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Macroeconomic observations on paying for and funding universal basic income

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Abstract: The paper undertakes macroeconomic analysis of Universal Basic Income (UBI). It focuses on issues of paying for and the funding of universal basic income. A number of proposals are examined and the limitations of borrowing and money creation for the funding of UBI are indicated. It is generally argued that funding of UBI should be examined in terms of funding through taxation. The effects of UBI on employment and national output and the macroeconomic limits on the scale on UBI in terms of work force participation and tax rates are investigated.

Key words: universal basic income, budget deficits, money, full employment

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1. Introduction

This paper conducts a macroeconomic analysis of universal basic income (hereafter UBI). Universal basic income is a flat rate payment made to all citizens (or residents) regardless of their income and wealth status. There is a large literature on the ideas for UBI (often under different names ranging from negative income tax to citizens income), and some with detailed proposals for a UBI. The literature is wide in scope covering social and philosophical cases for UBI through to microeconomic analysis of the distributional effects of a UBI. This paper is limited to a macroeconomic analysis of UBI, issues of its funding and effects of introduction of UBI on paid employment and output.

How a UBI programme could be paid for and the consequences for the public finances are frequently raised issues and is discussed in section 2. A wide range of answers have been given ranging from increased government budget deficit, monetary creation to finance UBI through a range of additional tax measures, and these are examined.

In Section 3 the ways which have been advanced for the funding of UBI are discussed. Two specific aspects are considered. The first is the case where the fiscal costs of UBI are largely or wholly met by forms of increased taxation and levies (which can take a wide range of forms including commons wealth funds). The second relates to the money funding of UBI, where a number of proposals have been made that in effect amount to the possible full funding of UBI through monetary means.

In section 4 some of the routes through which a UBI could reduce the strength of the links between income and employment and the ways by which labour force participation could change.

In section 5, a simple macroeconomic model is developed. It is used to explore the relationship between the rate of taxation (tax revenue expressed as a percent of national income), the level of universal basic income and the budget deficit. It also explores the outcomes when allowance is made for effects of a UBI on labour force participation.

Section 6 offers some concluding remarks.

2. Financing and funding of UBI

A wide range of answers have been given to the question of how a UBI programme would be paid for ranging from forms of increased government budget deficit, monetary creation to

finance UBI through a range of additional tax measures as will be seen below. To consider this issue it is necessary to discuss what is to be understood by paying for and funding of government expenditure

Mehrling (2023) makes a distinction between paying for and funding. In the monetary circuit analysis, a distinction between 'initial finance' and 'final finance' is made (e.g. Graziani (1989, 2003). 'Paying for' and 'Initial finance' are the idea that in order to be able to spend prior possession of money is required, reflecting the key role of money as the generally accepted means of payment. Funding (final finance) relates to funds used (from receipts, from borrowing, and from use of own assets) to cover total expenditure over a period of time.

Government expenditure is paid for through the government drawing on its account with the central bank. The undertaking of expenditure by government then places central bank money in to the private sector in the form of commercial bank reserves and notes and coins, and the counterpart of the commercial bank reserves is the bank deposits (whether in current or savings accounts) held by the public. The precise manner through which the government is able to draw on its account with the central bank differs over time and between countries. The central bank may enable the (initial) financing through overdraft facilities for the government or through purchase, directly or indirectly, of government securities. However, the analysis does not depend on the precise route through which the initial financing is provided and the key aspect is that such financing has to be provided to enable expenditure to proceed. Central bank money can be created at virtually zero resource cost. There is then a simple answer to the question of 'where does the money come from' – it comes from the central bank. In terms of payment, the UBI is 'paid for' as any other form of public expenditure is 'paid for'. The government draws on its account with the central bank to make the relevant payments, including, if necessary, being overdrawn. Money spent by government generates economic activity and tax revenues, and much of the money spent returns to government, and thereby diminishes the amount of money in circulation.

The *funding* of government expenditure, where the term funding is used in the sense indicated above, comes from a combination of tax revenues and government borrowing. This can be written for the central government (that is excluding the central bank):

(1) $G = T + DB$

Government expenditure G is funded by tax revenues T and the net sale of government bonds (DB) (that is net after maturing bonds are 'rolled over'). The government expenditure will

have been initially financed by the use of central bank money paid into the private sector, and subsequent tax receipts and the sale of bonds by government withdraw some central bank money from circulation. Some of the government bonds will have been acquired by the central bank through forms of open market operations. Then

(2) $DCBM = DBb$

where *DCBM* is the net increase in central bank money (held as reserves by commercial banks) and *DBb* is the quantity of bonds purchased by the central bank.

The consolidated accounts of central government and central bank then reads:

(3) $G = T + DBh + DBb = T + DBh + DCBM$

where *DBh* is the net increase in bonds held by the public. At the consolidated level, government expenditure is funded by a combination of tax receipts, bonds and increase in central bank money held as reserves by commercial banks (where for convenience the notes and coins issued by the central bank and held by the public are ignored). Decisions have to be made on the split between *DBh* and *DCBM*, and those can be undertaken in a wide range of ways, and can reflect the extent to which government and central bank seek to monetise the deficit.

The budget deficit of government expenditure minus tax revenues is funded by borrowing from the public. There is a simple relationship between private savings and investment (here meaning gross fixed capital formation) and the budget deficit (here for simplicity, the case of a closed economy is assumed):

(4) $S - I = G - T$,

where *S* is private savings and *I* private investment. This relationship is a consistency requirement that net financial flows sum to zero: here reduced to flows between private and public sectors. In terms of outcomes, this provides a national income accounting identity. But the accounting identity does not mean that the savings, investment, government expenditure and tax revenues are those which were desired or planned for. The identity does not provide analysis of how the separate intentions regarding each of the variables are brought into a consistent relationship. A Keynesian approach would focus on variations in economic activity: for example, a higher intention to undertake investment which is financed would stimulate economic activity, which would tend to lead to higher intentions to save and higher yields for tax revenues.

In turn, this provides:

(5) $S - I = DBh + DCBM = DBh + DBD$

where *DBD* is the increase in bank deposits which correspond to the increase in bank reserves with the central bank, which are equal to *DCBM*.

Eqns. (4) and (5) applies to the total public expenditure, tax receipts and budget deficit. The question can be asked as to the implications of the introduction of UBI which involves a net increase in government expenditure (that is net of the expenditure on programmes which would be ended with the introduction of UBI, such as unemployment benefit). The amount of net private savings (private savings minus private investment) may appear to be a constraint on the size of the budget deficit. However, the volume of net private savings itself depends on the level of government expenditure. An increase in government expenditure (financed by the availability of central bank money) leads to a rise in income, and thereby in savings. It is useful to formulate the upper limit on private net savings, and thereby the upper limit on the budget deficit as $S^* - I^*$ where S^* and I^* are the intended savings and investment if the economy were operating at full capacity output Y^*. But if the economy is to operate at Y^* then the budget deficit would be equal to $S^* - I^*$ – in effect to enable the level of savings to be realised. It has also to be recognized that what is deemed capacity output is difficult to determine with precision, and this is particularly the case in a service-based economy.

The upper limit on the budget deficit can be indicated, namely maximum $(G - T) = S^* - I^*$. Suppose that prior to the introduction of UBI government budget deficit was $G0 - T0$, where *G0* includes welfare benefits. Then:

(7) $G0 - T0 = DB0 = DB0c + DBR0 = S0 - I0$

where *DB0* is net change in government bonds, *DB0c* net change in bonds, *DBR0* change in bank reserves, *S0* savings in period 0, *I0* investment in period 0.

With introduction of UBI,

(8) $G0 + UX - T1 = DB1c + DBR1 = S1 - I1$

where *UX* is the net financial cost of UBI (after allowance for the replacement of other benefits), *T1* tax revenue at the post UBI level of income, and *DB1c* and *DBR1* net change in government bonds and in bank reserves respectively in period 1.

