105,437.72$
v	: investment	= 0.00$/litre
q	: annual sales and production quantity	= 125,000 litre
r	: unit price	= 3.00$/litre
t	: corporate income tax rate	= 10%

(m, l, p, s, a, q, r, t > 0)

Cash-based cost and expense function:	f(c) = (m+l+p+s)q+a+v
Cash-based income function:	f(i) = (r*q)
Cash-based profit function:	f(p) = [(r*q)-((m+l+p+s)q+a+v)]
Net cash-based profit function:	f(p) = [(r*q)-((m+l+p+s)q+a+v)](1-t)

Total annual cash-based profit before tax	= 82,062.28$
Tax amount	= 8,206.23$
Total annual net cash-based profit	= 73,856.05$

Case 2:

We assume that, based on technology development realised at the beginning of following year in collaboration with a university, in total material expenditures will be reduced by 15%. Maintenance and utility expenditures in total remain in same level (due to approximate increase in maintenance and decreasing in utility expenditure's levels) In the meantime after these improvements 10% of direct labour substitution is realised in the company. Total value of the new technology developed via collaboration of the University is 100,000$ and the payments will be done in two installments as 50,000$ in current year and 50,000$ in following year. The litre sales price of the product has not been changed based on sales and finance strategy of the company considering market and macro economic conditions.

There are two tax incentives starting from current year: refunding unemployment portion via ofsetting from the CIT, and VAT refund for the customers to the extent of increasion in CIT comparing to previous year.

With the new investments realised at the beginning of following year, the current parameters:

Net cash based profit function: $f(p) = [(r*q)-((m+l+p+s)q+a+v)](1-t)$

m	: direct material expenditures	= 0.4505$/litre
l	: direct labour	= 0.3111$/litre
p	: indirect production expenditures	= 0.4602$/litre
s	: SG&A expenditures variable portion	= 0.1641$/litre
a	: SG&A expenditures fixed portion and other fixed expenditures	= 105,437.72$
v	: investment	= 50,000.00$
q	: annual sales quantity	= 125,000 litre
r	: unit price	= 3.00$/litre
t	: corporate income tax rate	= 10%

Total annual cash based profit before tax	= 46,321.28$
Tax amount	= 4,632.13$
Total annual net cash based profit	= 41,689.15$

Unit labour expenditure/product decreased+~2% inflation : 0.3456$*0.10*1.02 ~ 0.03526$
Unit tax/product after establishing new technology : 4,632.13$/125,000 ~ 0.03706$

Minimum refund optimisation of compensating unemployment:

$CBP*CIT\%=q*e^{gn}*(l*substitution\%)*e^{in}$

We assume that there is already a benefit plan of unemployment for which a deposit fund account is stated with existing balance for the employess out of the social premiums (evaluation of this deposit account is an exempt from taxation and the account is funded by retained earnings). The living standards of personnel whose income is reduced after technology renewal, can be guaranteed via benefit plan and this unemployment portion can be refunded via potential CIT (corporate income tax) to be calculated by this company after its operations performed in a year (the aforementioned pre calculated unemployment portion is not becoming a tax indeed because it is considered as an allowance item from the calculated tax amount based on tax regulations).

Case 3:

If we add inflation and economic growth parameters to the model:

We assume the expected daily, producer indexes as; inflation rate in the economy will be 0.00543% considering central bank policy for current year, and daily economic growth foreseen is 0.0108% and the labour, maintenance, administrative and material expenditures are contractual based and determined in advance for one year since inflation and growth level in the economy were quite low so that they were considered as negligible.

The general economic equilibrium ($Y=C+(I_{r+f}-S)+(G-T)+(X-M)$) is assumed that structured as G-T=0 (and the volume of government transactions are constrained with only basic essential services such as security and public services), X-M=0 and I-S=0 so that Y=C, where C is equal to total product at the beginning of the year. (Y: total income, C: consumption, I_{r+f}: investment(real+financial), S: saving, G: government expenditures, T: taxes, X: export, M: import).

The equation of exchange (M*V=P*T) in the economy is currently assumed that structured as M and P are in direct relation and 100% correlated with each other. V and T are in direct relation and 100% correlated with each other. (M: quantity of money, V: velocity of money, P: level of prices, T: number of transactions).

Supply and demand are occurred and exist together without significant time differences. And the unemployment ratio is closed to frictional level.

