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Targets, Models and Policies:

A Quantitative Approach to Raising the EU Employment Rate

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Abstract

The EU 2020 process has the key headline target of raising the average employment rate in the EU to 75 from the present 69 per cent. In this paper, we first derive a new result for optimal policymaking under uncertainty. It consists of two components: one of a unilateral policy reaction under certainty, which is then multiplied by a scale factor, reflecting the uncertainty over the impact coefficient concerned with respect to those of the other policy variables. Based on this finding, we use a large multi-country labour market model, estimated in Bassanini and Duval (2006), to derive and discuss the various employment policy interventions and relevant labour market indicators to be monitored in the EU's Joint Assessment Framework (JAF). As the derived optimal labour market policy entails streamlining welfare benefits and may thus jeopardise the other target of inclusion in the EU 2020 process, we then discuss and evaluate how the distributional consequences of such a policy can be mitigated through transfer and tax changes. It turns out that compensation of the losers is possible in such a way that all will gain, and employment, GDP and aggregate labour supply will all rise.

Key words: Employment rate, optimal policy, compensation, tax policy

JEL: J08, J20, J30

Tiivistelmä

EU:n 2020-prosessilla on yhtenä päätavoitteena nostaa keskimääräinen työllisyysaste 75 prosenttiin nykyisestä 69 prosentista. Tässä tutkimuksessa johdamme ensin uuden tuloksen koskien optimaalista politiikkaa, joka muodostuu kahdesta komponentista: ensinnäkin yksittäisestä politiikasta varmuuden vallitessa, joka toiseksi kerrotaan skaalatekijällä, joka on yhden ja nollan välillä ja joka kuvaa kyseisen politiikan vaikutuskertoimen epävarmuutta suhteessa muiden politiikkamuuttujien kertoimien epävarmuuteen. Tähän tulokseen perustuen hyödynnämme laajaa useita maita kattavaa työmarkkinamallia, jonka ovat rakentaneet Bassanini ja Duval (2006) ja jonka avulla ratkaistaan optimaalinen työllisyyspolitiikka. Koska johdettu politiikka merkitsee mm. hyvinvointietuuksien karsintaa, tarkastelemme, kuinka tällaisen politiikan tulonjakovaikutuksia voidaan lieventää verotuksen ja tulonsiirtojen välityksellä. Saamme tuloksen, jonka mukaan häviäjien kompensointi on siten mahdollista, että työllisyys, BKT ja työn tarjonta nousevat verrattuna tilanteeseen ennen politiikkaa.

Asiasanat: Työllisyysaste, optimaalinen politiikka, kompensaatio, verotus

1 Introduction

The European Union has adopted an ambitious process, called EU 2020, for the present decade, with the goal of realising smart, sustainable and inclusive growth. Specifically, there are five headline targets in this process, the first of which is to raise the average employment rate of the population aged 20–64 years to 75 per cent by 2020 from the present 69 per cent. The relevant policies are decomposed into 12 areas. These and the outcome of policies are followed, evaluated and discussed in the extensive Joint Assessment Framework (JAF) process between the EU Commission and the Member States with several hundreds of labour market indicators. However, there is no explicit link between targets and policies in the JAF process. The aim of this paper is to provide one such missing analytical bridge by constructing a new result on policymaking trying to utilise intensively the information of the causal links and impacts between targets and policies revealed by large-scale multi-country labour market models.

Typical labour market theory, operating with labour market stock variables, determines the equilibrium unemployment rate as the long-run equilibrium between wage setting and price setting (i.e. labour demand) mechanisms in the economy, see Layard, Nickell and Jackman (1991, 2005). In the long run, the equilibrium unemployment level is determined by the wage-setting mechanism, in combination with the equilibrium distribution of national income, i.e. as measured by the share of wages in it. The long-run level of employment is then the labour supply less the equilibrium unemployment level. The equilibrium unemployment rate is independent of the size of the labour force. In the short run, this dichotomy does not hold, and employment and labour supply are closely affected by the phase of the business cycle, i.e., the size of the existing gap between the actual and potential GDP. In the long run, the fluctuations of aggregate demand do not affect the equilibrium rate of unemployment (see Alho 2002 how this is accomplished in an estimated time series model). In equilibrium, the labour supply is determined by the wage rate in combination with the tax and benefit system, affecting especially the labour supply of the female labour force, the young and the old-age workers and low-skilled labour.

The rise in European unemployment in the last decades of the 20th century sparked off important theoretical and empirical research. One of the seminal works has been done by Layard, Nickell, and Jackman (1991, 2005), see also Nickell (2003). However, utilisation of the results of labour market models can still be improved. So, in this paper, we derive the optimal labour market policies under uncertainty that will lead to a rise in the employment rate. The optimal policy decomposes in a neat way the policy reaction into a unilateral policy reaction under certainty, and a multiplicative scale factor which is less than unity, reflecting the relative uncertainty linked to the impact coefficient of the policy variable concerned in relation to those of impact coefficients of other policy variables in the estimated model. We then apply this method empirically to a selection of policies utilising the large-scale multi-country labour market model by Bassanini and Duval (2006). As the derived policy may entail a harsh cut in welfare benefits, jeopardising another EU 2020 goal namely securing social inclusion, we also discuss changes in tax revenues and the implementation of the policy in such a way that those who suffer can be compensated by those who gain through the government budget. It turns out that the compensation scheme can be constructed so that there will be a rise in employment, GDP and the aggregate labour supply as compared to the initial situation.