The difference between eqns. (7) and (8) gives:

(9) $UX + T0 - T1 = (S1 - I1) - (S0 - I0)$

From this equation, it can be said that the maximum size *UX* could be is $(T^* - T0) + (S^* - I^*) - (S0 - I0)$, where T^* is the tax revenue from economy working at capacity output with

unchanged tax rates. In the case where the budget was set to achieve full employment in the initial period then the maximum size would be zero.

I draw three conclusions from eqns. (8) and (9). First, there is a clear limit on the scale of UBI which can be funded by borrowing (compared with the starting point) and there would in general be requirements for increased taxation. Second, since *S0* – *I0* fluctuates substantially over time, the scope for UBI to be covered by additional borrowing would also fluctuate. Third, the limit on the scale of UBI without increasing tax rates depends on the maximum difference between savings and investment, and that is not directly affected by the way in which additional borrowing would be funded. The additional deficit would be funded by some combination of increase in money and in government bonds. It is generally the case that the actual budget deficit is too small to secure a high level of employment in the sense that an expansion of the budget deficit would lead to higher levels of economic activity and to a higher level of savings which would form the basis of the funding a larger budget deficit. The degree to which the budget deficit can be regarded 'too small' (i.e. is not consistent with a low level of unemployment) varies over time and is dependent on private sector behaviour. For example, a higher propensity to or a lower propensity to invest save would lead to a rise in the appropriate scale of budget deficit which would secure low unemployment.

There are differing ideas on what should be the objectives of fiscal policy and of particular relevance here are different ideas adopted to the aim for the scale of the budget deficit (or surplus).

Three examples can be used to illustrate the general point. The first one would be seeking to set the budget deficit to achieve full employment, which would mean setting the budget deficit equivalent to *S** - *I**. A second would be setting a balanced budget, whether on an annual basis, over the course of the business cycle, on a structural budget basis and whether or not relating to current budget or total budget. A third would be a general recognition that budget deficit is set in response to the perceived needs of the economy, e.g. to reduce inflationary pressures, to address exchange rate issues. Insofar as a government has a target for the scale of the budget, and thereby government borrowing, the introduction of UBI would need to be accompanied by a corresponding rise in tax revenue. From that perspective it is reasonable to consider the introduction of UBI as a package of measures which increase both government expenditure and tax revenues to the same extent.

The extent to which a budget deficit is funded through an increase in central bank money in circulation (with the remained funded by sale of government bonds) is determined by a set of macroeconomic considerations. From that perspective, the introduction of UBI would not itself change those macroeconomic considerations. In summary, UBI, like any form of public expenditure, can always be financed ('paid for') through the use of central bank money, which itself can be created at close to zero resource cost. The introduction of UBI should be considered on a fiscally neutral basis, with the appropriate scale of budget deficit and the ways in which that deficit is funded set through macroeconomic considerations and the state of the economy.

3. Proposals for funding of UBI

A wide range of ways have been advanced for the funding of UBI, and here two aspects are considered. One is that the fiscal costs of UBI are largely or wholly met by increased taxation. The fiscal costs relate to the net costs of UBI—that is payment of UBI with allowance for welfare benefits replaced by UBI, and allowance for direct taxation of UBI. The other relates to the money funding of UBI, where a number of proposals have been made that in effect amount to the possible full funding of UBI through monetary means. The two subsections here considered some of the proposals which have been advanced under each of those headings.

Fully funded (almost)

In this sub-section, two proposals for the funding of UBI are taken as examples for discussion of the issues involved.

Rieedl (2020) draws up (for the USA) UBI program expenditures based on $12,190 per adult (2019 prices) and $4,420 per child, with total expenditures around $4 trillion (his Table 1). A list of revenue funding sources is given including a 20 per cent VAT, inheritance tax etc. which would provide funds also around $4 trillion. "Each funding source could be designated ("ear-marked") specifically toward a UBI payment" (p.7). A UBI Trust Fund is proposed "to ensure that the revenue generated would not be spent elsewhere". There is allowance for the Trust Fund to run temporary deficits and surpluses in the context of an overall balanced budget. This proposal comes close to a hypothecated set of taxes, which can run the danger of tying the level of UBI payments to the tax revenues from the specified taxes. In general, I would argue that proposals for additional taxes should be discussed on their own merits rather than

hypothecated for UBI. For example, proposals for a wealth tax should be considered on the merits of a wealth tax rather than associated with UBI.

Rieedl (2020) draws on Barnes (2013) to consider the use monetary finance as part of the funding of UBI. He argues that the current arrangement "allows banks to essentially add to the money supply by lending a multiple of their reserves" (p.23). This is a misrepresentation of the way in which banks can be said to create money in the form of bank deposits. Banks provide loans to their customers which thereby create bank deposits. "As an alternative, revenue could be generated by shifting money creation from banks to writing money directly to citizens as a dividend. An independent board (such as the fed) would manage the amount of new money creation to ensure stable prices" (p.23). As indicated above, central bank money is created as required to finance government expenditure including welfare payments and income transfers. Much of the money thereby put into the private sector returns in the form of tax receipts and sale of government bonds. The funding equation above indicates that the budget deficit would be funded by a combination of bonds and increase in central bank money in private hands (banks).

Reed et al (2023) examine (for the UK) three schemes, with two of the schemes each having two variants with small differences, and each of those variants simulated on a fiscally neutral basis and fiscally non-neutral basis. Scheme 1 single adult £63 per week (£3376 annual), tax free allowance reduced to £750 per annum, Universal Credit retained. income tax rates raised by 3 per cent. Overall tax increases by £160 billion.

Scheme 2: single adult £145 per week (£7540): basic income tax rate raised to 40 per cent, higher rates at 60 and 70 per cent. overall tax increases £319.6 billion

Scheme 3: single adult £225 (£11,700); families reach Minimum Income Standard; Income tax rates raised to 65 per cent, 85 per cent and 95 per cent. Overall tax increases by £510.4 billion.

Variants of schemes 2 and 3 are presented. One set of variants retains fiscal neutrality with the scale of increase in tax revenues indicated above (and which can be compared with GDP in 2022 of around £2,500 billion). There are relatively high rates of income tax (or equivalent) which would result under scheme 3 with achievement of minimum income standard.

In the non-fiscally neutral version of the schemes has budgetary deficits ranging from £74.8 billion (around 3 per cent of GDP) through to £284.3 billion (over 11 per cent of GDP).

The departure from fiscal neutrality would be problematic on two grounds. First, it would seem likely that budget deficits of the order envisaged would not in general fit with the limits

on the overall scale of budget deficits as discussed above. An additional deficit of around 3 per cent of GDP (as in scheme 2 on fiscally non-neutral basis above) would require that there was 'space' for such an increase. A further complication is that the 'space' for additional budget deficit varies over time, and even if on average there was such 'space' there would be occasions when there was not such 'space'. Second, a primary deficit (that is government expenditure excluding interest payments minus tax revenue) of *x* per cent of GDP leads to rising debt to GDP ratios and rising interest payments on the accumulating debt, and the debt to GDP ratio converges on $x/(g - r)$ where *g* is the growth rate and *r* the interest rate on government debt (either both in real terms or both in nominal terms) which requires growth rate greater than interest rate, otherwise there would be no convergence and the debt ratio would rise indefinitely.

Money financed

In this sub-section I consider two sets of proposals which involve a UBI being largely or wholly funded through money creation.