Net cash based profit function in comprehensive model:

$$f(p) = [(r+((r*e^{in}-r)/2))q*e^{gn})-((m+l+p+s)q*e^{gn}+a+v)](1-t)$$

m	: direct material expenditures	= 0.4505$/litre
l	: direct labour expenditures	= 0.3111$/litre
p	: indirect production expenditures	= 0.4602$/litre
s	: SG&A expenditures variable portion	= 0.1641$/litre
a	: SG&A expenditures fixed portion and other fixed expenditures	= 105,437.72$
v	: investment	= 50,000.00$
q	: base annual sales quantity	= 125,000.00 litre
r	: base unit price	= 3.00$/litre
t	: corporate income tax rate	= 10%
i	: daily inflation rate:	= 0.00543%
g	: daily economic growth	= 0.01080%
n	: number of days	= 365

Total annual cash based profit before tax (CBP)	= 58,337.60$
Tax amount	= 5,833.76$
Total annual net cash based profit (NCBP)	= 52,503.84$

Comparing with Case 2 there is ((58,337.60$-46,321.28$)/58,337.60$)*100 ~ 26% increase in cash-based profit, generated 12,016.31$ cash under assumption of industry and the company operations are 100% correlated with the entire inflation and economic growth dynamics. Increase in total cash-based income is 18,981.86$ (393,981.86$-375,000.00$) However, of which inflation effect is 3,904.13$ (0.0300258154547273$*130,026pcs). And the economic growth effect is 15,077.73$ (3.00$*5,026pcs=15,077.73$)

The unit price is increased to ~3.06$ and the total production quantity is increased to ~130,026 litre at the end of the year.

Now if we assume that during transition period the government enacts a partial tax exemption on the indirect tax (VAT/sales/excise tax) of the product (might be regulated on a specific or a group of product) under taken by the distributors to lower the financial effect of this tax. And we assume that the indirect tax incentive ratio is 2%. Considering basic mechanism of indirect taxation (might be VAT, sales or excise tax) in scope of above mentioned operations only, without next chain of sales transaction/s, the tax effect to occure:

Increase in CIT amount comparing with Case 2: 5,833.76$-4,632.13$ = 1,201.63$

When tax incentive% nominator result is ϵ of $+\mathbb{Z}$ and $\underset{t.i.\rightarrow\Delta CIT}{\text{Limit}}$ = f(tax incentive) = 1,166.75$

so VAT saving of distributors after tax regulation: 58,337.60$ **(0.02)** = 1,166.75$

Maximum optimisation of customers' tax saving:
CBP*tax incentive% =ΔMUCBP*q*t% (MUCBP= Marginal Unit Cash based profit)
When tax incentive% nominator result is ϵ of $+\mathbb{R}$ and $\underset{t.i.\rightarrow\Delta CIT}{\text{Limit}}$ = f(tax incentive) = ΔCIT
so maximum tax incentive rate: 2.05978908330574% , tax incentive amount: 1,201.63$

If we assume that during transition period, the government enacts a tax regulation on the personal income tax for this product (might be regulated also on a specific or a group of product) under taken by the consumers to lower this financial effect. And assuming that the 20% of the expenditure can be deductible from personal income during taxation and the income tax ratio is 10%. Considering basic mechanism of income taxation in scope of above mentioned operations only, the tax effect to occur:

Increase in CIT amount comparing with Case 2: 5,833.76$-4,632.13$ = 1,201.63$
When tax incentive% nominator result is ϵ of $+\mathbb{Z}$ and $\underset{t.i.\rightarrow\Delta CIT}{\text{Limit}}$ = f(tax incentive) = 1,166.75$
so income tax saving of consumers after tax regulation: 58,337.60$ **(0.2)(0.1)** = 1,166.75$

Maximum optimisation of customers' tax saving: CBP*tax incentive%=ΔMUCBP*q*t%

When tax $\underset{t.i.\rightarrow\Delta CIT}{\text{incentive\%}}$ nominator result is ϵ of $+\mathbb{R}$ and Limit = f(tax incentive) = ΔCIT
so maximum net tax incentive rate: 2.05978908330574%, tax incentive amount: 1,201.63$

Case: 4
Assuming that in following year contracts have been renewed, the expenditures have been increased with the annual inflation rate of previous year (2%) and there will be 1% value increased expenditure for the AI investment. Consumer and producer price indexes were in same level. Expected daily inflation rate of the company for next term is ~0.0003272% and the expected daily growth rate is ~0.0024000%.

