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TOWARDS A MODEL OF BAUMOL'S COST DISEASE IN A POSTGROWTH ECONOMY — DEVELOPMENTS OF THE FALSTAFF STOCK-FLOW CONSISTENT (SFC) MODEL

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Abstract

This working paper describes an extension of the stock-flow consistent FALSTAFF model originally developed by Jackson and Victor (2015) to test the existence of a monetary growth imperative. The extension described here is designed to simulate the phenomenon known as Baumol's Cost Disease which arises from the existence of differential labour productivity rates in a mixed economy. Sectors with lower productivity growth find themselves penalised by rising wage costs which cannot be offset by technological productivity gains. Depressed wage rates for workers and reduced profit margins for investors threaten to unleash both social and financial unsustainability. Nonetheless, this part of the economy, which includes activities such as care, craft and creativity, is central to the pursuit of human wellbeing and critical in the transition to a sustainable prosperity. This paper first describes the extensions to the FALSTAFF model. These are principally the division of the firms sector into two sectors 'fast' and 'slow' with differential labour productivity rates, the introduction of an input-output structure to simulate interactions between the two sectors, and the elaboration of a relative pricing structure. It then illustrates the use of the extended model through a series of scenarios: 1) to reproduce the stationary state achieved in the original FALSTAFF model; 2) to demonstrate the Baumol effect; 3) to simulate a transition to a more service-based economy and 4) to test some other innovations attributable to a postgrowth transition. The final section reflects on the limitations and uses of the model and points in the direction of future work.

1. Introduction

This working paper describes the development of a simulation model capable of exploring the phenomenon known as Baumol's Cost Disease, in which low-productivity growth sectors of the economy find themselves subject to rising relative prices as a result of the inability to offset rising wages driven by the high productivity growth sectors of the economy (Baumol et al 2012). The economist William Baumol first elaborated on this effect in the 1960s (Baumol 1967, Baumol and Bowen 1965). He described those sectors of the economy with high labour productivity growth as 'progressive' and those with low labour productivity growth as 'stagnant' in keeping with the decades-long preoccupation of economists with economic growth, which is seen to be unequivocally good. Our aim in developing the model lies primarily in exploring the feasibility of a transition to a postgrowth, service-based economy capable of delivering a sustainable prosperity (Jackson 2017, 2021) and developing policy options to achieve that goal. Consequently, we prefer the terms proposed by Gallant (2023) which refer to the high productivity growth sector as 'fast' and the low productivity growth sector as 'slow'.

The modelling framework described in this working paper builds on a macroeconomic model of Financial Assets and Liabilities in a Stock and Flow consistent Framework (FALSTAFF), designed to reflect the structure of a national economy. The approach draws on the post-Keynesian field of stock-flow consistent (SFC) macroeconomic modelling (Copeland 1949, Godley and Lavoie 2007). Such models are demand-driven and incorporate a consistent account of all monetary flows. SFC modelling emerged as a strong contender to conventional modelling approaches in the wake of the 2007/8 financial crisis, because of the consistency of its accounting principles and the transparency these principles bring to the underlying financial flows and balance sheets. It is notable that Godley (1999) was one of the few economists who predicted the crisis before it happened.[1]

The overall rationale of the SFC approach is to account consistently for all monetary flows between different sectors across the economy. This rationale can be captured in three broad axioms: first that each expenditure from a given actor (or sector) is also the income to another actor (or sector); second, that each sector's financial asset corresponds to some financial liability for at least one other sector, with the sum of all assets and liabilities across all sectors equalling zero; and finally, that changes in stocks of financial assets are consistently related to flows within and between economic sectors. These simple understandings lead to a set of accounting principles with implications for actors in both the real and financial economy which can be used to test the consistency of economic models and the validity of scenario predictions.

An earlier version of the FALSTAFF model (Jackson and Victor 2015) embodying these principles—hereafter referred to as FALSTAFF 1.0—was designed to question the existence of a 'monetary growth imperative' in capitalist economies. It showed that, at least under certain conditions, the existence of interest-bearing credit does not in and of itself create a growth imperative. Jackson and Victor (2015) demonstrated the existence of a quasi-stationary state in the presence of interest-bearing debt and illustrated the stabilising influence of government spending under demand shocks.

The aim of the current paper is to describe an extension of that earlier model (hereafter referred to as FALSTAFF 2.0) and to illustrate its use in exploring the Baumol effect and identifying policy solutions to it. The specific innovations described in the paper include the division of the non-financial

1 For an overview of the literature on SFC macroeconomic modelling, see Caverzasi and Godin 2015.

firms sector of FALSTAFF 1.0 into two distinct industry sectors: one representing the fast sector and one representing the slow sector. These two sectors are linked through an input-output model allowing us to explore the dependencies between one sector and the other. Markup pricing is used to add a price structure to the model and allow us to explore the relative price impacts at the heart of the Baumol hypothesis.

In the following sections we first provide a broad overview of the structure of FALSTAFF 2.0 (Section 2). We then set out the principal model equations in some detail (Section 3). Section 4 presents four simple scenarios developed using the model. Finally (Section 5), we draw some tentative conclusions and point readers in the direction of future research.

2. Overview of the FALSTAFF 2.0 Model

FALSTAFF 2.0 is articulated in terms of six inter-related financial sector accounts: households, firms, banks, government, central bank and the 'rest of the world' (or foreign sector). Firms accounts are then further subdivided into 'fast' (high productivity growth) and 'slow' (low productivity growth) firms. The former mainly represent sectors of the economy associated with resource extraction and material production. The latter represent sectors of the economy associated with human services such as health, social care, education, craft and creativity. The accounts of fast and slow firms and banks are further subdivided into current and capital accounts in line with national accounting practices. The household sector can be subdivided into two sectors in order to test the distributional aspects of changes in the real or financial economy—though we do not report on such explorations here.

The FALSTAFF model is built using the system dynamics software STELLA Architect. This kind of software provides a useful platform for exploring economic systems for several reasons, not the least of which is the ease of undertaking collaborative, interactive work in a visual (iconographic) environment. Further advantages are the transparency with which one can model fully dynamic relationships and mirror the stock-flow consistency that underlies our approach to macroeconomic modelling. STELLA also allows for an online user-interface through which the interested reader can follow the scenarios presented in this paper and explore their own. Data collation and reporting are carried out in Excel.

For the purposes of this paper, we have 'turned off' some features of the FALSTAFF structure in order to focus specifically on questions of price related to the Baumol effect. For instance, we assume balanced trade (no net exports) in the version of FALSTAFF 2.0 described here and restrict the number of categories of assets and liabilities to include only loans, deposits, equities and government bonds. In addition, we will not be using the division of households into two sectors, though we note that there may well be important distributional consequences from either the Baumol effect itself or from policies enacted to mitigate it (Hartwick and Kramer 2022, eg). Figure 1 illustrates the top-level structure of financial flows for the version of FALSTAFF 2.0 described in this paper.