The first to be examined is the use of Quantitative Easing as funding UBI. Over the past decade or so (and particularly in the aftermath of the global financial crises and associated recession, and then during the pandemic of 2020), many central banks have undertaken Quantitative Easing (QE). The Bank of England describes QE in the following terms. It "involves us [central bank] creating digital money. We then use it to buy things like government debt in the form of bonds. … The aim of QE is simple: by creating this 'new' money, we aim to boost spending and investment in the economy."[1] Questions can be raised as to how successful QE has been in that respect, but that is not central here. As QE provides money to the private sector (in exchange for financial assets), the question has been posed as to the issue of money by the central bank can be used in a more direct way. Coppola (2019) lists many proposals which have been put forward, using the general term 'QE for people' which she groups into "those that involve giving money directly to people to boost spending in the short term [and] those that involve longer-term investment to achieve some sort of rebalancing of the economy" (p.58) with seven listed in each group (see Box 3.1 on p.67). Amongst those proposals are those who put forward UBI as being financed through QE. A number of advocates of UBI have

[1] www.bankofengland.co.uk/monetary-policy/quantitative-easing (accessed December 2020).

indeed done that. For example, “the idea basically consists in redirecting the ongoing money creation of the ECB [European Central Bank] towards the real economy, for instance as a citizens’ dividend.”[2].

The key feature of QE is that the central bank purchases financial assets from the private sector to reach a target level of holdings of those financial assets. QE is a balance sheet rearrangement from which some changes to asset prices, interest rates and spending may follow. The central bank now owns more interest-bearing assets than before but has issued central bank money on which interest is often paid. The banks hold reserves with the central bank, and as their reserve ratio is now much higher (and the commercial banks are in effect not able to reverse the change). The central bank has enabled central bank money to enter into the private economy.

There are some aspects of QE which are particularly relevant in consideration of UBI and which in my view make QE unsuitable for sustained operation of QE.

First, QE involves asset purchase by central bank usually but not necessarily of government bonds and the issue of central bank money. The purchase of financial assets can be from commercial banks and from the public. There are a set of balance sheet operations involved which can be summarised as follows:

	Decrease in wealth	Increase in wealth
Central Bank	Issue of central bank money	Acquisition of financial assets
Commercial Banks	Bank deposits held by public Financial assets sold	Reserves held with central bank
Public	Financial assets sold	Bank deposits acquired

Source: own construction

This operation changes the structure of financial assets held by the private sector, and the hope was that by doing so the private sector, and particularly the banks, became more liquid and more likely to provide loans: hopes which do not appear to have much impact. QE also in effect changes the composition of public sector debt. The debt of the central government is the bonds which it has sold and on which it is paying interest. The consolidated debt of government including the central bank (assumed to be public owned) is government bonds

[2] For example, https://basicincome.org/topic/quantitative-easing/

held by the private sector plus central bank money (notes and coins, bank reserves held with the central bank). Under current arrangements interest is paid by central bank on banks' reserves (at the 'bank rate').

Sovereign Money

It has been argued that "sovereign money makes a meaningful level of UBI affordable" (Crocker, 2020b, p. 244), where sovereign money is perceived as 'debt free' money issued by central bank. "Since sovereign money is not interest bearing, it removes the inequality in the seigniorage of money creation by the sale of government bonds …. There is no reason why this funding cannot be by debt-free sovereign money" (Crocker, 2020b, p.242). It should here first be noted here that in many countries the money issued by the central bank which is held as reserves by commercial banks is paid interest by the central bank (at the 'bank rate').

It is argued that "financial orthodoxy insists that deficit government expenditure and money issue must be balanced by new government debt." (p. 243). It is not financial orthodoxy but simple accounting practice to write, in effect, expenditure - income = borrowing. "This debt accumulates to a level above annual GDP, and so also becomes unrepayable" (Crocker, 2020b, p. 242). The UK debt to annual GDP is around 100 per cent, but in the post-war period had fallen from over 250 per cent to under 30 per cent before rising again during the 2010s to reach around 100 per cent. Although the absolute level of debt rarely fell (in vast majority of years government budget in deficit), the ratio clearly did. The issue of whether the government debt is repayable would depend on the ability of the government to run a budget surplus, although running a budget surplus is relatively rare, and often inadvisable.

It is argued that "debt-free sovereign money funds basic income, removes the deficit constraint on public expenditure, and reverses austerity policies " (Crocker, 2020a, p.1). The deficit constraint on public expenditure comes from the relationship between tax revenues, private savings and private investment (in a closed economy) as explained above.

Further, it is argued that "sovereign money advocates, who propose shifting *all* money creation from commercial banks to state central bank, to avoid excessive lending creating economic crisis, and to return seigniorage to the state" (Crocker, 2020b, p. 243). Sovereign money is very similar to other proposals such as full reserve banking, which has beencritiqued in, for example, Fontana and Sawyer (2016).

The argument is summarised in a diagram which is described in terms of "the dashed lines show how direct sovereign money can be created by the central bank crediting consumers'

accounts, and central and local government expenditure accounts, without creating any matching debt, and therefore without incurring interest cost." This indicates that sovereign money is used to finance some (perhaps all) of government expenditure. This suggests that $G - T = DSM$ (or perhaps $G - T = DSM + DB$), where *DSM* is rise in sovereign money and *DB* rise in government bonds. This is constrained by $G - T = DSM = S - I$, and by $G - T <= S^* - I$. Alternatively $G0 - T0 = DB0$ is the pre-UBI position, and $G0 + UBI - T1 = DB0 + DSM$, where *UX* is net cost of UBI (after replacement), *T1* tax revenue at higher level of income. Then $UX - (T1 - T0) = DSM$. At maximum $DB0 + DSM = S^* - I$, and $DB0 = S0 - I$, hence $DSM = S^* - S0$, and $UX = DSM + (T1 - T0) = S^* - S0 + T1 - T0$. This is the upper limit on UBI if funded through sovereign money.

In the short term, this is little different from use of say bond funding. There would be differences in so far as bonds are interest bearing and sovereign money non-interest bearing. There are two sides to this. On the one side, under sovereign money there would not be future interest payments to be made, whereas under bond funding there would be rising interest payments as the outstanding national debt rose. On the other side, the public are holding money (sovereign money) as part of their wealth, and have made part of their savings in each period in the form of increased holding of sovereign money.

It has been argued above there is an upper limit on the scale of a budget deficit (in effect that the budget deficit cannot be pushed past full employment level). Within that, the present practice is to use a combination of money and bond funding, with the mix determined by private sector's willingness to hold bonds and money (recalling that net private savings = budget deficit) in their asset portfolio. If the budget deficit is entirely money funded, will the private sector be willing to hold more money than previously. Note that money is an asset (as far as the private sector is concerned) which depreciates in value as inflation continues and in the sovereign money proposal with no payment of interest[3].

4. Paid employment and market output

A UBI paid at a level which could be said to provide a minimum decent income would go towards reducing the strength of the links between income and employment, and enable some to detach themselves from paid employment if they so wished. Some advocates of UBI

[3] Note that commercial banks reserves with the central bank are often paid interest (at the 'bank rate').

argue that it enables individuals the possibilities of working less (whether on a weekly, annual or lifetime basis), and to become more selective in the jobs they accept. A reduction in paid employment would likely lead to a reduction in marketed output, which some would welcome in so far as it reduces environmental pressures, and enables more time in unpaid activities. It could be expected to have impacts on the workings of the labour market particularly with regard to relatively low paid workers.

The general argument is made of the liberating effects of UBI and the loosening of links of work and income and enabling a wide range of leisure activities, voluntary and communal work etc. (Schachtschneider, 2017).

It can be readily acknowledged that the unconditional payment of a basic income at a level which would provide a reasonable standard of living would have significant beneficial effects on the operations of the labour market, the level of earnings and the nature of work. It is, however, not my purpose here to examine such changes, but rather to ask a simple question: would there be sufficient people undertaking paid employment to produce the goods and services which those on the UBI (and no other income) would seek to purchase?