With the mentioned business conditions (after regained investment value with the operations of previous two years) the new parameters and net cash values will be as following:

m	: direct material expenditures	= 0.4596$/litre
l	: direct labour expenditures	= 0.3173$/litre
p	: indirect production expenditures	= 0.4695$/litre
s	: SG&A expenditures variable portion	= 0.1673$/litre
a	: SG&A expenditures fixed portion and other fixed expenditures	= 107,546.47$
v	: investment	= 1,000.00$

q	: base annual sales quantity	= 130,026 litre
r	: base unit price	= 3.06$/litre
t	: corporate income tax rate	= 10%
i	: daily inflation rate:	= 0.0003272%
g	: daily economic growth	= 0.0024000%
n	: number of days	= 365

$f(p) = [(r+((r*e^{in}-r)/2))q*e^{gn})-((m+l+p+s)q*e^{gn}+a+v)](1-t)$

Total annual cash based profit before tax	= 107,652.21$
Tax amount	= 10,765.22$
Total annual net cash based profit	= 96,886.99$

With the above mentioned limit and optimisation conditions:

Increase in CIT amount comparing with Case 3: 10,765.22$-5,833.76$ = 4,931.46$
VAT saving of distributors after tax regulation: 107,652.21$ **(0.04)** = 4,306.09$
Maximum tax incentive rate: 4.58091971475227%

Increase in CIT amount comparing with Case 3: 10,765.22$-5,833.76$ = 4,931.46$
Income tax saving of consumers after tax regulation: 107,652.21$ **(0.4)(0.1)** = 4,306.09$
Maximum net tax incentive rate: 4.58091971475227%

After regaining of AI investment, tax incentive capacity has increased. And next year the investments and economic growth can be maintained.

Total change in cash-based income compared to Case3: 7,644.75$ (401,626.62$-393,981.86$) of which inflation effect corresponding to current year: 239,83$ (0.00182836521558083$*131.170 pcs) and inflation effect corresponding to previous year: 3,904.13$ (0.0300258154547273$*130,026 pcs) And the economic growth effect: 3,500.79$ (3.06*(131,170 pcs-130,026 pcs))

The unit price is increased to ~3.064$ and the total production quantity is increased to ~131,170 litre at the end of the year.

Note: Some of the function parameters used as input in the model calculated based on market data have extending decimals and therefore they were stated as 4 digit only.

Maximum and minimum limit for „g" and „i" variables:
$f(p)=(r+((r*e^{in}-r)/2))q*e^{gn})-((m+l+p+s)q*e^{gn}+a+v)$
$f(p)=(r+((r*e^{in}-r)/2))q*e^{gn})-((z)q*e^{gn}+a)$, when $(m+l+p+s=z)$
$f(p)=0.5r*q*e^{gn}+0.5r*e^{in}q*e^{gn}-zq*e^{gn}-a$
$f(p)=0.5(r-z)*q*e^{gn}+0.5r*e^{in}q*e^{gn}-a$
$r,q,n,z(m+l+p+s),a \geq 0$ and $\epsilon \mathbb{R}$

If: Y=p
Y(including qrowth+inflation)=p(including growth+inflation)
Y(including growth+inflation)=f(g,i),
Maximization of p:
$\partial f/\partial y=0.5(r-z)*q*e^{y}+0.5r*e^{x}q*e^{y}-a$, when $(^{gn=y}, ^{in=x})$

$\partial f/\partial y=0.5q(r-z)*e^{y}+0.5qr*e^{x}e^{y}$ (= second derivative)
$\partial f/\partial x=0.5(r-z)*q*e^{y}+0.5r*e^{x}q*e^{y}$-a , when ($^{gn=y}$, $^{in=x}$)
$\partial f/\partial x=0.5q*r*e^{x}e^{y}$ (= second derivative)
$0.5q(r-z)*e^{y}+0.5qr*e^{x}e^{y}\neq 0$
$0.5q*r*e^{x}e^{y}\neq 0$
The model has no maximum or minimum limit for „g" and „i" factors.