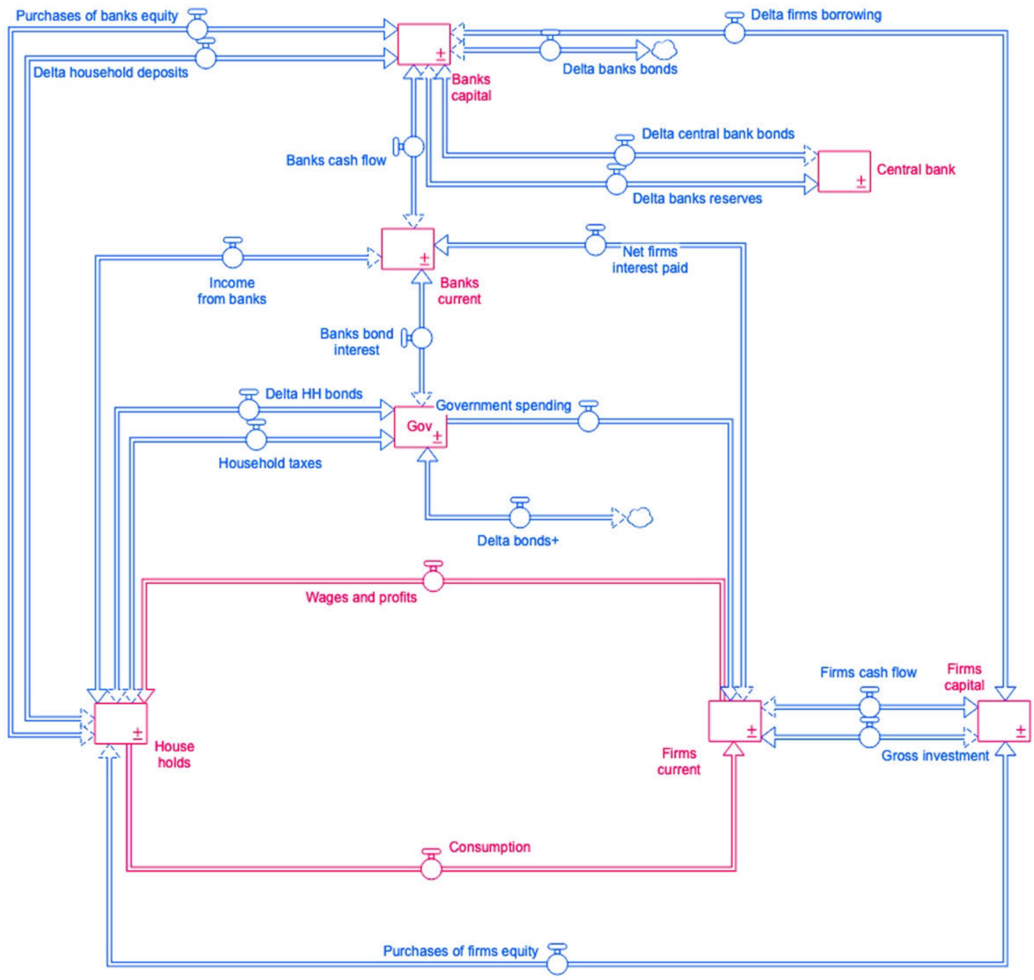

Figure 1| Structure of the FALSTAFF model
Source: Screenshot from STELLA Architect version of FALSTAFF 2.0

The familiar 'circular flow' of the macroeconomy is visible (in red) towards the bottom of the diagram in Figure 1. The rather more complex surrounding structure represents financial flows of the monetary economy in the banking, government and foreign sectors. If the model is stock-flow consistent, the financial flows into and out of each financial sector consistently sum to zero throughout the model run. So, for instance, the incomes of households (consisting of wages, dividends and interest receipts) must be exactly equal to the outgoings of households (including consumption, taxes, interest payments and net acquisitions of financial assets). Likewise, for each other sector in the model. These balances provide a ready test of consistency in the model.

Households' propensity to consume is dependent both on income and on financial wealth (Godley and Lavoie 2007). Household saving may in principle be distributed between government bonds, firms equities, banks equities, bank deposits and loans. Household demand for bonds is assumed here to be equal to the excess supply of bonds from government, once banks' demands for bonds are met. Household demand for equities is assumed to be equal to the issuance of equities from firms and banks. Thus, households are the sole owners of equity in this model and the return on equities is limited to dividends received, since there are no capital gains in the model. The balance of household saving, once bond and equity purchases have been made, is allocated to paying down loans or building up deposits. If saving is negative, households may also increase the level of loans.

Firms are assumed to produce goods and services on demand for households, governments and gross fixed capital investment. Investment decisions are based on a 'partial adjustment' function (Godley and Lavoie 2007) in which net investment is assumed to be a fixed proportion of the difference between capital stock in the previous period, and a target capital stock determined by expected demand and an assumed capital-to-output ratio. A proportion of gross profits equal to the depreciation of the capital stock over the previous period is assumed to be retained by firms for investment, with net (additional) investment financed through a mixture of new loans from banks and the issuance of equities to households, according to a desired debt-to-equity ratio.

Central to our exploration of the Baumol effect is the differentiation between fast and slow firms within the firms sector. This differentiation is realised primarily through different rates of labour productivity growth in each of the fast and slow sectors. We have also differentiated the output, labour requirements and capital requirements associated with each of the two sectors. Interactions (intermediate purchases and intermediate sales) between the two sectors are articulated through an input-output model. For the purposes of our demonstration of the Baumol effect, the wage rate growth is subject to the 'pull' of labour productivity growth in the fast sector. But the extent to which this pull is exerted can be varied by the user.

Government receives income from taxation and purchases services (for the benefit of the public) from the slow sector. Taxation is only levied on households in this version of the model, at a rate which provides for an initially balanced budget under the default values for aggregate demand. The modelling framework also allows a variety of government spending scenarios including counter-cyclical spending and austerity (Jackson and Victor 2015). In the current paper however, we restrict attention to a constant taxation rate designed to achieve a balanced budget in the stationary state. Government bonds are issued to cover deficit spending.

Banks accept deposits and provide loans to households and to firms, as demanded. Bank profits are generated from the interest rate spread between deposits and loans, plus interest paid on any government bonds they hold. Profits are distributed to households as dividends, except for any retained earnings that may be required to meet the capital account 'financing requirement'. This financing requirement is the difference between deposits (inflows into the capital account) and the sum of loans, bond purchases and increases in central bank reserves (outgoings from the capital account).

The central bank plays a very simple role in the stationary state version of FALSTAFF, providing liquidity on demand (in the form of central bank reserves) to commercial banks in exchange for government bonds. It should be noted that FALSTAFF is entirely a credit economy. No physical cash changes hands, and transactions are all deemed to be electronic transactions through the bank accounts of firms, household and government (and through the reserve account of the central bank).

FALSTAFF provides for two regulatory policies that might reasonably be imposed on banks. First, the model can impose a 'capital adequacy' requirement in which banks are required to hold enough 'capital' to cover a given proportion of risky assets. Second, banks may be subject to a central bank 'reserve ratio' in which reserves are held at the central bank up to a given proportion of deposits held on account. Many countries no longer retain formal reserve ratios, leaving it up to the banks themselves to decide what reserves to hold. FALSTAFF 1.0 included a default reserve ratio of 5% in order to test Binswanger's hypothesis that such requirements might lead to a growth imperative. We retain that assumption here. Likewise we retain the capital adequacy requirement derived from the BASEL III requirement that banks' 'capital' (the book value of equity in the banks' balance sheet) should be equal to 8% of risk-weighted assets (loans to households and firms). To meet this requirement, banks in FALSTAFF issue equities to households. This has the effect of shifting deposits to equity on the liability side of the balance sheet and increasing the ratio of capital to loans. To balance the balance sheet, banks purchase government bonds (conventionally deemed risk-free) which together with central bank reserves (also risk-free) provide for a certain proportion of 'safe' capital to balance against risky assets.

As mentioned above, the balance sheet structure in this paper is straightforward. Households own firm equities and purchase government bonds. Balances are held either as deposits or as loans. Firms take out loans or issue equities in order to finance investment. Firms' surpluses can either be used to pay down loans or to increase deposits. In addition to the loans they provide to firms and households, commercial banks also hold government bonds for capital adequacy reasons and central bank reserves for liquidity reasons. The central bank balances its reserve liabilities with government bonds purchased from banks on the secondary market. Governments hold only liabilities in the form of bonds. A simplified balance sheet (with fast and slow conflated into one sector) is shown in Table 1.

	Households	Firms	Banks	Central bank	Government	Total
Net financial worth	$D^h + E + B^h - L^h$	$-L^f - E^f + D^f$	$L + R + B^b - D - E^b$	$B^{cb} - R$	$-B$	0
Financial Assets	$D^h + E + B^h$	D^f	$L + R$	B^{cb}	0	$R + D + L + B + E$
Reserves			R			R
Deposits	D^h	D^f				D
Loans			L			L
Bonds	B^h		B^b	B^{cb}		B
Equities	E					E
Financial Liabilities	L^h	$L^f + E^f$	$D + E^b$	R	B	$R + D + L + B + E$
Reserves				R		R
Deposits			D			D
Loans	L^h	L^f				L
Bonds					B	B
Equities		E^f	E^b			E

Table 1 | Simplified Balance Sheet Matrix for FALSTAFF
Source: Jackson and Victor 2015, Table 1: note that for the purposes of this Table, fast and slow firms are accounted together. A numerical version of the initial balance sheet for the stationary case is shown in Appendix C.