In the macroeconomic analysis below, the effects of the level of basic income on labour market participation (in the paid work force) are included, and consequent effects on income and production. The decline in income and output is a possible outcome from a UBI, and this would be welcomed by many on ecological grounds. This would be a decline in marketed output, though it could well be replaced by other economic effects which do not appear in the GDP measure of output – ranging from undertaking social care to food preparation.

There is little guidance from the so-called experiments on UBI on the size of the impact of UBI on labour force participation. The experiments have been far from universal in their coverage, and have been operated for one or two years which do not allow for full adjustment to, for example, age on entering or leaving the work force. In the modelling below the possible effects of a UBI on labour force participation is represented in a simple equation which is used is a linear one: $e = e_0 + e_1 ubi$ where e is the proportion of the population who are in the active paid labour force, *ubi* is the ratio of the Universal Basic Income to GDP per capita (or employed).. The cases examined below use values of e_1 of -0.1 and -0.3, hence a rise in UBI of 0.01 (which at the value of UBI taken as 0.20 would be a rise of 5 per cent) would involve a reduction in labour force participation of 0.001 and 0.003 respectively which would represent for a labour force participation rate of 0.7 represents a reduction of 1/7th and 3/7ths per cent.

Moving from a level of say 0.1 (taken to be a representation of the pre-UBI transfers) to a UBI of o 0.3 would then lead to reduction of labour force participation of 0.02 i.e. by around 3 per cent (on initial level of 0.7), and 0.06, i.e. around 9 per cent respectively. A 3 per cent reduction would be the equivalent of someone working 1.5 years less in a career of 50 years. The numbers used here are for purposes of illustration for, as argued above, there is little guidance on the effects with a UBI could have on labour force participation.

5. Macroeconomic limitations

In this section a simple macroeconomic model is set out and used to explore two issues. The first is the relationship between the rate of taxation (tax revenue expressed as a percent of national income), the level of universal basic income and the budget deficit. Representing tax revenue as percent of national income should not be taken to imply that income tax is the only tax being used, and tax revenues here include all forms of taxation. A UBI would replace a set of means-tested benefits, and as such would involve the appearance of a higher rate of tax. Under means-tested benefits, the level of benefits which an individual would receive would decline as any other income received increased, and this rate of withdrawal of benefits is often high (of the order of 60 per cent plus and case of over 100 per cent are not unknown). Although the withdrawal rate could be seen in terms of tax, it is not reported as such. Under UBI, there is in effect withdrawal through the income tax system, and as the payment of UBI would involve larger government expenditure, the income tax rate may be higher as well as other forms of taxation.

The second issue relates to the possible effects of UBI on labour force participation, employment rate and national income. In the simple model, the labour force participation rate is influenced by the level of the universal basic income (as suggested above), which interacting with the employment rate would settle the level of national income.

The macroeconomic model is post Keynesian in nature, that is to say the levels of economic activity and employment are determined by the level of aggregate demand. On the supply side, the labour force L is treated as $e.P$ where e is the labour force participation rate and P the adult population. The labour force and paid employment are measured in terms of person hours (on say an annual basis). The size of the labour force would then depend on annual hours of work, care time, and sabbatical leave. The total population would then similarly be measured on a person hours basis. The participation rate would be age-dependent, and the age structure is taken as given. Thus e is a weighted average across age groups. The decision

to seek paid employment is dependent on numerous social factors, but those decisions are treated as given except in so far as the decision is influenced by the level of UBI and tax rates (it being assumed that the overall tax rate will be higher with UBI). The level of UBI is labelled α, and the participation rate is taken as negatively related with the level of UBI.

Employment N is related in a simple way with the level of output $Y = \beta N$. The level of output and thereby level of employment is treated as demand determined. The employment rate $r = N/e.P$. The pre-tax income of a person in paid employment is based on the universal basic income, wages and profits received and disposable income the post-tax income. Consumer expenditure for an individual is a linear function of disposable income. Consumer expenditure is derived from aggregating over individuals. Aggregate demand sets the level of output and is based on consumer demand, investment and government expenditure on goods and services. Taxes are expressed relative to wages and profits (and for simplicity the same rate is applied to both), though the taxes deployed would range from income and wealth taxes, VAT through to excise duties. The equations for the model used are listed in the appendix.

Two variants of the model are explored, depending on whether the UBI is scaled on the level of national income per person, recalling that the introduction of UBI may lower the proportion of the population in employment or is scaled on level of national income per person employed (a measure of productivity and thereby wages). Government expenditure on goods and services is treated as proportionate to the population, and investment as proportional to level of income. By way of comparison, the three UBI levels used by Reid et al (2023) reported above amount to £3376, £7540, £11700, respectively which represent around 6 2/3 per cent. 15 ¼ per cent and 23 per cent per cent of GDP per adult respectively and 4 1/2 , 10 and 15 per cent of GDP per person employed.

The model deployed is an extremely simple one. The parameter values are in general of the same order of magnitude as observed in reality with the exception of the parameters of the participation equation where there is a lack of information. The analysis seeks to raise some questions on the macro limitations on UBI in terms of tax rates and effects on labour force participation and level of income.

Two forms of fiscal policy (and hence size of budget deficit) are used in the simulations. The first is one in which the aim is for full employment through the setting of the budget deficit. The second is one in which fiscal policy aims for a balanced budget.

Full employment fiscal policy with UBI linked with per adult income

The first set of simulations impose a full employment outcome achieved through setting fiscal policy in terms of the rate of tax for specified government expenditure and level of UBI. The budget deficit which is thereby set is the highest which does not result in 'over heating' of the economy – that is pushing the economy beyond full employment. This can alternatively be expressed that since budget deficit is equal to private savings minus private investment the budget deficit is at the highest level which can be funded by private net savings. The precise size of the budget deficit depends on private sector behaviour specifically in the form of propensities to save and to invest, and specifically the budget deficit required to secure full employment will be lower as propensity to investment is higher or the propensity to save is lower. Government expenditure is set at 0.15, that is government expenditure per adult is 15 per cent of national income per adult and a value for the investment ratio is set at 0.125 (i.e. 12.5 per cent of national income).

Figure 1 near here

In the first exercise, the level of UBI is related with the per capita national income. The effects of increasing UBI on tax rate, employment rate (as proportion of population), budget deficit and tax rate are represented in Figure 1. The parameter values used are indicated under the figure.

Raising the level of UBI (in the figure calculations were made for 0.01 increments), leads to tax rate rising and at a somewhat faster pace than the level of UBI, the participation rate and the employment rate both decline (and with the full employment requirement those rates are equal here), and the budget deficit required to secure full employment declines. This latter result reflects that a higher UBI stimulates demand while a higher tax rate depresses demand, but the former effect is larger than the latter effect.

In the simulations here, for e_1=-0.1, as the UBI ratio moves from 0.1 to 0.3, the tax rate moves from 0.274 to 0.514; and the corresponding figures for e_1=-0.3 are 0.296 and 0.565 respectively. There is potentially a reduction in the participation in the labour market rate, and thereby (with the full employment assumption made for the simulations) in the overall level of output. With the participation rate parameter at -0.1, for the UBI ratio moving from 0.1 to 0.3, the participation rate falls from 0.69 to 0.67, which would imply a decline in near 3 per cent. With the participation rate parameter at -0.3, the participation rate moves from 0.67 (at ratio of 0.1) to 0.61 (at ratio of 0.4), implying a decline of over 9 per cent in the participation rate. In this simulation full employment is imposed, and the decline in the

participation rate translates into declines of employment and national income of the same magnitude (in percentage terms).

Figure 1 near here

These (and the other simulations to follow) may enable some discussion from a macroeconomic perspective on the limits on the scale of UBI. The precise results depend, of course, on the model which has been used and the parameter values.