Optimisations:

Minimum refund optimisation of compensating unemployment:
$CBP*CIT\%=q*e^{gn}*(l*substitution\%)*e^{in}$

Maximum optimisation of customers' tax saving:
$CBP*tax\ incentive\%=\Delta MUCBP*q*t\%$

When q=production=sales

Optimisation for Case3:

Minimum refund optimisation of compensating unemployment:

$[(r+((r*e^{in}-r)/2))q*e^{gn})-((m+l+p+s)q*e^{gn}+a+v)]_3t=q*e^{gn}*(l*substitution\%)*e^{in}$

$[(3.0300258154547273)q*1.040207279)-((1.38592798363835)q*1.040207279+(155,437.72))]0.1=(q*1.040207279)*(0.3456366084302290000 00*0.1)*1.02001721030315$

q = 115,698.52 litre in Case 3

Maximum optimisation of customers' tax saving:

For Case: 3 at tax rate (t) =10% (indirect tax as an example) , tax incentive rate (t_i) = 2% with given growth and inflation parameters at same production level

$[(r+((r*e^{in}-r)/2))q*e^{gn})-((m+l+p+s)q*e^{gn}+a+v)]_3*0,02=df/dq\{[(r+((r*e^{in}-r)/2))q*e^{gn})-((m+l+p+s)q*e^{gn}+((a+v)/(q*e^{gn}))]_3-[(r*q)-((m+l+p+s)q+(a+v)/q]_2\}q*t$

$[(r+((r*e^{in}-r)/2))q*e^{gn})-((m+l+p+s)q*e^{gn}+a+v)]_3*0,02=\{[(r+((r*e^{in}-r)/2)e^{gn})-((m+l+p+s)e^{gn}+(-(a+v)*q^{-2}*(e^{gn})^{-1})]_3-[(r)-((m+l+p+s)-(a+v)*q^{-2}]_2\}q*t$

$[(3.0300258154547273q*1.04020727897394)-((1.38592798363835)q*1.04020727897394+155,437.72)]*0.02=\{[(3.0300258154547273*1.04020727897394)-(1.38592798363835*1.04020727897394+(-(155,437.72)*q^{-2}*1.04020727897394^{-1})]-[(3)-((1.38592798363835)-(155,437.72)*q^{-2}]\}q*0.1$

$0.024590999076111538450141447395 04q^{2}-3,108.7544q-600.81561602586570309284872849 1=0$

$\mathbf{q_{1,2}} = -b +/- ((b^{2}-4ac)^{0,5})/2a$
q_1~126,419 litre amount is the optimal solution of the equation.

*q_2~-0.193265 litre as a root of the equation is a negative real solution and is not accepted as an optimal solution. Total production to be reached at the end of the year q_1~126,419*1.04020727897394 ~ 131,502 in Case 3*

Elasticity Analysis:

Table 1: Elasticity parameters of Case3 Expenditure allocation: Variable: 54% Fixed: 46% (started with V:64% F:36% in Case 1)

Elasticity parameters of Case3				
Expenditure allocation: Variable: 54% Fixed: 46% (started with V:64% F:36% in Case 1)				
For 365 days and when other parameters are constant				
	10% increase in daily inflation rate	**10% increase in daily economic growth rate**	**10% increase in fixed expenditures**	**~178,05% increase in daily economic growth rate (0,0300298335622585%) and 10% increase in fixed expenditures**
Cost and expense	0.00000000000%	0.21206267103%	4.63102561869%	8.53484926024%
Income	0.10017874114%	0.39497799014%	0.00000000000%	7.27107891432%
Cash based profit	0.67655524825%	1.44737784596%	-26.64451898796%	-0.00000005409%
Tax	0.67655524825%	1.44737784596%	-26.64451898796%	-0.00000005409%
Net Cash Based Profit (NCBP)	0.67655524825%	1.44737784596%	-26.64451898796%	-0.00000005409%
Unit Tax/Product	0.67655524825%	1.04825946166%	-26.64451898796%	-6.77822861670%
Tax advantage of customers	0.67655524825%	1.44737784596%	-26.64451898796%	-0.00000005409%

Source: Own creation (2023)

Table 2: Elasticity parameters of Case3 Expenditure allocation: Variable: 47% Fixed: 53% (started with V:57% F:43% in Case 1)