	Households (h)	Firms (f)		Banks (b)		Central bank (cb)	Gov (g)	Σ
		Current	Capital	Current	Capital			
Consumption (C)	$-C$	C						0
Gov spending (G)		G					$-G$	0
Investment (I)		I	$-I$					0
Wages (W)	W	$-W$						0
Profits (P)	$+F^{fd}+F^{bd}$	$-F^f$	$+F^{fr}$	$-F^b$	$+F^{br}$			0
Depreciation (δ)		$-\delta$	$+\delta$					0
Taxes (T)	$-T$						T	0
Interest on Loans (L)	$-r_l L^h_{-1}$	$-r_l L^f_{-1}$		$+r_l L_{-1}$				0
Interest on Deposits (D)	$+r_d D^h_{-1}$	$+r_d D^f_{-1}$		$-r_d D_{-1}$				0
Interest on Bonds (B)	$+r_b B^h_{-1}$			$+r_b B^b_{-1}$		$+r_b B^{cb}_{-1}$	$-r_b B_{-1}$	0
Change in Reserves (R)					$-\Delta R$	$+\Delta R$		0
Change in Deposits (D)	$-\Delta D^h$	$-\Delta D^f$			$+\Delta D$			0
Change in Bonds (B)	$-\Delta B^h$				$-\Delta B^b$	$-\Delta B^{cb}$	$+\Delta B$	0
Change in Equities (E)	$-\Delta E$		$+\Delta E^f$		$+\Delta E^b$			0
Change in Loans (L)	$+\Delta L^h$		$+\Delta L^f$		$-\Delta L^b$			0
Σ	0	0	0	0	0	0	0	0

Table 2 | Simplified Transaction Flows Matrix for FALSTAFF
Source: Jackson and Victor 2015, Table 1: note that for the purposes of this Table, fast and slow firms are accounted together. A numerical version of the initial transaction flows matrix for the stationary case is shown in Appendix C.

The transaction flows matrix (eg Godley and Lavoie 2007: 39) for FALSTAFF incorporates an account of the incomes and expenditures in the national economy, reflecting directly the structure of the system of national accounts. Thus, the first ten rows in Table 2 above illustrate the flow accounts of each sector. For instance, the household sector receives money in the form of wages and dividends from production firms and dividends and (net) interest from banks. Households spend money on consumption and on taxes. The balance between income and spending represents the saving of the household sector.

Note that the top rows of columns 2 and 3 (firms' current accounts) represent a simplified form of the conventional GDP accounting identity.

$$C + G + I = GDP_e = GDP_i = W + F + INT_f^{net} + \delta \quad (1)$$

where GDP_e represents the expenditure-based formulation of the GDP, GDP_i represents the income based formulation. C represents consumer spending, G represents government spending and I represents gross investment. F denotes the sum of both firms' profits F^f and banks' profits F^b, INT_f^{net}

represents the net interest paid out to firms and $\delta = r_\delta K$ represents the depreciation on capital assets K at a depreciation rate given by r_δ.

As a rule, we use uppercase nomenclature to designate nominal values and lower case nomenclature to designate real values. Hence the real GDP—which provides a measure of the goods and services produced by the model economy which can be compared across model periods—is written as gdp and calculated by dividing nominal GDP in either expenditure or income terms by the price level $\bar{P}$ so that:

$$GDP_e = GDP_i = \bar{P}.gdp \qquad (2)$$

In alignment with post-Keynesian thinking (Lavoie 2014), FALSTAFF 2.0 assumes that prices are set by firms through a 'markup' on nominal unit costs. Essentially firms in the fast and the slow sector add a percentage to costs in order to ensure the profitability of the business and (ultimately) the distribution between wages and profits across the economy. The markup equations which determine these prices will be detailed in Section 3.3 below. They lead to one price P_F for fast sector goods, another price P_S for slow sector goods and a price level $\bar{P}$ across the economy which is determined (in accordance with national accounting practices) by taking an average of the prices in each sector weighted by the final demand FD_i in those sectors:

$$\bar{P} = \frac{P_F.FD_F + P_S.FD_S}{FD_F + FD_S} \qquad (3)$$

The inflation rate (φ) is determined by taking the rate of change of the price level:

$$\varphi = \frac{\bar{P} - \bar{P}_{t-1}}{\bar{P}_{t-1}} \qquad (4)$$

The bottom five rows of the table represent the transactions in financial assets and liabilities between sectors. So, for example, the net lending of the households sector (the sum of rows 1 to 10) is distributed amongst five different kinds of financial assets in this illustration: deposits, loans, government bonds, equities and central bank reserves. A key feature of the transaction matrix, indeed the core principle at the heart of SFC modelling, is that each of the rows and each of the columns must sum to zero. If the model is correctly constructed, these zero balances should not change over time as the simulation progress. The accounting identities shown in Table 2 therefore allow for a consistency check, to ensure that the simulations actually represent possible states of the monetary economy.

3. FALSTAFF 2.0 Model Equations

In the following sections, we set out the principal equations governing the FALSTAFF 2.0 model. Many of these are similar (aside from some changes to nomenclature) to the equations in Jackson and Victor (2015). We spend more time however, setting out the specific innovations in FALSTAFF 2.0. There are two main innovations. One relates to the articulation of two distinct non-financial firms sectors, representing the fast and slow economy. The other, which we need in order to be able to discuss the Baumol effect, is the introduction of relative prices. Both of these innovations are discussed in detail in section 3.2 which details the behavioural and structural equations that govern the firms sectors. We start however by exploring the dynamics of the household sector.

3.1. Households

We define first the nominal income Y^h, of households (in accordance with Table 2) as:

$$Y^h = W + F^{fd} + F^{bd} + INT_{B^h} + INT_{D^h} - INT_{L^h} \tag{5}$$

where $INT_{B^h} = r_B B^h_{-1}$ is the nominal interest paid on the stock of bonds held by households in the previous period[2], $INT_{D^h} = r_D D^h_{-1}$ is the interest paid on households deposits, $INT_{L^h} = r_L L^h_{-1}$ the interest paid by households on loans, F^{bd} is the profit distributed by banks and $F^{fd} = F^{fd}_F + F^{fd}_S$ is the profit distributed from the fast and slow sectors respectively. Nominal disposable income, Y^{hd}, is given by:

$$Y^{hd} = (1-\theta)Y^h \tag{6}$$

where θ is the rate of income tax on households, determined (below) by government's initial financing requirement and real disposable income y^{hd}, is given by:

$$y^{hd} = Y^{hd}/\bar{P} \tag{7}$$

where $\bar{P}$ is the price level. Households are deemed to allocate real income between total consumption spending, c and saving s^h, via a consumption function of the form (Godley and Lavoie 2007 eg):

$$c = \alpha_1 y^{hde} + \alpha_2 nw^h_{-1} \tag{8}$$

where α_1 and α_2 (both assumed constant here) are the propensity to consume from expected disposable income y^{hde} and the propensity to

2 In line with the conventions of SFC modelling, we typically suppress the time denominator, except where we wish to indicate a time period different from the current one. So for example Z_{-1} indicates the value of the variable Z in the previous period.

consume from wealth nw^h_{-1} respectively, and expected disposable income y^{hde} is given by a simple extrapolation of the trend over the previous period:

$$y^{hde} = y^{hd}_{-1}(1 + \frac{(y^{hd}_{-1} - y^{hd}_{-2})}{y^{hd}_{-1}}) \quad (9)$$

Real net worth nw^h is given by:

$$nw^h = NW^h/\bar{P}, \quad (10)$$

and remembering that households are the only owners of equity in this model, the NW^h is equal (see Table 1) to:

$$NW^h = D^h + B^h + E_F + E_S - L^h. \quad (11)$$

In this version of the FALSTAFF model, real consumption is allocated between fast sector consumption c_F and slow sector consumption c_S, either using constant initial shares σ_i^0 (with $i = F \text{ or } S$ and $\sigma_F^0 + \sigma_S^0 = 1$) or else using shares which change exogenously over time in a linear fashion between σ_i^0 and σ_i^T: the initial share and the share at time T. This construction allows us to explore the impact on relative prices of an exogenous transition in favour of the slow sector, of the kind hypothesised (eg) by Jackson 2017 towards a service-based, employment-rich economy. Hence, real consumption is divided according to:

$$c = c_F + c_S \quad (12)$$

Nominal household saving is determined by:

$$S^h = Y^{hd} - C, \quad (13)$$

where:

$$C = \bar{P}c. \quad (14)$$

In this version of FALSTAFF we do not have households making fixed capital investments, and so the nominal net lending NL^h of households is given simply by:

$$NL^h = S^h. \quad (15)$$

The next step in the model is to determine the allocation of net lending between different assets and liabilities. For this version of the model, we assume simply that households purchase all the equities issued by firms and absorb all the bonds not required by banks and the central bank (see below) for the purposes of ensuring their capital adequacy and reserve requirements. The change in household deposits is then determined as a residual according to:

$$\Delta D^h = \max\{\left(NL^h - \Delta E^f - \left(\Delta B - \Delta B^b - \Delta B^{cb}\right)\right), -D^h_{-1}\} \quad (16)$$