If the question is asked on the limits on the scale of UBI from the perspective of the tax rate, then in the case of Figure 1 a tax rate of 50 per cent (0.5) would occur at UBI of 0.29 (when e1=-0.1), 0.26 (when e1=-0.3), and not shown in Figure 1 60 per cent at UBI of 0.39 and 0.34 respectively, and 70 per cent at 0.48 and 0.42 respectively. These calculations are for government expenditure equal to 0.15. If, for example, it was thought that a tax rate above 60 per cent would be politically unacceptable, the level of UBI would be limited to 39 per cent/34 per cent of national income per capita income. With the full employment assumption here, national income declines proportionately with the participation rate. And the decline in national income as UBI increases can be read off from Figure 1.

The third segment of Figure 1 raises $e1$ to -0.5 and the corresponding impacts can be read from the graph.

Full employment fiscal policy with UBI linked with productivity

The second set of simulations are similar other than that UBI is treated proportional to labour productivity. This has the effect that as UBI rises, participation rate in labour force and national income decline, and hence UBI rises faster relative to national income. The results are reported in Figure 2 (with all other parameter values remaining the same as in the first set of simulations). In considering this Figure, it should be borne in mind that UBI is linked with output per person employed rather than output per person, and that as UBI rises, output (and hence output per person) declines.

Figure 2 near here

In these two sets of simulations, the assumption has been made here that fiscal policy is used to achieve full employment, and the budget deficit set accordingly. It is the setting of the budget deficit in this manner which achieves full employment, and in that way the achievement of full employment does not rely on universal basic income. The constraints on the achievement of full employment, including sufficient productive capacity to underpin full employment and overcoming social and political obstacles to full employment, would remain

unchanged. The scale of the budget deficit required to achieve full employment under UBI could be smaller in so far as UBI redistributes income in the direction of high propensity to consume, low propensity to save households.

Figure 2 relates to case where the basic income is linked with GDP per person employed (and hence linking with average earnings in so far as earning are linked with productivity). As the basic income is raised, the tax rate rises and at a faster rate than basic income. As UBI rises, labour force participation and national income decline, and here UBI is linked with GDP per person employed and becomes a larger proportion of GDP as GDP declines. The participation rate declines, and in this case with a full employment assumption, output declines in line with the participation rate. The budget deficit declines somewhat—this is a reflection that the tax rate increases faster than basic income.

Figure 2 near here

In the first half of Figure 2 with the response of participation rate to UBI set at -0.1, a UBI of 0.1 leads to tax rate of 0.33, and with a UBI of 0.3 the tax rate rises to 0.674. From second half of Figure 2, the response of participation rate to UBI is raised to -0.3, a UBI of 0.1 involves tax rate of 0.346, and of 0.3 tax rate of 0.757.

A UBI would generate a shift in the distribution of income towards lower income groups, and that could be anticipated to raise the propensity to consume. In this specific model, it can be judged (from eqns. 10 and 12) that the budget deficit would be smaller and the tax rate higher when allowance is made for a rise in the average propensity to consume following introduction of UBI (for a full employment scenario).

Balanced budget with UBI linked with per capita income

The final set of simulations is based on a balanced budget. With the parameter values used in our simulations, the achievement of full employment requires a budget deficit as private savings forthcoming at full employment is larger than private investment. With a balanced budget imposed, the level of economic activity is set by the equality between (ex ante) private savings and private investment. As such the level of economic activity would be unaffected by changes in UBI, government expenditure or tax rate unless such a change shifted the propensity to save or the propensity to invest. In the simple formulation here, as UBI changes so does the tax rate and does so in a way which leaves the propensities to save and to invest unchanged, yielding a constant level of economic activity. With the coefficients used in the simulations, the level of economic activity under a balanced budget is 10.7per cent below the

maximum (where participation rate is unaffected by UBI and at 70 percent). As the rate of UBI is raised, the participation declines and correspondingly the rate of employment rises, and rate of unemployment declines.

Figure 3 summarises the results. When e_1=-0.1, then full employment (rate =1.0) would be reached with UBI=0.75 (not shown in figure), and at the cost (or perhaps benefit) of the participation rate of 0.625 (as compared with a rate of 0.70 when UBI is zero). The tax rate runs in parallel with increases in UBI to maintain the balanced budget. When e_1=-0.3, then full employment (rate =1.0) would be reached with UBI=0.25, and at the cost (or perhaps benefit) of the participation rate of 0.625 (as compared with a rate of 0.70 when UBI is zero).

Figure 3 near here

When the economy is operating below capacity, then any additional programme including UBI can to some degree be funded by operating a larger budget deficit and consequent borrowing. This requires a change in fiscal policy from one which permits below capacity operations to one which seeks to achieve full employment/capacity. This can be illustrated by the following simulation. Consider an economy without UBI (but with some welfare benefits) operating subject to a balanced budget requirement, which has as a consequent unemployment and under-utilisation of capacity. The balanced budget requirement leads to a given tax rate in light of the levels of government expenditure and transfer payments. A UBI is now introduced while the previous levels of government expenditure and tax rates are maintained. Figure 4 illustrates that from the starting point (with balanced budget) at point A, increases in UBI leads to rising employment levels until full employment is reached. The difference between UBI at point Y and benefits at X is the extent to which UBI can be funded through borrowing. The budget deficit rises over the range X Y. This illustrates two points. First, the degree to which UBI can draw upon budget deficit and borrowing depends on the scale of UBI and the degree to which the economy is operating below full capacity. Second, a change in fiscal rules would be required – in this example from balanced budget to using fiscal policy to achieve full capacity utilisation.

Figure 4 near here

In Figure 4 there is a comparison between two regimes, one with a balanced budget and the other with fiscal policy targeting full employment. Over the range considered, employment rate under the full employment fiscal policy (r=1) would be above the rate with a balanced budget. The tax rate with a balanced budget would be higher than tax rate with full

employment. If a balanced budget rule had been in operation and a UBI introduced there would be some space for the UBI to be partially funded by a budget deficit. To illustrate take the case where a pre-UBI situation could be approximated by ubi=0.1, and the UBI was introduced for ubi=0.2. Moving from a balanced budget to fiscal policy which secured full employment, then the introduction of UBI here would involve tax rate moving from 0.388 to 0.429, and budget deficit from zero to 0.0129.

6. Concluding comments

The introduction of a UBI would involve an increase in government expenditure, even at relatively low levels of UBI – as illustrated by the estimates of Reid et al (2023) cited above. The issues involved in the funding of the increased government expenditure remain very similar whatever the levels of the basic income, though with more intensity as the basic income is higher. A UBI, as with all forms of government expenditure, is paid for through the use of central bank money. The question on which I have focused is what combination of increased taxation, borrowing through bonds and monetisation of deficit could be used to fund a basic income. I have argued that the scope for funding UBI through additional borrowing is circumscribed – I have pointed to the upper limit on the size of budget deficits limiting the degree to which a UBI can be funded by borrowing. It is also pointed out that covering the additional costs of UBI through borrowing would lead to high and rising debt to GDP ratio which could well be unsustainable. There have been a range of suggestions for in effect monetising the additional budget deficit resulting from the introduction of UBI. I have argued that these suggestions do not overcome the limits on the scale of budget deficits. In general, higher tax rates and/or additional forms of taxation would be required to fund a UBI. The funding of UBI should be approached on a neutral fiscal cost basis – that is expenditure on UBI offset by increase in tax revenue—leaving the budget deficit broadly unchanged. The simple macroeconomic modelling which has been undertaken suggests that UBI could have impacts on overall levels of income and paid employment, though there is little empirical guidance to the magnitudes which could be involved. The lower levels of income and employment should be considered against what are viewed as the liberating effects of UBI, and whether that would be a 'price worth paying' (and indeed many may welcome the lower levels of output and the reduced workforce participation).