The rest of the paper is organised as follows. In Section 2 we derive our basic result of how to use empirical multi-country models to choose optimal policies under uncertainty. Section 3 applies this to the information embedded in the extensive Bassanini and Duval (2006) model. Section 4 considers some modifications and enlargement of the approach, e.g. to a nonlinear model. Sections 5 and 6 introduce the tax policy and compensation measures to the empirical analysis because our employment policy may initially be in conflict with the other targets of the EU 2020 process, notably inclusion. Section 7 concludes.

2 Optimal policies under uncertainty based on modelling

Now, we derive how the findings of the empirical labour market literature can be utilised in labour market policies and in the selection of suitable indicators for the labour market, and their respective importance. Imagine a set of labour market indicators y_i, i = 1,…,I, being the target variables of the EU 2020 agenda, and a set of specified numerical values y_{iT}^* for them in T = 2020, for example, such as the employment rate being raised to 75 per cent on average over the EU MS. Let us consider the case of a single target variable y in turn, notably employment.

Existing reduced form labour market models, based on labour market theory, depicting the causal links in a quantitative way, and estimated using panel and time series data, suggest for country j,

$$y_{jt} = \delta_j + \eta_t + \sum_{k=1}^{K} b_k x_{kjt} + \sum_{n=1}^{N} a_n z_{njt} + \gamma gap_{jt} . \quad (1)$$

Here t refers to the time period, x's are the K employment policy variables and z's the set of N other exogenous control variables, gap is the output gap (actual less potential GDP). Other variables δ and η refer to time and country fixed effects, respectively. The parameters are estimated from a panel data set for the relevant set of countries, typically the EU or the OECD. A meaningful empirical result of Eq. (1) by and large defines the proper set of indicators to be followed in the analysis of the labour market, being, in addition to the y's, the policy variables x's, control variables z's and the output gap. But below we are able to markedly sharpen this quite general statement.

Let us define the concept "future target gap" for some period T, (e.g. 2020), which is $\Delta y_{jT}^* = (y_{jT}^* - y_{j0}) - \sum_{k=1}^{N} a_k \Delta z_{kjT} - \gamma \Delta gap_{jT}$ where the superscript * denotes the relevant target value and Δ is the backward difference indicator, i.e. the difference from T=2020 to the present and the subscript 0 denotes the initial, present moment in time. It is then the task of policies to eliminate these gaps. We can initially use the model (1) to solve for the required set of policy variables so that

$$\Delta x_{ijT} = (\Delta y_{jT}^* - \sum_{k=1,k\neq i}^{K} b_k \Delta x_{kjT}) / b_i \ . \quad (2)$$

These reactions do not, simultaneously taken, normally identify a unique set of policies, except if there are equal number of policies and targets when the policies can be solved from (2).

So, in general, (2) rather defines a plane in the policy space with respect to each target variable. This can be applied as in Alho (2007) to evaluate the past policies adopted with respect to the various policy instruments. However, in order to reach a more determinate outcome for the policy selection, we can sharpen the analysis in the following way.

All future policy-making aiming at the target to be reached in period T has to be carried out under uncertainty. Let us accordingly define that the task of the policies is to minimize the squared deviation (variance) of the expected target gap in the target period, i.e. $V = E(y_T - y_T^*)^2$, where E is the expectation operator (we delete the subscript j when unnecessary).[1] Let there first be two labour market policy instruments x_1 and x_2. Let us assume initially further that their estimated impact coefficients b_k do not correlate with each other.[2] In a straightforward way we can derive the following optimal use of labour policy instrument x_1 in this case (for details, see the Appendix):

$$\Delta x_{1T}^* = \frac{\Delta y_T^*}{b_1} \frac{1}{1 + t_1^{-2}(1 + t_2^2)}, \tag{3}$$

where t_k is the t-value of the estimated coefficient b_k, i.e., $t_k = b_k / s_k$, with s being the standard error of the estimate of the coefficient and $\Delta x_{1T} = x_{1T}^* - x_{10}$. The solution for optimal policy can be split into the unilateral policy response under certainty, which is the first fraction in Eq. (3) (see also (2)), and it is then multiplied and scaled by a factor, being positive and less than unity, depicting the relative uncertainty related to the estimated impact coefficients in relation to that of the other policy variable. We see that the policy response is the more vigorous, the more certain is the policy response concerned (indicated by a high t_1 value). If t_1 is zero or deviates very little from zero, the optimal value of x_1 also goes to zero. This indicator x_1 is then irrelevant and should not be included in the proper set of labour market indicators to be followed. Similarly, the higher the t_2 -value of the other policy instrument, the less effective the use of the instrument x_1 becomes and policy will give more emphasis on x_2.