So long as $NL^h - \Delta E^f - (\Delta B - \Delta B^b - \Delta B^{cb}) \geq -D^h_{-1}$, households do not need to take out loans. In the case where the supply of equities and the residual supply of bonds exceeds saving, households draw down deposits in order to purchase these assets. Where there are insufficient deposits, ie, where $NL^h - \Delta E^f - (\Delta B - \Delta B^b - \Delta B^{cb}) < -D^h_{-1}$, then households will take out loans ΔL^h according to:

$$\Delta L^h = \Delta E^f + (\Delta B - \Delta B^b - \Delta B^{cb}) - NL^h - D^h_{-1}. \qquad (17)$$

3.2. Firms

The main innovation in FALSTAFF 2.0 is the splitting of the firms sector into two sectors, fast and slow, and the introduction of markup pricing in each of these sectors. Aside from this innovation both sectors share many of the same behavioural and structural characteristics as the single firms sector in Jackson and Victor (2015)—and as each other. For instance, both subsectors are assumed to have the same investment behaviour and the same loan to equity ratio as each other. The two subsectors draw from the same pool of labour, borrow from the same banking sector and sell to the same group of consumers (households). The fast and slow sectors interact with one another through intermediate sales and purchases. Each sector purchases goods and services from the other for use in the production process. Each sector has a balance sheet constraint and a budget constraint. These accounting identities form the basic structure of the model and ensure stock-flow consistency.

Given these similarities between sectors, we simplify the presentation in the following, by using the subscript i to refer to either the fast or slow sector as appropriate. Subscripts F or S are used when we need to indicate that a variable relates only to the fast or slow sector (respectively). The subscript j is used to denote the other sector when an equation relates a quantity in sector i to one in sector j.

Both subsectors provide goods and services to the rest of the economy and to each other. Each subsector's nominal sales, $S_i = s_i P_i$, consist in nominal final demand, FD_i, and intermediate sales IP_j to (ie intermediate purchases from) the other sector j. Hence, we have:

$$S_i = s_i . P_i = FD_i + IP_j, \qquad (18)$$

where as usual final demand FD_i is composed of household consumption C_i, government consumption G_i and the gross formation of fixed capital (gross investment) $GCGC_i$ produced by each subsector. In other words:

$$FD_i = C_i + G_i + GCFC_i \qquad (19)$$

For simplicity, in this version of FALSTAFF we assume that government consumption is in the form of services and so is purchased only from the slow sector, while investment goods are purely material in form and purchased from the fast sector, so that equation (19) can be written out as:

$$FD_F = I + C_F \tag{20}$$

$$FD_S = G + C_S \tag{21}$$

where $G = G_S$ represents the demand for services by government and $I = GCFC_F$ represents the sum of the gross investment needs I_i of each subsector.

The investment decision is one of the most critical behavioural decisions in the model. It depends in part on the expected demand for goods and in part on the depreciation, δ_i of the previous year's capital stock $K_{i,-1}$. Specifically, nominal gross investment by each sector is given by:

$$I_i = I_i^{net} + \delta_i \tag{22}$$

where:

$$\delta_i = r_\delta K_{i,-1} \tag{23}$$

for some rate of depreciation r_δ (assumed constant across sectors).

Since we have made the simplifying assumption (equation 20) that investment goods are all provided by the fast (materials) sector, it follows that:

$$I_i^{net} = P_F i_i^{net} \tag{24}$$

where i_i^{net} is real net investment and P_F is the price of goods in the fast sector (which produces investment goods). The real net investment i_i^{net} is determined through a 'partial adjustment function' (Godley and Lavoie 2007: 227, eg) calculated from the difference between the real capital stock at the end of the previous period $k_{i,-1}$ and a 'target' capital stock k_i^τ sufficient to meet the expected output assuming a fixed target capital-to-output ratio κ_i^τ, so that:

$$i_i^{net} = \gamma_i(k_i^\tau - k_{i,-1}) \tag{25}$$

for some 'partial adjustment coefficient' γ_i, with $0 \le \gamma \le 1$. The target real capital stock k_i^τ is given by:

$$k_i^\tau = \kappa_i^\tau x_i^e \tag{26}$$

where the expected real output x_i^e is estimated from the real output x_i in previous years (as for disposable income) via a simple trend function of the same form as shown in equation (9).

Real output in its turn is determined via an input-output model of a form given by the simultaneous (Leontief) equations:

$$x_i = a_{ii}x_i + a_{ij}x_j + y_i \qquad (27)$$

Or equivalently in matrix form as:

$$\underline{x} = \underline{A}.\underline{x} + \underline{y} \qquad (28)$$

where $\underline{A}$ is the so-called 'technical coefficients matrix' and $\underline{y}$ is a vector of real final demand. Equation (26) is perhaps more easily recognisable (and solvable) in the Leontief form:

$$\underline{x} = (\underline{1} - \underline{A})^{-1}.\underline{y} = \underline{L}.\underline{y}, \qquad (29)$$

where $\underline{L}$ is the Leontief inverse matrix and $\underline{1}$ is the identity matrix with 1's on the diagonal and zeros elsewhere (see Miller and Blair 2009 eg). It follows that real output x_i in each subsector is equal to the sum of sales s_i and each subsector's 'own-use' consumption $a_{ii}x_i$, and that real intermediate purchases $ip_i = IP_i/P_j$ are given by the mixed terms $a_{ij}x_j$ in equation (27).

Aside from capital and intermediate goods, the other main input to production in FALSTAFF is wage labour. Firms employ the workers needed to produce output x_i according to how much output those workers can produce in each hour of work, ie according to the labour productivity η_i of each subsector. The demand for labour, measured in terms of hours worked H_i in each sector, is then given by:

$$H_i = \frac{x_i}{\eta_i} \qquad (30)$$

and the total demand for hours worked H across the economy is obtained by summing the demand for work in the slow sector and the demand for work in the fast sector:

$$H = H_F + H_S = \frac{x_F}{\eta_F} + \frac{x_S}{\eta_S} \qquad (31)$$

H can then be used to calculate the level of unemployment U in the economy. Specifically, the sum of hours worked H is divided by the total supply of labour, which is given by hours worked per worker h in each year multiplied by the total number of workers N in the workforce, so that:

$$U = \frac{H}{h.N} \qquad (32)$$

H can be also be used to calculate the average level of labour productivity η across the economy in the form:

$$\eta = x/H, \quad (33)$$

where $x = x_F + x_s$ is the total output from the fast and the slow sectors.[3]

Wage rate growth in FALSTAFF 2.0 can be driven either by the average productivity growth $\hat{\eta}$ across the economy, or by the labour productivity growth $\hat{\eta}_F$ in the fast sector or else by a rate (set by the user) that lies somewhere between $\hat{\eta}$ and $\hat{\eta}_F$. It is a premise of the Baumol hypothesis that labour productivity growth in the fast sector exerts an upward pressure on wage growth in both sectors. The scenarios described in Section 4 assume that wage growth in the fast sector follows labour productivity growth and wage growth in the slow sector increases at a rate half way between the rate of labour productivity growth in the fast sector and the average labour productivity growth across the economy so that the hourly wage rate μ_F in the fast sector is given by:

$$\mu_F = (1 + \hat{\eta}_F)\mu_{F,-1}, \quad (34)$$

And in the slow sector, the wage rate μ_S is given by:

$$\mu_S = (1 + (\hat{\eta} + \hat{\eta}_F)/2)\mu_{S,-1}, \quad (35)$$

In the stationary state, labour productivity growth is zero and so the wage rate is constant. In order to test for the Baumol effect, however, our scenarios in this paper will use differential labour productivity growth rates $\hat{\eta}_i$ in the different subsectors, which may also change over time, so that:

$$\eta_i = \hat{\eta}_i \eta_{i,-1} \quad (36)$$

where $\hat{\eta}_i$ is exogenously determined. Knowing both the wage rate and the hours worked in each sector, it is possible to determine the real wage bill w_i in each sector according to:

$$w_i = \mu_i H_i. \quad (37)$$

Firms' profits F_i^f can now be established for each subsector by subtracting costs (the wage bill, intermediate purchases and interest payments on loans)

3 In the scenarios described in this working paper, we have endogenised hours h per worker to maintain a given target unemployment rate. The literature on postgrowth economics typically sees a shorter working week (ie fewer hours worked per year) as a means of maintaining full employment in an economy with rising labour productivity but stationary (or falling) aggregate demand. Interestingly, in our scenarios the opposite also happens: people work more hours in the economy to maintain output as the labour productivity slows down. Some evidence for this can also be found in economies experiencing secular stagnation (Jackson 2019).

from total income received from sales and interest payments on deposits. Accordingly, we have:

$$F_i^f = S_i + INT_{D^f i} - W_i - INT_{L^f i} \tag{38}$$

where $INT_{D^f i} = r_D D_{-1}^{f_i}$, $INT_{L^f i} = r_L L_{-1}^{f_i}$ and $W_i = \bar{P} w_i$; D^{f_i} and L^{f_i} are the deposits and (respectively) loans held by subsector i.