Unemployment of labour can be viewed as arising from a lack of aggregate demand leading to a shortfall of demand for labour, or a lack of productive capacity in terms of quantity and

location on which labour can be employed. An inflation barrier such that low unemployment would lead to rising inflation could be seen as arising from a lack of productive capacity and that aggregate demand has to be constrained. The introduction of UBI would make very little difference to the level of employment in so far as it is constrained by lack of demand and/or lack of productive capacity. Unemployment which arises from a lack of aggregate demand could be addressed through fiscal policy whether or not UBI is in place, and the introduction of UBI does not in itself lead to an expansionary fiscal policy. When there is a perceived 'lack of jobs' (which could arise from insufficient aggregate demand and/or lack of productive capacity), I would argue that while the introduction of UBI would have little effect on the level of employment it could well lead to lower unemployment insofar as it leads to some withdrawal from the paid workforce. Unemployment is the difference between the potential workforce and paid employment, and unemployment would fall in so far as there is a fall in the potential workforce.

The modelling approach in this paper can illustrate the scale of higher taxes and possible reductions in output and labour force participation. There have to be questions on whether such higher taxes and lower output would be politically acceptable. But they would also have to be set against with the gains coming from substantial reductions in income inequality and for increased non-market economic and social activities.

Appendix

This sets out the equations which lie behind the simulations reported in the text.

The adult population (that is those who can legally undertake paid work) is labelled *P*, and the labour force *L* is *e.P* where *e* is the labour force participation rate. The labour force and paid employment are measured in terms of person hours (on say an annual basis).

The level of UBI for the adult population is labelled α and to allow for possible effects of UBI on labour force participation $e = e(\alpha)$ with the partial derivative of *e* being negative (or zero). Employment is labelled *N* and output is directly related with employment $Y = \beta N$; the employment rate is $r = N/e.P$. UBI for children (child benefits) is related to adult rate as $\lambda.\ \alpha$. The ratio of children to adults is labelled μ, and the total UBI for children is then $\lambda.\ \alpha\ .\ \mu.\ P.$

The pre-tax income of a person in paid employment is $y_i = \alpha + w_i + \pi_i$ where w_i is the wage of the *i*th paid employee and π_i the profits received, and disposable income is $\alpha + (1 - t_w)w_i + (1 - t_\pi)\ \pi_i$ where t_w, t_π are tax rates on wages and profits respectively. Consumer expenditure for an individual is a linear function of disposable income, $c_0 + c_1.yd$. It is here assumed that all child benefits are spent. Aggregating over all individuals, consumer expenditure in total is given by:

(1) $C = Nc_0 + c_1(N\alpha + (1 - t_w)\sum w_i + (1 - t_\pi)\sum \pi_i) + (P - N)c_0 + c_1((P - N)\alpha + (1 - t_\pi)\sum \pi_j + \ \alpha\ .\lambda.\ \mu.\ P$

Writing $\sum w_i = w.N$ where w is average wage, $\sum \pi_i + \sum \pi_j$ as π (total profits), and treating the distribution of income between wages and profits as $\pi = mY$, $W = (1 - m).Y$ leads to

(2) $C = P(c_0 + c_1\alpha + \alpha\ .\lambda.\mu.) + c_1(1 - t_w)(1 - m).Y + c_1(1 - t_\pi)m.Y$

Aggregate demand sets the level of output, which leads to employment as follows:

(3) $P(c_0 + c_1\alpha + \alpha\ .\lambda.\mu.) + c_1(1 - t_w)(1 - m).Y + c_1(1 - t_\pi)m.Y + G + I = Y = \beta N$

Where *G* is government expenditure on goods and services and to be treated as one of the policy variables, and *I* is investment treated as exogenous.

UBI scaled on level of national income per person employed

The level of the UBI α is scaled against the level of national income per person employed = $\Upsilon.\ \beta$. Government expenditure on goods and services on a per capita basis is labelled *g*, hence government expenditure in total is $g.\beta.P$. Investment is treated as proportional to level of income $I = iY$.

(4) $P(c_0 + c_1\beta\gamma + \beta\gamma.\lambda.\mu.) + c_1(1-t_w)(1-m).\beta N + c_1(1-t_\pi)m.\beta N + g\beta P + i\beta N = \beta N$

Dividing through by *P* and β yields:

(5) $\frac{(c_0}{\beta} + c_1\gamma + \gamma.\lambda.\mu) + c_1(1-t_w).(1-m).r.e + c_1(1-t_\pi).m.r.e + g + i.r.e = r.e$

The budget deficit is t:

(6) $bd = g + \gamma(1+\lambda.\mu) - (t_w).(1-m).r.e - t_\pi.m.r.e$

Simplify with tax rates on wages and profits the same:

(7) $(c_0' + c_1\gamma + \gamma.\lambda.\mu) + c_1(1-t).r.e + g + i.r.e = r.e$

where $c_0' = c_0/\beta$

(8) $bd = g + \gamma\,(1+\lambda.\mu) - t.e.r$

At full employment (that is r =1) and indicating dependence of participation rare *e* on UBI level:

(9) $(c_0' + c_1\gamma + \gamma.\lambda.\mu)) + c_1(1-t).e(\gamma) + g + i.e(\gamma) = e(\gamma)$

This gives the relationship between tax rate and UBI rate:

(10) $(c_0' + c_1\gamma + \gamma.\lambda.\mu)) + c_1.e(\gamma) + g + i.e(\gamma) = t.c_1e(\gamma)$

The budget deficit at full employment is:

(11) $bd* = g + \gamma\,(1+\lambda.\mu) - t.e(\gamma)$

(12) $bd* = g + \gamma\,(1+\lambda.\mu) - [(c_0' + c_1\gamma + \gamma.\lambda.\mu)) + c_1.e(\gamma) + g + i.e(\gamma)]/c_1$

The derivative of *bd* with respect to γ is negative in the range of values of the parameters which is considered.

UBI scaled on income per adult

The level of UBI is treated as related with the per capita GDP (instead of with output per employed person). Equation (3) is replaced by:

(13) $P(c_0 + c_1\beta.\left(\frac{N}{P}\right)\gamma + \beta.\gamma.\lambda.\mu) + c_1(1-t_w)(1-m).\beta N + c_1(1-t_\pi)m.\beta N + g\beta P + i\beta N = \beta N$

Dividing through by *P* and β)

(14) $\frac{(c_0}{\beta} + c_1e.r.\gamma + \gamma.\lambda.\mu) + c_1(1-t_w)(1-m).e.r + c_1(1-t_\pi)m.e.r + g + ie.r = e.r$

Moving to uniform tax rate on wages and profits:

(15) $$(c_0' + c_1 e.r.\gamma + \gamma.\lambda.\mu) + c_1(1-t).e.r + g + i.e.r = e.r$$

Where $c_o' = c_o/\beta$

Putting *r*=1 in this equation would provide equation relating to full employment:

(16)

$$(c_0' + c_1 e.\gamma + \gamma.\lambda.\mu) + c_1.e + g + i.e - e = c_1.t.e$$

(17)

$$bd *= g + \gamma.e(\gamma)\,(1 + \lambda.\mu) - [(c_0' + c_1\gamma.e(\gamma) + \gamma.\lambda.\mu)) + c_1.e(\gamma) + g + i.e(\gamma)]/c_1$$

The derivative of the budget deficit with respect to ubi is negative.

Balanced budget

The analysis is now conducted for a balanced budget. The level of UBI is treated as related with the per capita GDP, and eqn. (14) is the relevant one.

The budget deficit is given by $\beta\gamma.N + \beta.\gamma.\lambda.\mu.N + g\beta P - t\,\beta N$ so that a balanced budget would correspond to:

(18) $$\gamma.N + \gamma.\lambda.\mu.N + gP = t\,N$$

Divide through by *P* to give

(19) $$\gamma.e.r + \gamma.\lambda.\mu.e.r + g = t\,.e.r$$

Combining eqns. (17) and (19) gives:

(20) $$c_0' + \frac{g}{t-\gamma}(c_1\gamma + c_1(1-t) + i - 1 + \gamma.\lambda.\mu) + g = 0$$

This equation is solved for the tax rate t for a specified level of UBI and government expenditure on goods and services *g*. From this the employment rate *e* can be calculated, and from equation above for *e.r*, *r* can be calculated.