The taxonomy of the optimal policy is intuitively quite neat and we can generalize Eq. (3) to apply to K policy variables,

$$\Delta x_{1T}^* = \frac{\Delta y_T^*}{b_1} \frac{1}{1 + t_1^{-2}(1 + t_2^2 + \ldots + t_K^2)} \quad . \tag{4}$$

The application of this result to the choice of the other policy variables $x_2,\ldots,x_K$ is now straightforward. If an identical uncertainty is attached to the impacts of the policy variables, we see that the policy response is determined so that the target gap is eliminated by the share $1/(b_iK)$, adjusted by the common uncertainty pertaining to each policy impact coefficient. We see that a high value of the policy coefficient b_k has a dual role in the optimal policy. First, this implies that the policy variable concerned is an efficient policy variable and it should be used only in a small dose. Secondly, if the uncertainty of this impact is large in relation to that of the other variables, this variable should be affected only in a small scale also due to this effect. Multiply-

[1] For simplicity, we discard the uncertainty attached to control variables and the output gap and treat this as independent from that related to the policy variables.

[2] This is the case if the respective policy variables are chosen independently from each other, i.e. the moment matrix of policy variables is diagonal. This stipulates that the OLS covariance matrix of the impact coefficients is also diagonal.

ing the coefficient b_k with the optimal policy Δx_{kT}^*, we derive a metric on how much the optimal policy making, i.e. reduction in the target gap, should rely on the policy variable x_k. We also see that if a policy variable is a weak one in the sense that b_k goes to zero, its optimal use also goes to zero, as in the second component in Eq. (4) the t-value of the coefficient is present as squared and this dominates the first term.

We note that due to uncertainty, it is not optimal to eliminate the existing gap between the target and the actual situation completely, i.e. $E(\Delta y_T) < \Delta y_T^*$, if this gap is positive. But in practice the deviation between the target gap and the expected outcome of policies is often likely to be quite negligible, if the model (1) has a good explanatory power, as is the case in the application considered below in Table 1. As is plausible, we also note that for each policy variable, the optimal policy always aims to reduce the target gap.

However, it may be that the same policy variable has leverage with respect to several target variables y_i. Therefore, it may not be uniquely determined from the above constellation. We want to widen the approach to a more general case. This is discussed further below in Section 4.

Using this approach it is possible to compare the outcome with the present situation in policy making, i.e., compare x* to the existing stance x_0 of policy. Without this approach, we are left with a very large set of indicators without a methodology for evaluating them with respect to each other. If we want to sharpen this kind of analysis from a practical policy point of view, we can complement this deviation with information on the difficulty of changing the policy by comparing it to the standard deviation of the x-variable in past policy-making (see below for a further discussion on this).

3 Application to finding proper employment policies

An illustration of this methodology is an application to the choice of employment policies based on the extensive multi-country model by Bassanini and Duval (2006). We take the case of raising the employment rate in the EU gradually to 75 per cent by the year 2020. We consider that the task is to raise the rates for both prime age male and female employment and the employment rates of the young and old-age workers.

In the estimation results in Bassanini and Duval (2006) the employment rate (in their Tables 2.1., 2.2. and 2.3.) is basically regressed on the following variables: replacement rate, tax wedge on labour, a measure of Employment Protection Legislation (EPL), a measure of Product Market Regulation (PMR) and union density and corporatism variables, plus the output gap (see below Table 1a and b). In a separate estimation they carefully analyse as an additional effect that of the active labour market policy (ALMP). However, in these latter regressions the estimates of the above mentioned variables are not reported. Let us therefore simply assume, in the sense of the derivation above, that the coefficient of ALMP (amount of training in their Table 2.5.) is independent from those of the other variables and does not thereby have an effect on them. We now transform the above formulation so that the model fits the actual situation in the economy in period t = 0 through a proper shift in the equation constant. Thereby we can equivalently write the framework (1) above as follows, in difference form, for a single target variable y, like the employment rate,

$$y^*_{jT} = y_{j0} + (y^*_{jT} - y_{j0}) = y_{j0} + \sum_{k=1}^{K} b_k (x^*_{kjT} - x_{kj0}) + \sum_{n=1}^{N} a_k (z_{njT} - z_{nj0}) + \gamma (gap_{jT} - gap_{j0}) . \quad (5)$$

Using the above methodology derived in Section 2, we solve for the optimal policy responses $x^* - x_0$ to raise the employment rates towards the target, but not paying attention to the likely role of the elimination of the present output gap in the future (which is likely to be reduced over the coming years alleviating the need for policy to raise employment) and assuming that the institutional exogenous variables z remain unchanged over the period. The calculations leading to the solutions in Table 1a and b can be readily undertaken in an Excel worksheet.

The implied results would suggest the need for a harsh policy response. For male employment, only the policy of markedly reducing the replacement rate, and reducing the tax wedge by a similar amount, would deliver the required change. For female employment, the policy space

Table 1a The optimal policy responses when the target is to raise the employment rate by 1 percentage point*

	Full time male employment				*Full time female employment*			
Variable	*Coeff.*	*t-value*	*Optimal policy ($x^* - x_0$)*	*Impact of policy*	*Coeff.*	*t-value*	*Optimal policy ($x^* - x_0$)*	*Impact of policy*
Replacement rate	-0.17	7.42	-2.56 **	0.44 **	-0.14	3.71	-2.68 **	0.37 **
Tax wedge	-0.30	8.34	-1.84 **	0.55 **	-0.12	2.34	-1.24 **	0.15 **
EPL	-0.23	0.66	-0.01 ***	0.00 **	-1.54	3.06	-0.17 ***	0.25 **
PMR	-0.12	0.47	-0.01 ***	0.00 **	-0.75	2.67	-0.26 ***	0.19 **
Output gap	0.49	11.60	–	–	0.17	3.17	–	–
Total impact on empl.	–	–	–	0.99 **	–	–	–	0.97 **
ALMP	0.16	3.14	0.45 ****	0.07 **	0.10	0.91	0.23 ****	0.02 **

* For explanations, see the text, ** percentage points, *** change in the indicator value, **** public expenditures on active labour market policies, training, as a share of GDP. Impact of policy = $b_k \Delta x^*_{kT}$.