In accordance with the post-Keynesian perspective followed here, we regard the 'markup' as being the primary instrument through which firms achieve their desired profit outcomes (Lavoie 2014, Godley and Lavoie 2007). Specifically, firms set prices P_i through a markup M_i over their unit costs UC_i so that:

$$P_i = (1 + M_i)UC_i \tag{39}$$

where unit costs UC_i are given by:[4]

$$UC_i = (W_i + IP_i + T_i^f)/s_i. \tag{40}$$

and T_i^f represents any taxes (or transfers) levied directly on firms. Since firms tend to adjust their prices over time rather than instantaneously, FALSTAFF 2.0 allows for a partial adjustment mechanism in reaching the markup M_i which, analogously to the investment equation (25) above, proceeds via:

$$M_i = \beta_i(M_i^\tau - M_{i,-1}) \tag{41}$$

for some 'partial adjustment coefficient' β_i, with $0 \leq \beta \leq 1$.

FALSTAFF 2.0 also allows the target markup M_i^τ to be chosen in various ways. The simplest and most obvious choice is to adopt a constant markup. However, it is readily found that in the presence of the cost disease, the choice of a constant markup destabilises the fast sector and fast sector firms are eventually unable to sustain a positive profit rate. Accordingly, Gallant (2023) has developed a variable markup for use in the FALSTAFF model which allows firms to target an endogenous markup set at a level which attempts to maintain a particular rate of return ρ_i^τ (or profit rate) on capital assets for investors.[5]

This working paper employs a variation on the method introduced to the model by Gallant which allows firms better to achieve the desired profit rate.

4 In some policy scenarios, the unit costs UC_i can also include a tax or transfer from on sector to another.

5 The markup proposed in Gallant (2023) is given by: $M_{T_i} = ((\rho_i^\tau + r_\delta).K_i + INT_{f_i}^{net})/s_i UC_i$. Though simpler, it leaves some firms unable to achieve their desired profit rate under some circumstances. The method proposed here appears to track desired profit rates better although in doing so it tends to increase inflationary pressures in the model.

Specifically, we start from the assumption that firms calculate the change in markup from the previous year via the difference between their profit rate in the previous year and their target profit rate this year. Since each firm's markup rate M_i^τ when applied to costs $s_i UC_i$ aims to cover depreciation of capital $r_\delta K_i$, pay off net interest charges $INT_{f_i}^{net} = INT_{L^{f_i}} - INT_{D^{f_i}}$, and still leave sufficient profit to achieve the target profit $\rho_i^\tau K_i$, we have:

$$M_i^\tau s_i UC_i = (\rho_i^\tau + r_\delta) K_i + INT_{f_i}^{net} \quad (42)$$

By rearranging terms, we see that:

$$\rho_i^\tau = (M_i^\tau s_i UC_i - INT_{f_i}^{net} - r_\delta K_i)/K_i. \quad (43)$$

Likewise the actual profit rate in the previous period is given by:

$$\rho_{i,-1} = (M_{i,-1} s_i UC_i - INT_{f_i}^{net} - r_\delta K_i)/K_i \quad (44)$$

Subtracting equation (44) from equation (43) and rearranging terms we find that:

$$M_i^\tau - M_{i,-1} = (\rho_i^\tau - \rho_{i,-1}) K_i / s_i UC_i \quad (45)$$

In other words, the increase to the target markup rate over the previous year's markup rate is given by the difference between the target profit rate and the previous year's profit rate, multiplied by the capital stock and divided by the total costs. The actual markup is then allocated in the model according to equation (41).

Finally, we come to the funding mechanisms through which firms invest in new capital stock. The markup model assumes a funding mechanism in which each subsector retains sufficient profits F_i^{fr} to cover the nominal depreciation costs $P_F \delta_i$, so that the remaining profits distributed as dividends F_i^{fd} are equal to total profits F_i^f net of depreciation costs $r_\delta K_i$. In this case, the net lending of each subsector NL_i^f is given by:

$$NL_i^f = -I_i^{net}. \quad (46)$$

In other words, net borrowing (negative net lending) is used to finance investment in new capital stock and is funded by a mixture of loans ΔL^{f_i} from banks and equity ΔE^{f_i} sold to households. The exact split between debt and equity is determined by a desired debt to equity ratio ε, such that:

$$L^{f_i} = \varepsilon E^{f_i}. \quad (47)$$

Assuming that historical debt and equity more or less satisfy this ratio, then firms in each sector would be expected to take out net loans ΔL^{f_i} and issue new equities ΔE^{f_i} in the same proportions so that:

$$\Delta L^{f_i} = \varepsilon \Delta E^{f_i}, \tag{48}$$

from which it is straight forward to show that:

$$\Delta L^{f_i} = -\frac{1}{(1+\frac{1}{\varepsilon})} NL^{f_i} \tag{49}$$

while:

$$\Delta E^{f_i} = -\frac{1}{(1+\varepsilon)} NL^{f_i}. \tag{50}$$

When net investment is negative, ie when firms are inclined to disinvest in fixed capital assets, then firms' net lending is positive. We assume first that firms use this cash to pay off loans. In the event that there are no more loans to pay off, firms save excess cash as deposits with banks.

3.3. Banks and the Central Bank

The *banks sector* in FALSTAFF is a simplified accounting sector whose main function is to provide loans $\Delta L^f = \Delta L^{f_F} + \Delta L^{f_S}$ to (and where necessary take deposits ΔD^f from) fast and slow sector firms and to take deposits ΔD^h from (and where necessary provide loans ΔL^h to) households. In order to meet liquidity needs, commercial banks keep a certain level of reserves R with the *central bank*, depending on the level of deposits held on their balance sheet. The additional reserve requirement ΔR in any year is given by:

$$\Delta R = \psi\left(D^h_{-1} + D^f_{-1}\right) - R_{-1}, \tag{51}$$

where ψ is the desired (or required) reserve ratio. Banks 'pay for' these reserves by 'selling' an equivalent value in government bonds to the central bank, thus depleting their stock of bonds by an amount ΔB^{cb} equal to ΔR, and increasing the stock of government bonds held by the central bank by the same amount.

To comply with capital adequacy requirements under the long-term targets set out under the Basel III accord, banks are required to hold capital (equity) equivalent to a given proportion of risk-weighted assets. For the purposes of this paper we take the sum of risk-weighted assets to be equal to the sum of loans L^f and L^h to firms and households respectively. Banks' capital is defined by the book value of the banks sector equity E^b according to:

$$E^b = L + R + B^b - D \tag{52}$$

where B^b are government bonds held by the banks' sector, $D = D^f + D^h$, and $L = L^f + L^h$. The long-run Basel III requirement is then met by setting a target capital adequacy ratio π^τ, such that:

$$\pi^{\tau} = \frac{E^b}{L} = 0.08 \quad (53)$$

Assuming initial conditions in which this requirement is met, then the capital adequacy ratio is maintained by the banks' sector, provided that:

$$\Delta E^b = \pi^{\tau} L - E^b_{-1} \quad (54)$$

In other words, banks' issue new equities (to the households sector) equivalent to the shortfall between the required capital adequacy proportion of loans and the equity value in the previous period.[6] It is worth emphasising here that loans and deposits are determined by demand (from the household and firms sectors), reserves are determined by the reserve requirement and equities are determined by the capital adequacy requirement. The final discretionary element on the banks' balance sheet is government bonds, which we assume that banks will hold in preference to reserves where they can—ie once the reserve requirement is met—because they bring income from interest. The target value of banks' bonds $B^{b\tau}$ can be determined from equation (52) as:

$$B^{b\tau} = D - R - L + E^b \quad (55)$$

Or equivalently, using the reserve requirement to determine R and the capital adequacy ratio to determine E^b, we can write:

$$B^{bT} = D(1 - \psi) - L(1 - \pi). \quad (56)$$

Again assuming initial conditions meet this requirement, then banks target for holding government bonds is met, provided that:

$$\Delta B^b = B^{bT} - B^b_{-1} + \Delta B^{cb}, \quad (57)$$

where the last term is included to offset the purchase of banks bonds by the central banks to meet reserve requirements.