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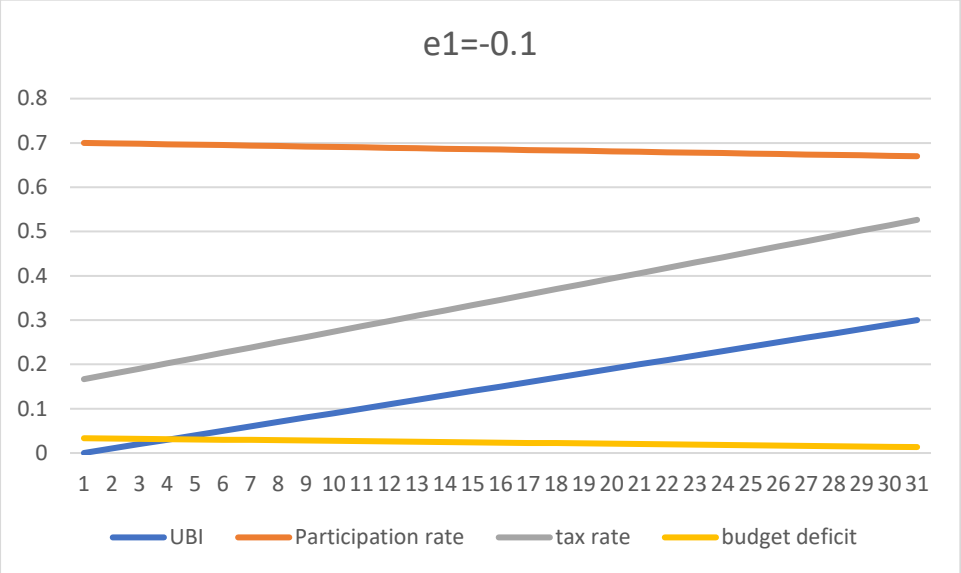
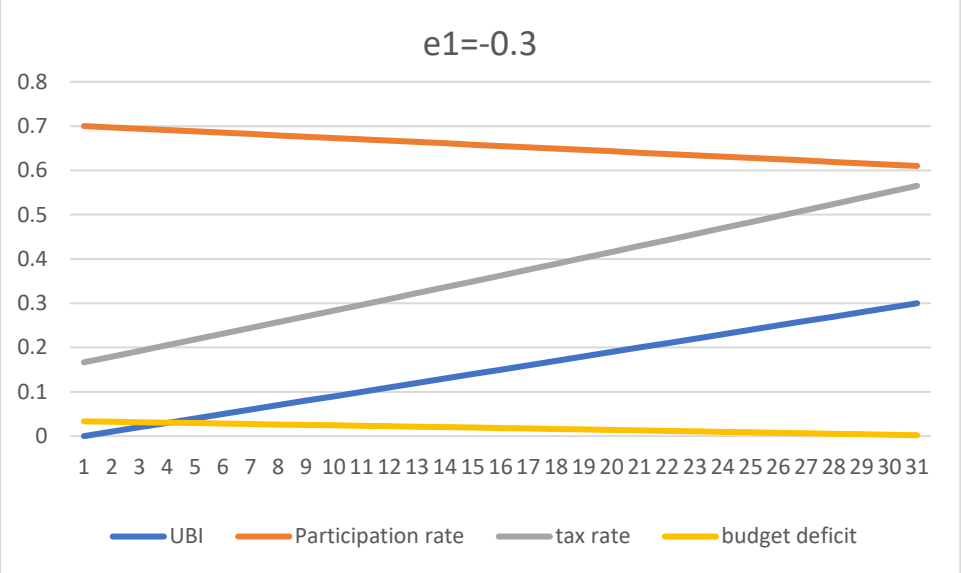
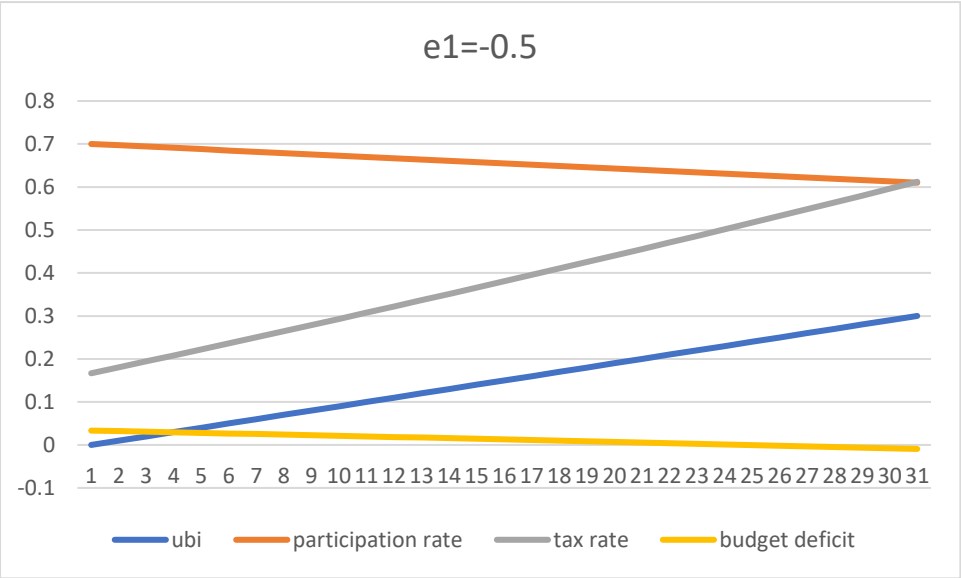
Figure 1: UBI set relative to GDP per person