Table 1b The optimal policy responses when the target is to raise the employment rate by 1 percentage point, continued*

	Youth employment, 20–24 years				*Old-age employment, 55–64 years*			
Variable	*Coeff.*	*t-value*	*Optimal policy ($x^* - x_0$)*	*Impact of policy*	*Coeff.*	*t-value*	*Optimal policy ($x^* - x_0$)*	*Impact of policy*
Replacement rate	-0.24	5.61	-1.71 **	0.41 **	-0.19	7.12	-2.49 **	0.47 **
Tax wedge	-0.34	5.86	-1.32 **	0.45 **	-0.31	6.74	-1.37 **	0.42 **
EPL	-2.35	2.97	-0.05 ***	0.11 **	1.59	2.62	0.04 ***	0.06 **
PMR	0.51	1.04	0.03 ***	0.01 **	0.56	1.74	0.05 ***	0.03 **
Output gap	0.82	10.72	–	–	0.20	4.39	–	–
Total impact on empl.	–	–	–	0.99 **	–	–	–	0.99 **
ALMP	0.27	2.31	0.24 ****	0.07 **	0.35	3.33	0.27 ****	0.09 **

* For explanations, see the text, ** percentage points, *** change in the indicator value, **** public expenditures on active labour market policies, training, as a share of GDP. Impact of policy = $b_k \Delta x^*_{kT}$.

is more diverse and covers reductions in EPL and PMR as well. Both these variables are measured on a scale from 0 to 6.

For young and old-age workers the policy responses are quite similar. Overall, according to these results, policies related to EPL and PMR are only minor aspects in policy making with respect to the employment target according to this evaluation. Alho (2007) evaluated the past policy measures as based on data of Bassanini and Duval (2006) and according to that evidence the most changes have been carried out with respect to reforms to deregulate the product markets. We also see that the total (expected) impact on the target is very near the stipulated target of raising the employment rate by 1 percentage point.

The additional impact of ALMP is most clearly to be seen in connection with the full-time male workers, although also its impact on the policy outcome is fairly small in comparison with that of the main policy variables, mentioned above.

Note, however, that if we follow this kind of policy line shown in Table 1 of cutting welfare benefits, we may well undermine the other EU 2020 goal of reducing poverty. Therefore, a wider approach taking into account these other impacts would need to be developed, see below Section 5.

There are, in practice, other goals related to the labour market, not covered by the existing modelling, which focuses on employment and unemployment. Perhaps the most significant among these from a labour market perspective are education, and the risk of poverty. The choice of a relevant set of indicators in the JAF, and the determination of their mutual weights, i.e. which labour market indicator is more relevant than the others, is also highlighted with this kind of approach. The output gap matters mostly for the young and male workers. The indicators of EPL and PMR should receive only a limited attention, while welfare benefits and taxes should receive a strong attention among the indicators. We also note that even though the t-value of the EPL variable in the model for young workers is quite high (almost 3), the implied optimal policy is very little based on this variable. The reason for this is the fact that there are more significant policy variables, which should be relied in the policy making.

4 Some further aspects in policy modelling

An important issue is that the bulk of the indicators used in JAF treat the EU member states as a country-by-country case, although comparing them to each other, but identifying policies separately over the MS. However, we should also consider coordination of labour market reforms over the EU countries, which is explicitly an omitted field in the indicator exercises, although implicitly recognised in peer review of developments in labour markets in the various MS. Normally, coordination brings a positive gain and the case for labour market reform is stronger in a MS if attention is paid to spillovers of reforms within the EU. It is an open question, how we take this fact into account in the indicator set rather than the policy set.

Interaction of reforms in a single country is also an important issue. This issue is raised and empirically analysed by Bassanini and Duval (2006). A more extensive set of reform policies will give a larger impact on employment than when policies are carried out in isolation from each other. Combination of policies, so that they also comprise some features of the driv-

ers of the causal chain from policies to targets, not explicitly present in reduced form models analysed above, is an important issue. So, e.g. as analysed by Alho (2009), combining an income tax cut with wage restraint, could be an important element in the policy making. Similarly, Bassanini and Duval analyse the interaction between unemployment benefit policies and ALMP. They conclude (p. 31) that "these estimates suggest that the unemployment effects of generosity of unemployment insurance becomes statistically insignificant in high ALMP countries, such as Denmark or the Netherlands".

Our suggested methodology implies, that to the extent that the estimated impact coefficients b_k are taken to be the same over the various MS, that the desired policy vector in countries m and n are similar, in the sense that $\Delta x^*_{mT} = \Delta x^*_{nT}$ if the target is the same in all the countries. Of course, the actual policy needs will still be different, as the initial stances of policy deviate from each other.