Whereas for firms, capital account positions are determined by the needs of the current account, in the case of banks, we derive the current account balances from the capital account positions, specifically we determine banks retained earnings (undistributed profits) from their financing needs. Banks income consists in the difference between interest received on loans and government bonds and the interest paid out on deposits.[7] Hence, banks' profits F^b are given by:

6 We assume in this version of FALSTAFF that households purchase all equities issued by the banks sector and that the market value of equities so issued is determined by the book value of equity.

7 We omit here for simplicity interest paid on reserves. In the event that this was included in the model, it would simply represent a transfer from the central bank (essentially from

$$F^b = INT_{L^f} + INT_{L^h} + INT_{B^b} - INT_{D^h} - INT_{D^f}. \quad (58)$$

Banks' saving is equal to the difference between total profits $F^b$and the profits F^{bd} distributed to households as dividends. Rather than specifying a fixed dividend ratio to determine F^{bd} and calculating banks' saving S^b from this, we determine instead a desired net lending NL^b for banks, according to the financing requirements of banks' capital account and set the saving equal to this. Hence, we have:

$$NL^b = \Delta L^f + \Delta L^h + \Delta B^b_{cap\ ad} - \Delta D^h - \Delta D^f, \quad (59)$$

and we can then determine banks' dividends, F^{bd}, according to:

$$F^{bd} = F^b - S^b = F^b - NL^b. \quad (60)$$

with NL^b given by equation (59).

3.4. Government Sector

Finally, we describe the *government sector* accounts. The current account elements[8] in the Government's account are relatively simply expressed in terms of the equation:

$$NL^g = S^g = T - G - INT_B, \quad (61)$$

where taxes, T, are given by:

$$T = \theta Y^h, \quad (62)$$

and the interest, INT_B, paid on government bonds is given by:

$$INT_B = INT_{B^h} + INT_{B^b} = r_B(B^h_{-1} + B^b_{-1}). \quad (63)$$

Note that no interest is included for government bonds owned by the central bank, as profits from the central bank are assumed to be returned directly to the government. The capital aspect of the government account is simply a matter of establishing the level of government debt, through the change in the stock of outstanding government bonds, B, according to:

$$\Delta B = -NL^g. \quad (64)$$

When the government runs a fiscal deficit, the net lending, NL^g, is negative leading to an increase in the stock of outstanding bonds. In the event that

government) to banks. We note here also that the banks sector does not pay wages in FALSTAFF.

8 In keeping with National Account conventions, the current and capital elements of the government sector are not shown in separate accounts in Table 2.

government runs a fiscal surplus, NL^g is positive and the stock of outstanding bonds declines.

A key feature of stock-flow consistent models is that they explicitly satisfy a key condition that prevails in the macroeconomy, namely that sum of net lending across all sectors is equal to zero. In other words:

$$NL^h + NL^f + NL^b + NL^g = 0. \quad (65)$$

Or in other words, using equations (13), (15), (46), (59) and (61) above, we should expect that:

$$Y^{hd} - C - I_{net} + F^b - F^{bd} + T - G - INT_{B^h} - INT_{B^b} = 0 \quad (66)$$

Noting that $Y^{hd} + T = Y^h$ and using equation (5), it follows that:

$$W + F^{fd} + INT_{D^h} - INT_{L^h} + F^b - INT_{B^b} = C + G + I^{net} \quad (67)$$

Since $F^{fd} = F^f$ and noting that F^b can be expanded (equation 58) as a sum of interest receipts (and payments), we can show that equation (67) can be rewritten as:

$$W + F^f + INT_{L^f} - INT_{D^f} = C + G + I^{net} \quad (68)$$

or equivalently that:

$$W + F^f + INT_f + \delta = C + G + I \quad (69)$$

which is precisely (see equation 1) where we started from. The net lending condition is therefore a useful consistency check for the validity of the model as a whole and will be one of the aspects tested across different scenarios in the numerical simulations.

3.5. Calibration and initialisation

Having established the accounting identities and behavioural relationships of the FALSTAFF model, we next need to determine some initial values consistent with stationary (or quasi-stationary) solution. For the purposes of this exercise, this means that there should be no long-term drivers of growth in the 'real economy'. So, for instance, we would expect no net accumulation of the productive capital stock K. Specifically this means setting the initial gross investment I_0 in productive capital equal to the initial depreciation δ_0:

$$I_0 = \delta_0 = r_\delta K_0, \quad (70)$$

where r_δ is the depreciation rate and K_0 denotes the value of the capital stock at time t = 0. In addition, government spending is assumed not to grow over time and government debt does not accumulate over time. This means setting initial government expenditure G_0 and the initial household income tax rate T_0 so that government achieves a fiscal balance:

$$G_0 + r_B B_0 = T_0, \tag{71}$$

where r_B is the rate of interest on government bonds (assumed constant) and B_0 is the stock of outstanding bonds at time t = 0. From equations (67) and (68) it follows that:

$$NL_0^f = NL_0^g = 0, \tag{72}$$

and hence that:

$$NL^h + NL^b = 0, \tag{73}$$

For stationary state solution, as Godley and Lavoie (2007: 73) point out, the net lending NL_0^h of the household sector must also be equal to zero. Otherwise, it is clear to that NW^h would either rise or fall, leading to rising or falling consumption. This means that the initial value C_0 of household consumption must be equal to the initial disposable income Y_0^{hd}. This can be satisfied by choosing a tax rate θ_0 at which equation (71) is satisfied. Since $T_0 = \theta_0 Y_0^h$, we can use equation (5) to deduce that:

$$\theta_0 = \frac{G_0 + r_B B_0}{W_0 + F_0^{fd} + F_0^{bd} + INT_{B_h 0} + INT_{D_h 0} - INT_{L_h 0}}. \tag{74}$$

In short, conditions (70) to (74) define an initial state consistent with a stationary solution to the model. In the following section, we illustrate this stationary state solution with specific numerical values, check its evolution over time, and explore what happens when the system is pushed away from equilibrium.

The reference case of FALSTAFF 2.0 in this working paper has been calibrated using initial values for the main economic aggregates which satisfy two criteria. First, they are consistent with the stationary state conditions defined through equations (70) to (74). Second they are in the same rough order of magnitude as those in a developed economy ‘like’ the UK. The Appendix provides input values for the scenarios explored in the following section.

4. Some Numerical Simulations and Tests

Our principal aim in this working paper is to elaborate on the innovations carried out to extend an SFC model of a closed economy called FALSTAFF, originally developed by Jackson and Victor (2015). In the previous sections we have provided an overview of the expanded model (FALSTAFF 2.0) and the principal equations governing the model’s behaviour and structural characteristics. In this section we aim to carry out some simple tests for the consistency of the model and illustrate how FALSTAFF 2.0 can be used to simulate Baumol's cost disease. Specifically, we develop four simple scenarios using the version of the model described above. These are:

1. *Stationary Case*: this scenario simply tests the ability of the two sector model to achieve a stationary state, under conditions where demand and labour productivity differ between the two sectors but remain constant over time;

2. *Baumol Case*: in this scenario we retain the assumption of constant shares of consumption in fast and slow sectors but we allow labour productivity growth to differ between the two sectors;

3. *Service Transition*: this scenario follows the assumptions of the Baumol Case but incorporates in addition a transition away from the materials intensive fast sector industries towards slow sector services;

4. *Postgrowth Transition*: the final scenario follows the assumptions of a shift in demand towards services, but introduces some additional elements implicit in the transition to a quasi-stationary postgrowth economy.

4.1. The Stationary Case

The first test of the FALSTAFF 2.0 model is to ensure that it recreates a stationary state as in the original paper (Jackson and Victor 2015). In this *Stationary Case*, the model is calibrated broadly according to empirical aggregate demand and input output data drawn from the UK in the year 2020.[9] Total initial final demand in FALSTAFF is $2 trillion; household consumption is $1.2 trillion; government spending is $500 billion and gross investment is $300 billion. Key values for various input values and exogenous parameters are shown in the Appendix. Figure 2 shows final demand (real GDP) in the *Stationary Case*.

9 Values are based broadly on data from the UK National Accounts. We use $ here rather than £ in deference to the fact that the reference values are indicative rather than exact.