Elasticity parameters of Case3				
Expenditure allocation: Variable: 47% Fixed: 53% (started with V:57% F:43% in Case 1)				
For 365 days and when other parameters are constant				
	10% increase in daily inflation rate	**10% increase in daily economic growth rate**	**10% increase in fixed expenditures**	**~183,11% increase in daily economic growth rate (0,0305754808872306%) and 10% increase in fixed expenditures**
Cost and expense	0.00000000000%	0.18740230951%	5.25537335782%	8.80669520315%
Income	0.10017874114%	0.39497799014%	0.00000000000%	7.48493424912%
Cash based profit	0.66747595105%	1.57044798637%	-29.76039236539%	-0.00000010799%
Tax	0.66747595105%	1.57044798637%	-29.76039236539%	-0.00000010799%
Net Cash Based Profit (NCBP)	0.66747595105%	1.57044798637%	-29.76039236539%	-0.00000010799%
Unit Tax/Product	0.66747595105%	1.17084541455%	-29.76039236539%	-6.96370557362%
Tax advantage of customers	0.66747595105%	1.57044798637%	-29.76039236539%	-0.00000010799%

Source: Own creation (2023)

Table 3: Elasticity parameters of Case4 Expenditure allocation: Variable: 63% Fixed: 37% (started with V:64% F:36% in Case 1)

Elasticity parameters of Case4				
Expenditure allocation: Variable: 63% Fixed: 37% (started with V:64% F:36% in Case 1)				
For 365 days and when other parameters are constant				
	10% increase in daily inflation rate	**10% increase in daily economic growth rate**	**10% increase in fixed expenditures**	**~559,21% increase in daily economic growth rate (0,0158211263316051%) and 10% increase in in fixed expenditures**
Cost and expense	0.00000000000%	0.05527897410%	3.69237837372%	6.85923427264%
Income	0.00597530429%	0.08763838001%	0.00000000000%	5.02068146530%
Cash based profit	0.02229254057%	0.17600477043%	-10.08306981684%	-0.00000017726%
Tax	0.02229254057%	0.17600477043%	-10.08306981684%	-0.00000017726%
Net Cash Based Profit (NCBP)	0.02229254057%	0.17600477043%	-10.08306981684%	-0.00000017726%
Unit Tax/Product	0.02229254057%	0.08828901536%	-10.08306981684%	-4.78065993527%
Tax advantage of customers	0.02229254057%	0.17600477043%	-10.08306981684%	-0.00000017726%

Source: Own creation (2023)

Table 4: Elasticity parameters of Case4 Expenditure allocation: Variable: 56% Fixed: %44 (started with V:57% F:43% in Case 1)

Elasticity parameters of Case4				
Expenditure allocation: Variable: 56% Fixed: 44% (started with V:57% F:43% in Case 1)				
For 365 days and when other parameters are constant				
	10% increase in daily inflation rate	**10% increase in daily economic growth rate**	**10% increase in fixed expenditures**	**~604,44% increase in daily economic growth rate (0,0169066205105371%) and 10% increase in fixed expenditures**
Cost and expense	0.00000000000%	0.04890168310%	4.42006081180%	7.45421102265%
Income	0.00597530429%	0.08763838001%	0.00000000000%	5.43760444068%
Cash based profit	0.02208719434%	0.19208852531%	-11.91831082433%	-0.00000039727%
Tax	0.02208719434%	0.19208852531%	-11.91831082433%	-0.00000039727%
Net Cash Based Profit (NCBP)	0.02208719434%	0.19208852531%	-11.91831082433%	-0.00000039727%
Unit Tax/Product	0.02208719434%	0.10435868704%	-11.91831082433%	-5.15717790327%
Tax saving of customers	0.02208719434%	0.19208852531%	-11.91831082433%	-0.00000039727%

Source: Own creation (2023)

Short Evaluation form Tax perspective:

Depending on the conditions of the economy, the tax and incentive policies can follow a different route as well. For instance, same unemployment portion can be also funded by the indirect taxes collected during the year from the customers first and followingly, the foreseen increased portion of corporate income tax calculated over profit at the end of the year as a sequence of growth in production operations might be used for refunding the foreseen portion of indirect taxes previously paid by the customers during the year for funding unemployment/partial unemployment. However there should be output indirect tax (VAT) balance enough to maintain funding unemployment for the foreseen period, the deffered indirect tax balance case may prevent/intersect these unemployment payments, in this case a Witholding tax mechanism about VAT can be regulated.

An unemployment portion of social security premiums reserved as a provision mechanism or private insurance funds can be some other methods of funding unemployment if available and deliberately managed.