Normally the budgetary impact of the policies is not explicitly considered in a policy making outlined above. But, especially in the current situation, this is very relevant. So, e.g. instead of across the board of uniform cuts in taxes on employment, with a large dead weight loss, we could operate with marginal measures with a smaller budgetary burden as are the marginal employment subsidies in the current Obama jobs programme. See analysis of this in Layard, Nickell and Jackman (2005), ch. 10. Alho, Kaitila and Kotilainen (2007) discuss the budgetary and inefficiency outcome of such a policy. The latter stems from the fact that all employment does not bear a uniform labour cost under such a scheme, but this harmful effect remains as fairly small anyway in quantitative terms in practice.

A more general case is then made by considering multiple target variables, multiple policies, correlated impact coefficients, and a non-linear regression model, allowing for interaction between policies. The policies may also have a different impact on the different target variables, as was also the case to some extent in Table 1. Consider a more general model, which is non-linear in the sense of allowing for interaction between policies, and allow for more target variables and a non-diagonal covariance matrix for the coefficients in each country j. The model is now,

$$y_{jt} = Bx_{jt} + Cx_{jt}x_{jt}'d + Az_{jt} + \gamma gap_{jt}\,, \tag{6}$$

where y, x, z and γ are now column vectors and B, C and A are respective conformable coefficient matrices, and d is a unit column vector.

The forecasts for the z variables and the output gap in the target period, i.e., 2020 determine the target gap vector analogously to the model described in equations (1)–(5). The target weight matrix for the targets is given by W so that the policy maker minimizes the target

$$V = E(y_j - y_j^*)'W_j(y_j - y_j^*)\,. \tag{7}$$

If W is diagonal, the policy maker simply aims to achieve the minimum of the sum of squared deviations of the target variables from the target values.

The policy makers may also bear a loss related to the change in the policy variables, depicting political willingness to make changes with respect to the status quo. So, we could also speci-

fy a loss function for the activism of the policies by adding the term $(x^*-x_0)'W_X(x^*-x_0)$ to the objective function V. We could perhaps base this function on how much the policy variables have been changed in the past to produce the weights in the W_X matrix.

The existence of multiplicative interaction terms in Eq. (6) imply in general that policies are affected in two ways. First, the leverage of the policy is enhanced in the case of positive coefficients in the C matrix (6). This calls for a more activist use of policy. Secondly, there is less need for activist policies, if several of them, when pursued in combination, lead with a smaller individual dose to a desired change in the target variable. We leave a further consideration of these aspects to a subsequent analysis.

However, with these modifications and extensions the framework becomes very tedious and virtually impossible to handle analytically. The recourse should be taken to a numerical solution. Therefore, we suggest a more simplified use of the linear framework outlined above to be applied to the choice of policies in the case of multiple goals and applied to the case illustrated in Table 1a and 1b. At the same time, we also illustrate how we can apply it to further sharpen the employment policy analysis in the JAF.

First, we apply the framework in the way illustrated in the Table 1a and b, in the case of a single target and multiple policies, for each employment component in turn. Second, we utilise the outcome of the JAF process so that the existing situation in a MS with respect to the various components of employment are evaluated and illustrated. The process leading to the evaluation is described in the report by the Commission (2010). In JAF, first, the ratings are measured in the MS as such and then evaluated over the various MS using the metric that the outcome is measured on the scale (score-average score)/standard deviation multiplied by 10. Accordingly, we use this approach to give the weights related to the target i in the following way. Let us first define

$$w_{imj} = -(y_{imj} - \overline{y}_{im}) / s_{im} \ , \tag{8}$$

where i indicates the headline target variable concerned (like employment), m indicates the component of the target i, like the employment rate of the old-age workers, and j indicates the country considered, and $\overline{y}_{im}$ is the average of the indicator i concerned over the EU countries and s_{im} is the respective standard deviation. Then we normalize their sum to unity by defining ω_{imj},

$$\varpi_{imj} = \frac{w_{imj}}{\sum_{m=1}^{M} w_{imj}} \ . \tag{9}$$

Next, we multiply with these weights the shares of each component of employment in the overall employment in a MS. Finally, we weigh with this procedure the policy responses $x^*_{jkT} - x_{jk0}$ reached in the exercise leading to Table 1a and b, in order to derive a single value for the employment policy variable concerned, having leverage with respect to all the components of employment.

This means that if the employment component m in country j is very weak in an EU comparison, i.e. the respective weight w_{imj} is very large, the more the policy k in country j are pursued with respect to the employment headline target.

Recognising the "ticks" and "crosses", as in Nickell (2003), is another way of proceeding to link the outcome of labour economics to the JAF. In effect, this means that we only recognise whether a country has made a good or bad change with respect to a policy variable or aspects of labour market institution and then add the ticks, indicating a good change, and the crosses, indicating a bad change, to reach an overall picture. This method explains about one half of the variation in European unemployment rates in the 1980s and 1990s.

5 On tax policy and the EU 2020 process

One of the features and weaknesses of the JAF is that it does not explicitly recognise the main positive interactions, on the one hand, and the potential risks of trade-offs between the policy areas with respect to the various headline targets of the EU 2020 process, on the other hand. Overall, we have to consider policy areas and their potential trade-offs with respect to the various headline targets of the EU 2020 process. This is based on the fact that a given policy may lead to an improvement with respect to a target, but at the cost of leading to a deviation from another target. Of course, the reverse may also hold so that a measure can simultaneously improve the achievement of another target in addition to the primary target.