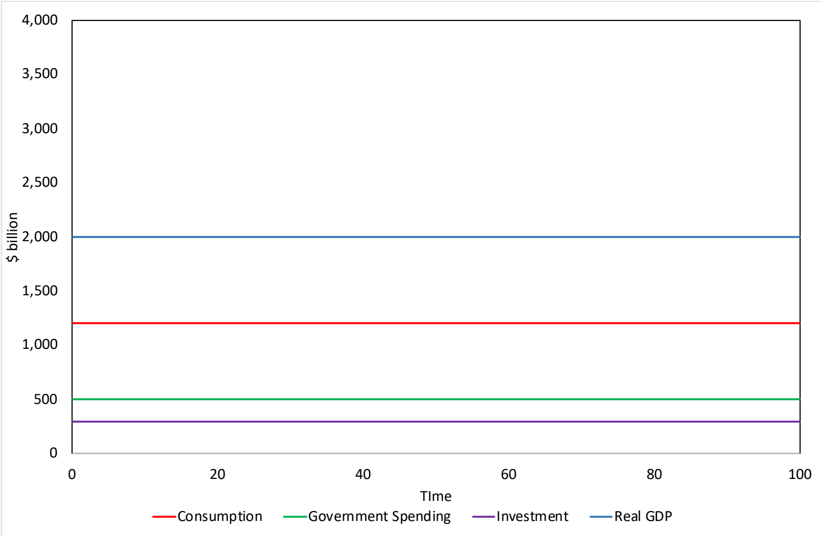

Figure 2 | Real GDP by expenditure in the Stationary Case
Source: Output from FALSTAFF 2.0

Labour productivity in the fast sector is assumed to be twice that in the slow sector but is held constant in both sectors in the stationary case (Figure 3). Government consumption is assumed to come entirely from the slow (service) sector. Gross investment demand is supplied from the fast (materials) sector. The share of household consumption from the slow sector is initially assumed to be 35% meaning that the overall share of final demand from the slow sector is about 46%—in line with empirical split between fast and slow sectors in the UK (Gallant 2023).

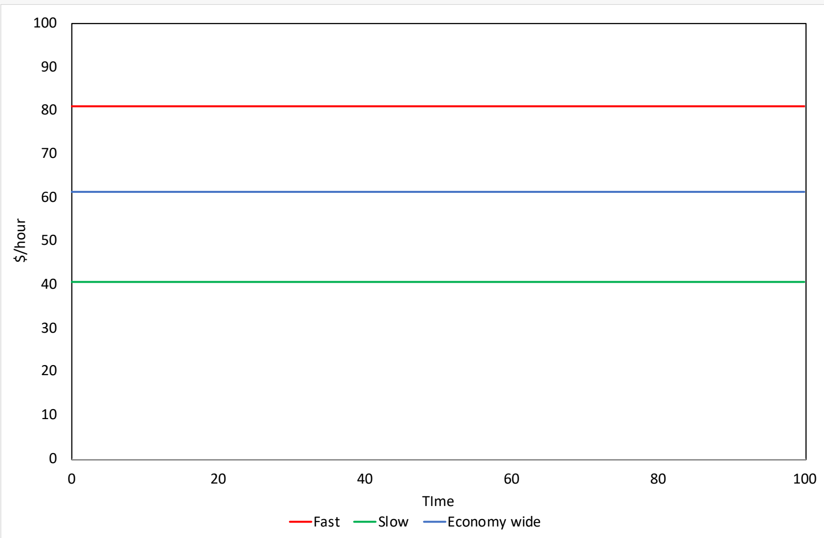

Figure 3 | Average and sector level productivity in the Stationary Case
Source: Output from FALSTAFF 2.0

The technical coefficients of the A matrix are derived broadly from a partition of the UK Input-Output data (Gallant 2023) into two sectors (fast and slow). The values chosen for the scenarios in this working paper are shown in Table 1. It is notable that the largest coefficient is the one describing fast sector consumption of fast sector goods. Not surprisingly, the production of material goods is itself materials-intensive (0.4), while the service (slow) sector also requires significant quantities of material goods (0.2). By contrast both sectors typically require fewer intermediate goods from the service (slow) sector.

A matrix	Fast	Slow
Fast	0.40	0.20
Slow	0.02	0.05

Table 3 | Initial Technical Coefficients in the FALSTAFF A-Matrix

Using the final demand split shown in Figure 2 and the Leontief derived from Table 3 it is straightforward to show that the total output in the Stationary Case is around $3.15 trillion with $2.14 trillion supplied by the fast sector and just over $1 trillion supplied by the slow sector. The gross capital stock in 2020 in the UK was around £5 trillion. We assume this is skewed more heavily towards the materials intensive fast sector. It takes kit to make kit. Specifically, for the purposes of this working paper, the fast sector capital stock was taken as $3.5 trillion while the slow sector capital stock was $1.5 trillion. The capital to output ratios of the fast and slow sectors were then 1.64 and 1.48 respectively. These numbers lead to a rate of return on capital (the profit rate) for the fast sector of just over 11% and for the slow sector of 7%, broadly in line with rates of return in the respective sectors in the UK. In the Stationary Case these rates of return remain constant (Figure 4) as do the markup on prices in each sector (Figure 5). Consequently, there is no price inflation in either sector or across the economy as a whole (Figure 6), and the shares of real final demand in each sector (Figure 7) remain constant over time. That is, there is no evidence of the Baumol effect in the Stationary Case.

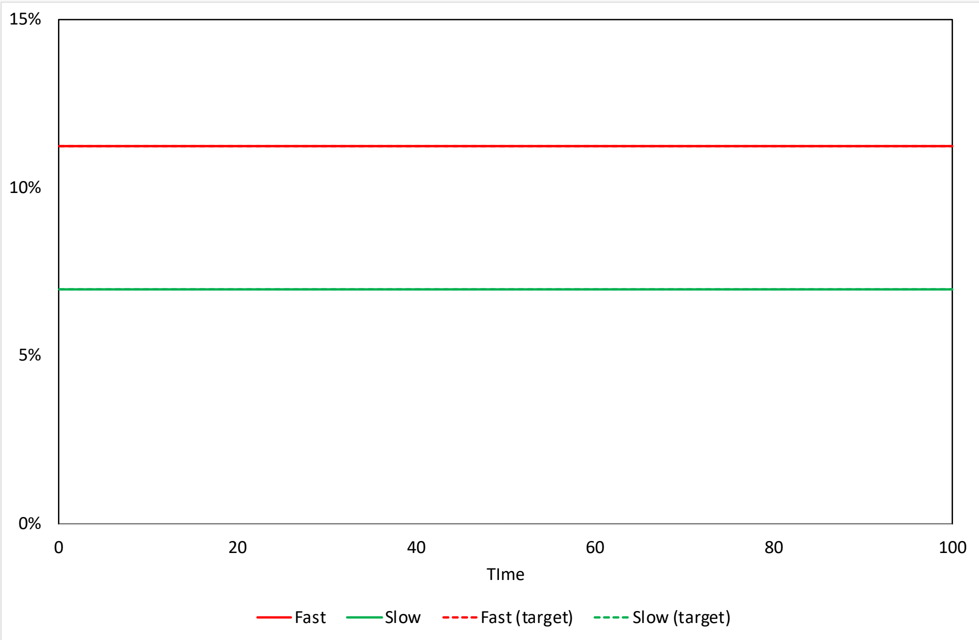

Figure 4 | Rate of return on capital (profit rate) in the Stationary Case
Source: Output from FALSTAFF 2.0