In this analysis one of the occasional case is simulated and the companies own cash flows and CIT calculated in sequence of term operation result has been considered as base to keep sustainity in the economy together with a portion of economic growth. Because finally the operation result can be the dynamic to complete this cycle. So during the year the unemployment is funded by the cash received through an employee benefit plan fund previously determined by the company, and the funded unemployment amount is deducted in the tax return filling directly from the calculated tax of the term, followingly the difference in the CIT corresponding to economic growth (and inflation) are allocated for tax refund for the customers based on the incentive policy.

The unemployment payments for the subsituted labour are not considered in the profit functions as a part of operation and tax base naturally since there are no real work to perform for this portion of the labour.

Model variations:

Based on business forms and conditions the models can be differentiated;
Manufacturer Business Model With or Without Production_Sales Time Difference:

$f(p)=[(r+((r*e^{in}-r)/2))q_s*e^{gn})-((m+l+p+s)q_p*e^{gn}+a+v)](1-t)$
$f(p)=[(r+((r*e^{in}-r)/2))q*e^{gn})-(v+((v*e^{in}-v)/2)q*e^{gn}+a+v)](1-t)$

Manufacturing and Outsourcing Group Consolidated Business Models:

$f(p)=\{[(r_1+((r_1*e^{in}-r_1)/2))q_1*e^{gn})-((m+l+p+s)q_1*e^{gn}+a+v)]+[(r_2+((r_2*e^{in}-r_2)/2))q_2*e^{gn})-(o+((o*e^{in}-o)/2))q_2*e^{gn})]\}(1-t)$

$f(p)=\{[(r_1+((r_1*e^{in}-r_1)/2))q_1*e^{gn})-(v+((v*e^{in}-v)/2)q_1*e^{gn}+a+v)]+[(r_2+((r_2*e^{in}-r_2)/2))q_2*e^{gn})-(o+((o*e^{in}-o)/2))q_2*e^{gn})]\}(1-t)$

$f(p)=\{[(r_1+((r_1*e^{in}-r_1)/2))q_1*e^{gn})-(v+((v*e^{in}-v)/2)q_1*e^{gn}+a+v)]+[(r_2+((r_2*e^{in}-r_2)/2))q_2*e^{gn})-o*q_2*e^{gn})]\}(1-t)$

- m : direct material expenditures
- l : direct labour expenditures
- p : indirect production expenditures
- s : SG&A expenditures variable portion
- a : SG&A expenditures fixed portion and other fixed expenditures
- v : investment
- q : base annual sales quantity (q_1: total quantity of manufactured and sold manufactured goods, q_2: total quantity of procured and sold outsourced goods)
- r : unit sales price (r_1: unit sales price of own manufactured goods, r_2: unit sales price of outsourced goods)
- o : outsourced items procurement price
- t : corporate income tax rate
- i : daily inflation rate
- g : daily economic growth
- n : number of days
- q_s : Sales quantity (when sales and production quantity are not equal to each other)
- q_p : Production quantity (when sales and production quantity are not equal to each other)

5. Results

A real annual growth in the economy may result in increase of the annual net cash based profit of the company. In a growing economy these increase can also reflect to the salaries of the companies' employees in major scale, thus the purchasing power of the consumers can also increase.

The model can be criticised as being relatively hypothetic to practice, considering assumptions about: market conditions, companies' behaviours about salary policies, exponential inflation and positive growth conditions in the economy and foreseen tax regulations. However it can be seen that the artificial intelligence (higher technology) based economy transformation can be realised easier within a positive real growing economic environment than resessive conditions considering tax incentive capabilities.

In some cases during transition period, ofsetting regulations in taxation (via direct or indirect tax refund methods, or via deductible expenditure method in calculations of personal taxable income) can be applied at least on some specific products which create financial results in favour of producers and consumers. Such tax incentives can support production and sales of these specific products. With such regulations some strategic industries who are operated with other subindustries make economic growing more effective in the economy. The industries for which artificial intelligence technologies to be integrated might be prioritised based on their potential of contribution to economic growth to occur after these investments.

In the future AI might be seen in majority of daily human activities. However if the AI is started to be integrated by the manufacturing industries to increase their production and stimulate their subindustries at the beginning of the comprehensive transformation in the economy,

it may have more potential to support creating a sustainable economic growth environment. Country specific economic conditions can be another factor to be considered in this transformation. Last but not least, In this analysis relatively a sole investor's behaviour is taken as base simulating one of the occasional case as an uneven adoption of AI. The transition might be also modeled via a business cooperation and/or an international business practice without or with a very limitted tax regulation shift.

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