As to the labour market, the EU 2020 process stipulates basically the target for the aggregate employment rate to be 75% for the population aged 20–64, analysed above. However, there is another target of reducing the risk of poverty, which may lead to a conflict between this goal and the employment goal, with respect to at least some of the policy tools mentioned earlier, most notably the generosity of the welfare system. This is likely to be the most significant trade-off existing between the headline targets of the EU 2020 process with respect to the various policy areas. Let us next carry out an explicit analysis of the situation with respect to these two goals. We do that by considering the gains and losses of income related to the measure of streamlining the welfare system benefits and conclude that compensation through the government budget, through extra tax revenues and savings in transfer payments, is possible so that all can gain. According to the compensation principle, the measure should then be accomplished. However, we also have to consider, whether in practice the compensation scheme may offset some of the initial gains.

On the contrary, the headline target of EU 2020 of raising the R&D financing up to 3% of GDP in the EU on an average has a mutually reinforcing interaction effect on the employment goal. The potential level of output depends on productivity developments and the equilibrium level of employment. Changes in productivity, if unexpected and positive, lead to a lowering of the equilibrium level of unemployment, and vice versa with setbacks in the rise of productivity. This means that the goal of raising R&D financial and its beneficial implications for productivity lead to a rise in employment.

Tax policy in connection with enhancing employment has been analysed above, but only on a fairly aggregative level in terms of the total tax wedge on labour. Tax structure is also a measure of the structural reform policies operating both through the aggregate demand, i.e. consumption and investment, and the labour demand and supply. Aggregate demand leading to changes in the output gap in the short run is an important factor affecting the current employment. On the supply side of the labour market, the outcome of the tax measures has also potentially an important role as to inclusion.

Tax policies have a role in addition to the aggregate demand, in reduction of public sector deficits and debt, to employment and growth, and to how the burden of the current crisis with a faltering recovery is borne by the various income groups in the society. Thereby it has a direct link to the headline targets of the EU 2020 project, and can be put under the categories followed in JAF, namely policy area 4 (Adequate and employed oriented social security systems) and area 10 (Wage setting mechanism and labour cost developments). However, given the weight found above in Section 3 as related to the importance of the tax wedge on labour in labour market developments, taxation should perhaps earn a more prominent role as a policy area of its own within the JAF.

Tax policies can have a marked impact on long-run growth of the EU economies. Assuming that an accelerated growth needs an enhanced labour input or higher productivity, it can also have an indirect effect on employment as well. Although this latter item is not as such examined by Arnold *et al.* (2011), they show empirically that the various components of the tax structure have markedly diverse effects on the future growth. Especially taxes on corporates and labour should be lowered to enhance growth, and recourse should be taken to levy more taxes on property and consumption. For instance, in the long run the impact on GDP per capita of a 1% shift of tax revenues from income to consumption and property taxes can be between 0.25% and 1%. The paper also discusses many issues how tax reductions should be currently pursued in the crisis in a way that does not jeopardise the fiscal position over the longer term.

Normally, the unemployment rates are wide apart from each other for the various skill groups so that the least skilled have a markedly, even triple as high an unemployment rate as the most skilled workers, as is the case in Finland. The current crisis has witnessed a reduction in profits and non-wage income of the high income brackets. However, we can state that the poorest have been most hardly hit during the economic crisis in the sense that their employment has been reduced, and the aspirations to balance the public budgets and debt easily lead to a further pressure against the welfare of the poorest among the EU population. It is a general longstanding recommendation in the EU that the taxes of those with the lowest income should be lowered both in the income taxation and in the respective social security payments by the employers. This has also been advanced by Arnold *et al.* (2011).

However, there are some caveats with respect to this conclusion. If the taxes of the low income earners are lowered in general, not in the form of in-work benefits, this typically raises the after-tax benefits by these people. This has a negative impact on their labour supply. Also if the cost of hiring of these people is lowered to the employers, this impact may be watered down by an offsetting rise in the wage claims by the unions. This was analysed in a labour market general equilibrium model by Alho (2006). It, of course, depends on the horizon at which we operate, but in the long run it may even turn into a decline in employment. The reasoning behind this possibility runs as follows. A cut in the payroll tax on the low income earners will raise the profitability of the firms, which raises the wage claim by this group of workers. If there are tight wage-wage links within the labour market, this may lead to an emergence of compensatory wage claims, leading in the end to an overall reduction in labour demand and employment.

Lowering the taxes of the low-wage earners also typically leads to a rise in the progressivity of the tax scale for higher wage earners, with its setback in labour supply. If the tax reduction of

those living on the welfare benefits is aimed to raise their inclusion through enhanced labour supply, there should thus be a general reduction in the income tax scale, which may cost a lot to the public sector.