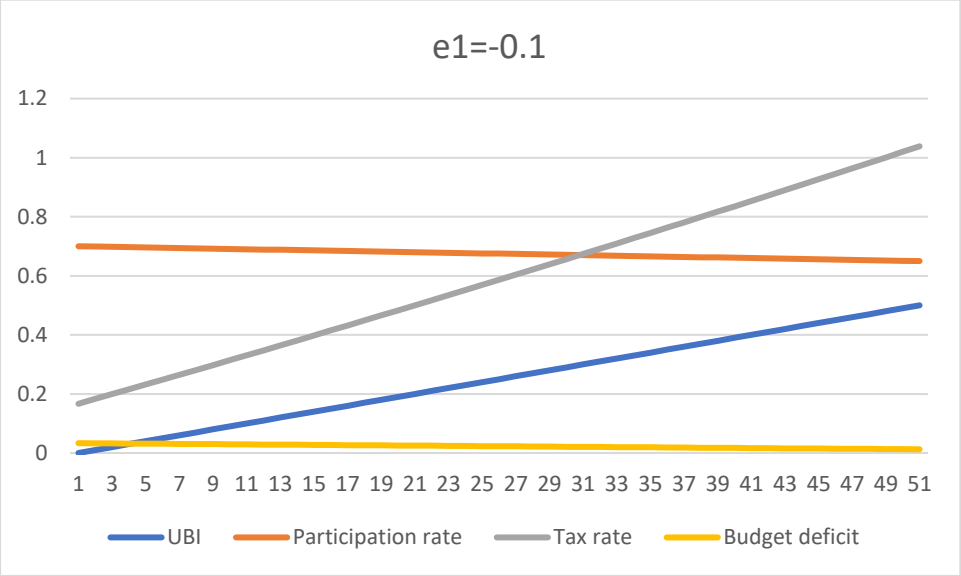


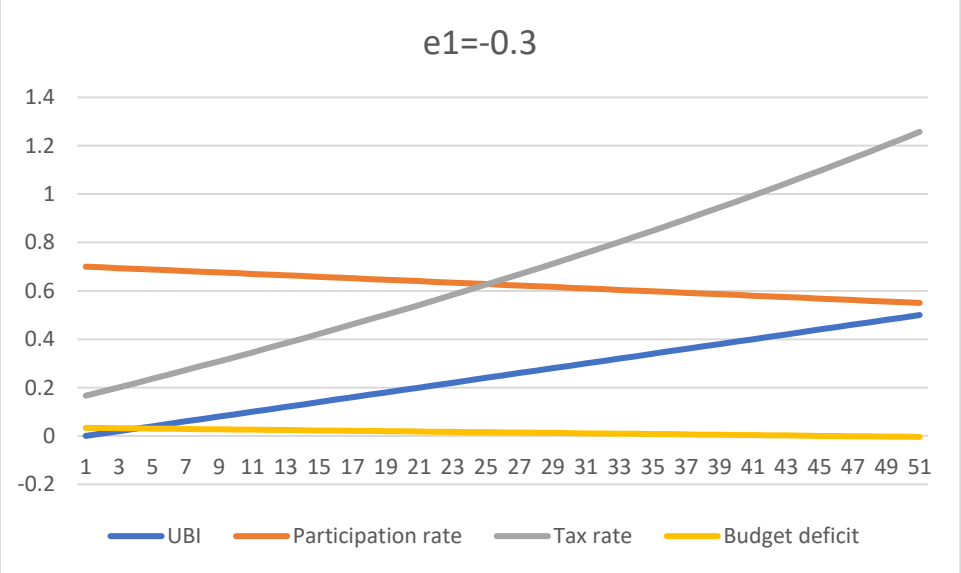


Constant in consumption function	Propensity to consume	Constant in participation equation	Response coefficient of participation to UBI	Government expenditure as proportion of productivity	Investment as proportion of income
c0	c1	e0	e1	g	i
0.025	0.75	0.7	-0.1 to -0.5	0.15	0.125

Source: own construction

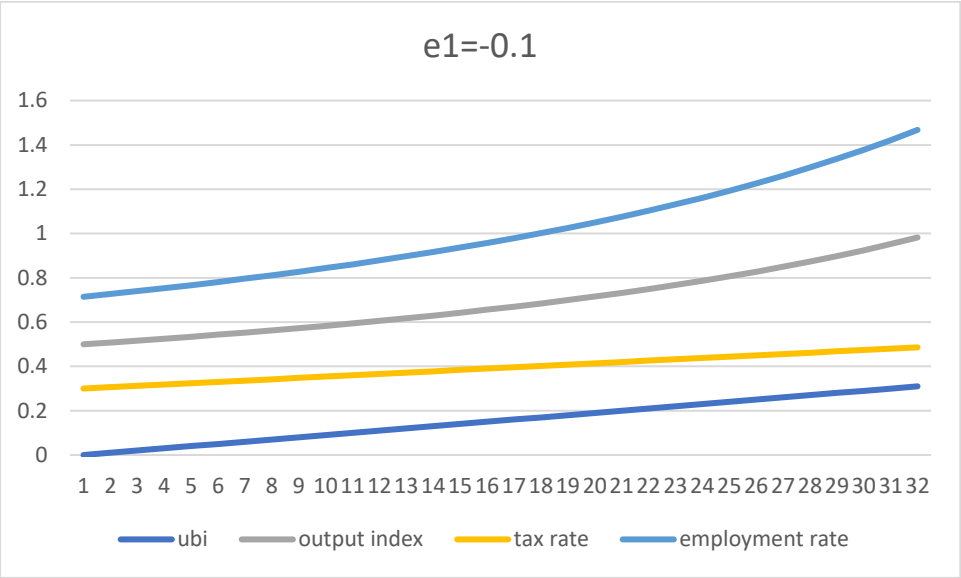
Figure 2: UBI set relative to GDP per person employed : full employment

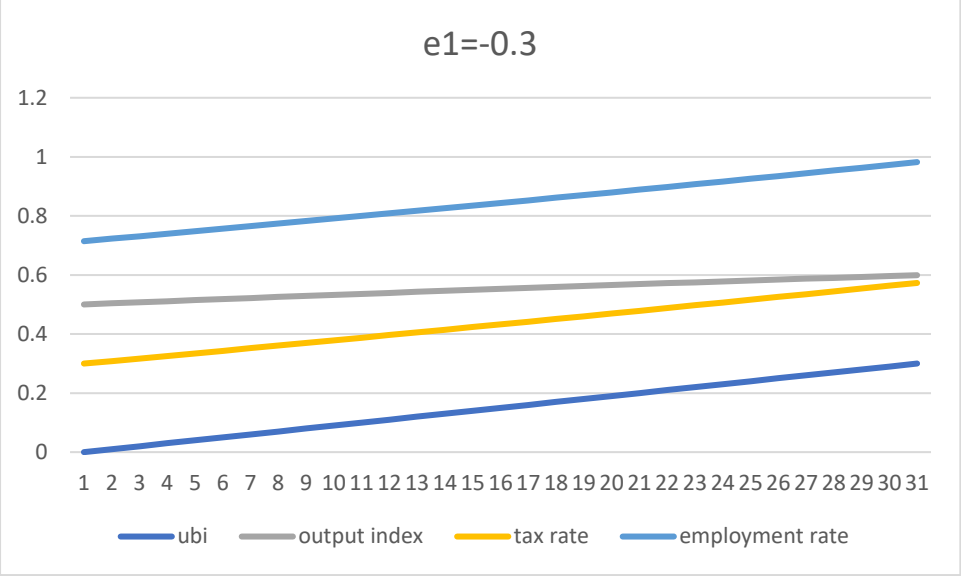




Source: own construction

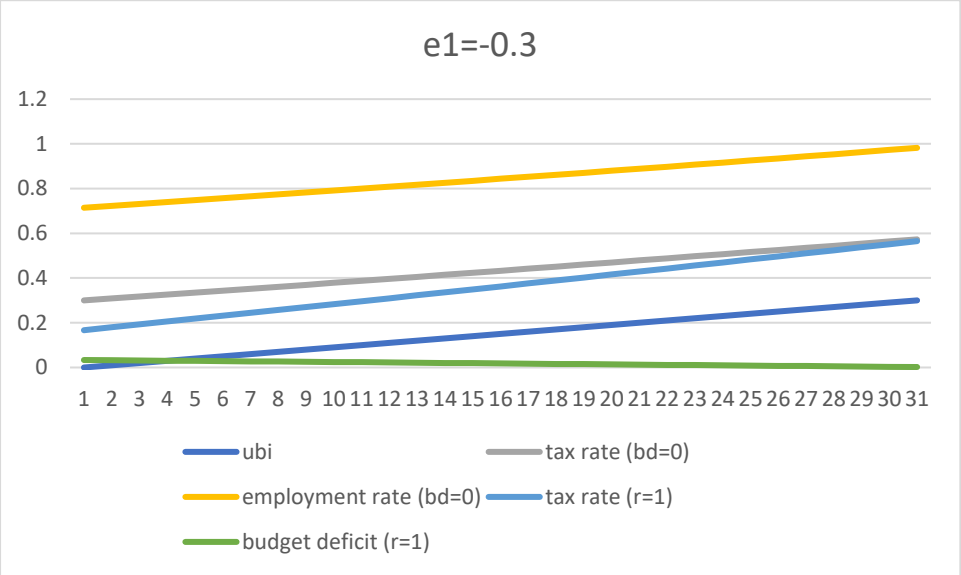
Figure 3 Balanced budget UBI set relative to GDP per person





Source: own construction

Figure 4: Comparing fiscal regimes



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