6 Realisation of the employment policy through a tax-compensation scheme

Let us now turn to explicitly analyse tax policies in a medium-run context, using a concise approach largely concentrating only on the most essential behavioural reactions. Tax policies are in a central position as to both having leverage to the labour market and the possible compensation scheme related to the labour market policies. Imagine that, based on the above calculations in Table 1, that the policies curtail the ratio of benefits to wage income (replacement rate after tax), denoted by r, from r_{OLD} to r_{NEW}, by 100z%-points so that this can lead to a reduction in the unemployment rate by 1 percentage point in the long run. Assume that productivity will remain unchanged so that aggregate production and employment will rise by AdL, where A is the labour productivity and dL is the increase in the number of employed L. Let us further denote by $\tilde{A}$ the net productivity faced by the firms after taxes paid on production like the VAT, with t_Q being the respective tax rate. This means that $(1+t_Q)\,\tilde{A}=A$. The tax rates are throughout assumed to be kept fixed.

We identify the following groups in the society: those who remain employed after the measure, those who were unemployed before it but will now be recruited, those who remain unemployed and those who own the capital stock and earn the corporate income. In addition, we consider the public sector budgetary position.

We assume that the real before-tax wage rate, denoted by w, will change by the amount 100b% as a consequence of the policy. b is negative as the wage rate will be reduced, because the outside option affecting wage setting is lower now. The reduced form labour market models like that of Bassanini and Duval (2006) are not explicit in this respect as they directly link benefits to employment and unemployment, but such a change is anyway necessary in order to get a boost in employment, see e.g. Alho (2006).

Let t_W be the labour income tax rate. The aggregate after-tax wage income of the old employed will change by $(1-t_w)wbL$. This is a reduction in net income. Denote further the corporate tax rate by t_C so that the after-tax income of the corporations will change by $(1-t_C)\left[(\tilde{A}-(1+b)w)\,dL-bwL\right]$. Corporate profits rise due to the marginal net profits linked to the rise in production and because the firms save in inframarginal costs.

The after-tax real aggregate income by the newly employed will rise by $\left[(1-t_W)(1+b)-r_{OLD}\right]$ wdL. We assume that the term in the square brackets is positive which is a necessary condition for that it pays to be hired and get employed. The aggregate income of those staying unemployed will be reduced, changed by the amount $\left[(1+b)r_{NEW}-r_{OLD}\right]w(U-dL)$, where U is the number of unemployed before the measure and we have assumed that (over time) the unemployment benefits will be linked to the new market wage. This change in income is negative as the term in square brackets is negative.

The budgetary balance of the public sector will also change. The aggregate tax revenues will change after some manipulation by $\left[(t_Q+t_C)\tilde{A}+(1+b)(t_W-t_C)w\right]dL+b(t_W-t_C)wL)$.[3] This is most likely to be positive under a variety of combinations of tax rates and is definitely so if $t_W=t_C$. The expenditure on welfare payments will change by the amount $\left[(1+b)r_{NEW}u_{NEW}-r_{OLD}u_{OLD}\right]wN$, where u_i is the respective unemployment rate and N is the labour force, employed and unemployed together. This change is negative. In all, the budgetary balance of the government will get stronger. This gives room for compensation of those remaining unemployed by the rise in aggregate income of the society and the newly employed, see below. Let us first check how the aggregate position of the old employed and (old) capital owners will change. Their aggregate wage and non-wage income after tax will change by the amount $(t_C-t_W)bwL+(1-t_C)\left[\tilde{A}-(1+b)w\right]dL$. If the corporate and income tax rates are equal this change in aggregate income of the previously employed and capital owners will definitely be positive. We get the outcome 1.

Outcome 1. Under the policy of cutting the welfare benefits, the capital owners can compensate with their increased income the loss of labour income by the old workers if the tax rates on corporate income is equal to that on labour income.

Note that this is a sufficient, not a necessary, condition and the possibility of compensation may well be in force under a wide range of different combinations of the respective tax rates, too, see Table 2. Let us then examine whether the compensation of the loss of those staying unemployed by the gainers through the government budget is possible. Let dT, dG and dY be the changes in aggregate tax revenue, public expenditure and income of the stayers in unemployment, respectively. It is straightforward to derive that the sum of the change in budgetary surplus and the change in the income of those remaining unemployed is definitely positive. This change can now be written as follows, $dT-dG+dY=dT+r_{OLD}(u_{OLD}-u_{NEW})wN$. As unemployment is lowered by the measure, the expression in brackets is definitely positive. This, together with the rise in tax revenues, assures that the loss of the unemployed can be clearly compensated by the gainers through the government budget. According to the compensation principle, the measure of cutting the welfare benefit r should thus be accomplished. Note that the sum –dG + dY does not directly depend on the size of the wage reaction parameter b. All this is quite a clear outcome of the fact that aggregate output and income will expand as a result of these policies. Anyway, we can infer that the budget deficit of the government will be reduced, even after compensation, as the reduction in outlays consisting of welfare benefits is enough to compensate the losers and the increase in the tax revenues is then fully reflected in the budgetary position of the government. We can then state the outcome 2.

Outcome 2. The compensation of those stayers in unemployment is possible through the government budget in such a way that the budget deficit will go down after the compensation in comparison to the initial situation before policy.

We should also consider the possibility of compensating with tax revenues all those bearing a loss as a result of the measure in welfare policies. So, we sum the change in the income of the old workers and of those staying unemployed. We come to the conclusion that a priori it cannot be said, whether this kind of compensation is possible, although it is likely to hold in practice, see below in Table 2.

[3] For simplicity, we assume that welfare payments are untaxed.

How can this compensation take place in practice? It is not an irrelevant question, as compensation may offset some of the overall gains reached above so that the enhancement in GDP and employment may become smaller due to the compensation measures.[4] Let us have a closer look to the compensation scheme and study whether the above arguments hold after allowing for behavioural reactions of those staying unemployed. The reaction of the labour supply will depend negatively on the income effect and positively on the incentives created by participation into the labour market in comparison to the option of being outside it. This holds for both the extensive margin of labour supply (we omit the desired change in working hours by the old employed and assume that the income and substitution effects roughly neutralise each other here) and the intensive margin. If the losers are compensated for their loss dY in income, the income effect will be eliminated in comparison to the initial situation. So, the labour supply depends on whether there will be a higher incentive to participate. The change in this incentive can be written as follows:

$$\left[(1-\tau_W)(1+b)-r_{NEW}(1+b)\right]-\left[(1-\tau_W)-r_{OLD}\right] > 0\,, \tag{10}$$

where τ_W is the marginal tax rate on labour income. The expression in (10) is positive if the following holds,

$$\frac{b}{\Delta r} < \frac{1}{1-\tau_W-r_{NEW}}\,. \tag{11}$$

The right-hand side is clearly (much) higher than unity, and the left-hand side is clearly smaller than unity, as e.g. witnessed by Alho (2002, 2006). This means that the labour supply will rise in comparison to the pre-policy intervention equilibrium situation. Thus, we come to the conclusion that the compensation can be successfully completed so that the initial policy recipe holds. The income of the capital owners is enough to compensate the wage earners in such a way that the rate of return on capital will rise even after compensation of the loss in real wages, delivering incentives for further capital accumulation. The change in the equilibrium employment rate is equal to the change in labour supply less the change in the equilibrium unemployment. So, we get

Outcome 3. With the reform aggregate labour supply and employment will definitely rise if the condition in Equation (11) holds.

So, what does this imply in the end? We conclude that the policies do not include a trade-off as the compensation scheme can be constructed in such a way as creating tax incentives for enhanced labour input. Let us now try to put some numbers to get a more concrete picture of the outcome of this kind of policies.

According to these results, in the long run there would be a marked gain in the income of the newly employed and the capital owners and the government gains a lot so that its budget deficit will be markedly reduced. Those living on welfare would lose quite substantially. However, compensation of all the losers is possible through just the increase in tax revenues. It is true that these measures are only captured here by their initial change admitting no further behavioural reactions. In order to allow for them, we could take recourse to a general equilibrium model like that presented in Alho (2006).

[4] See Davidson and Matusz (2006) for a general analysis of this point.

Table 2 The outcome of policies cutting the welfare benefits so that the unemployment rate will go down by 1%-point*

Variable	*Aggregate impact after tax in disposable income as a % of GDP*	*Impact on personal income per capita, % change after tax*
GDP, Aggregate employment	1	1
Old employed	-0.35	-1
Capital income	0.60	1.21
Newly employed	0.10	38.6
Unemployment stayers	-0.15	-5.95
Aggregate tax revenue[a]	0.36	–
Public expenditure[a]	-0.43	–
Budget surplus[a]	0.79	–

* The parameters used are the following: b = -1%[6], t_W = 30%, t_C = 25%, t_Q = 20%, u = 10%, r_{OLD} = 50%, r_{NEW} = 47.5%, so z = -2.5%-points, total taxes/GDP = 47.5%. Benefits are assumed to be untaxed, a = change in %-points of GDP. The firms are assumed to be owned by the old employed.

Above we also made the assumption that the productivity level remains within the relevant time span unaffected by the change in employment. It is a long standing issue in empirical macroeconomic research whether this holds, see e.g. the discussion in Alho and Nikula (2007). Here the broad conclusion was that over the EU-15 countries in the short run there exists a negative trade-off between employment and productivity, but this will disappear in the long run for most of the countries.

7 Concluding remarks

We have in this paper tried to derive an analytical and quantitative framework which can be utilised in the employment policies in the EU 2020 process and their evaluation in the MS, and the consequent policy discussions between the Commission and the MS within JAF. True, the approach, as all produced by a quantitative analysis, has its severe limitations, which should be recognised. The policy problems should not only be based on a common approach in the labour market over the EU economies, but also on country-wise approach recognising the specific policy problems in the various member countries. The JAF process could also make use of our results in the sense that monitoring of those policies for which the derived policy reaction is small should be given a fairly small role, like the EPL and PMR, and the focus should be devoted to the welfare system and the tax wedge, and in some cases the ALMP, too.

[6] The numerical value of this is roughly based on the simulation results in Alho (2006). It also corresponds with the assumption of a unitary elasticity of substitution between labour and capital in the production function.

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Appendix. Derivation of the basic result in Eq. (3)

The model is $y=b_1x_1+b_2x_2$ and the target is to minimize the expected squared deviation of the outcome variable y from the target y*, $V=E(y-y^*)^2$. Insert then the model into this function and use the expression that $E(b_k^2)=\beta_k^2+\sigma_k^2$, where $\beta_k = E(b_k)$ and σ_k^2 is the respective variance. Use then the above-mentioned assumption that there is no covariance between the coefficients b_1 and b_2, which implies that $E(b_1b_2)=\beta_1\beta_2$. Differentiating then the objective function V with respect to x_1 and x_2 and solving the equation system we can with some manipulation come to the expression (3).

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