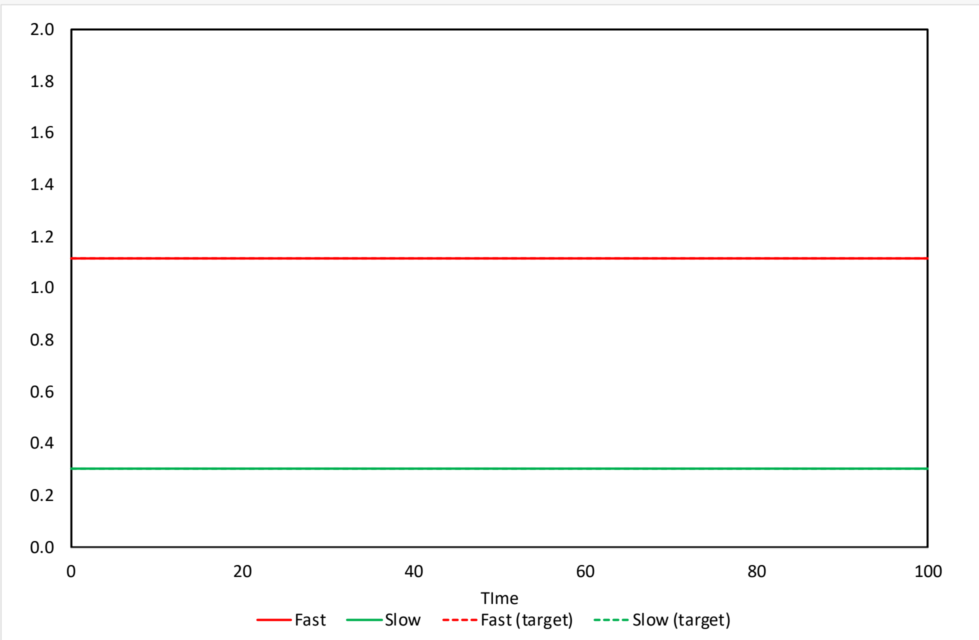

Figure 5 | Markup on prices in the Stationary Case
Source: Output from FALSTAFF 2.0

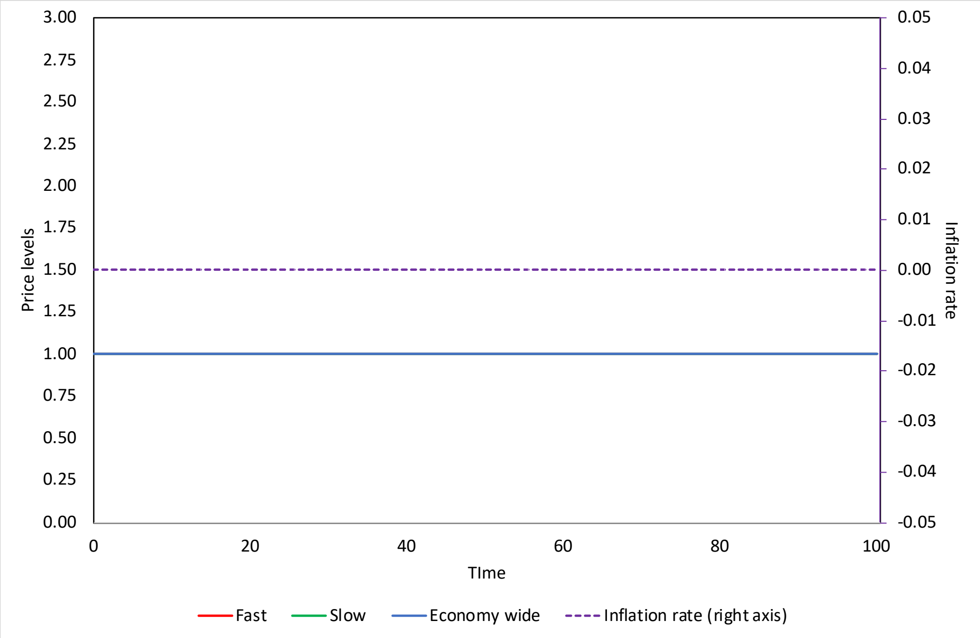

Figure 6 | Price levels and inflation in the Stationary Case
Source: Output from FALSTAFF 2.0

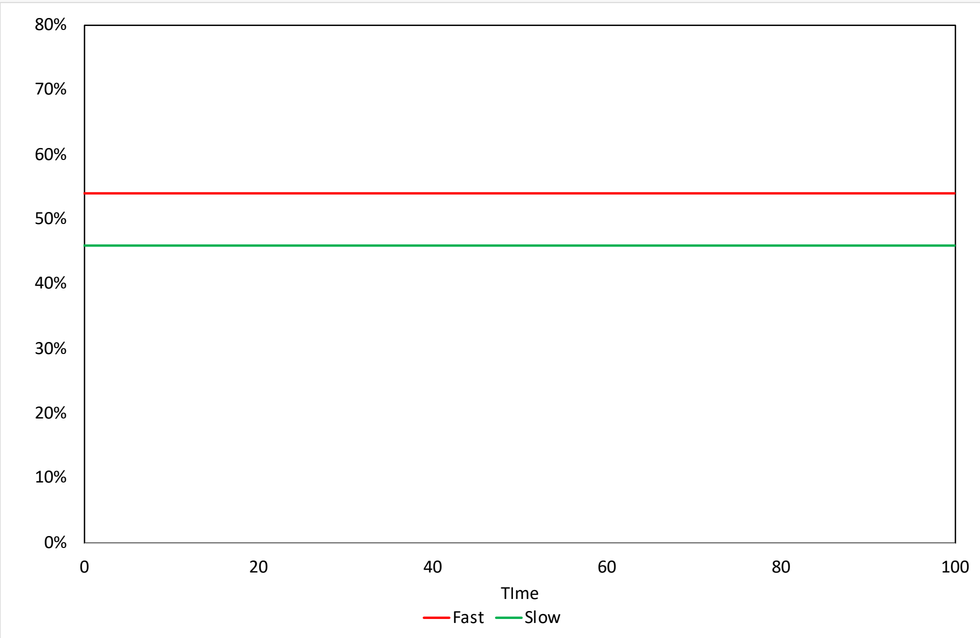

Figure 7 | Shares of real final demand in the Stationary Case
Source: Output from FALSTAFF 2.0

4.2. The Baumol Case

The aim of the previous scenario was simply to test the ability of FALSTAFF 2.0 to reproduce a stationary state economy, with no growth, no price changes, and constant shares of demand in each of the fast and slow sectors. In line with our overall aim of simulating the Baumol effect, the next step is to introduce a simple change into the calibration of the model. In the *Baumol Case*, labour productivity in the fast sector is deemed to *increase* at a steady 0.5% per annum. In the slow sector, it is deemed to *decrease* at 0.5% per annum. In other words, service based activities are deemed to become more labour intensive over time rather than less. These numbers are chosen primarily for illustrative purposes. However, in an economy such as the UK where labour productivity is close to being stagnant (Jackson 2019) and where high-tech industries (for instance) still exhibit productivity growth, it stands to reason that this growth is being offset by declines in productivity elsewhere. A plausible justification for this is that the labour intensity of certain kinds of service type activities may increase for a variety of reasons, including of course the desire to allocate more time rather than less to human services such as health care, social care, education, renovation, crafts and creativity, where it is the time that people spend working that creates value.

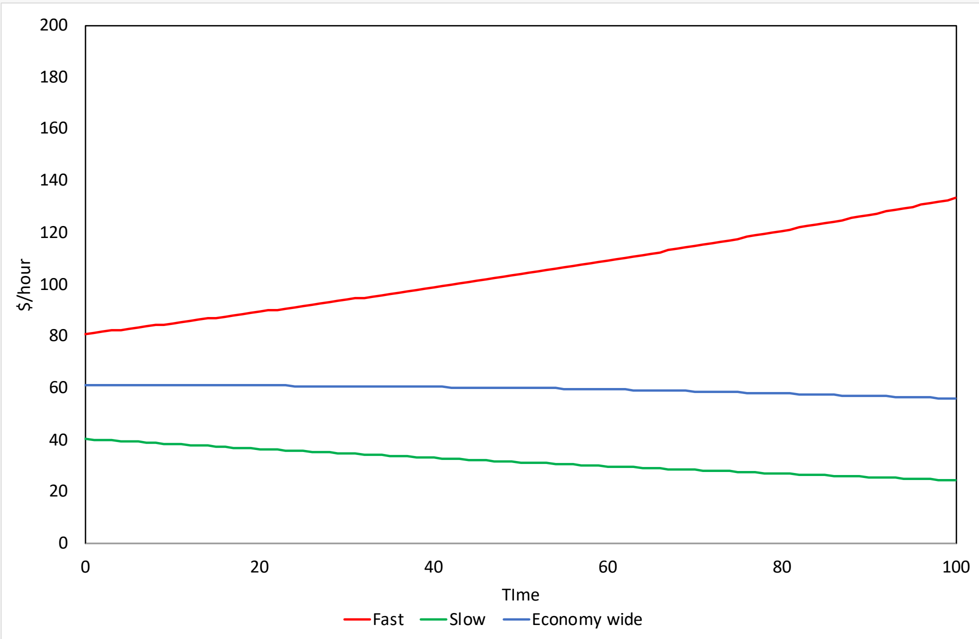

Figure 8 | Productivity (output per hours worked) in the Baumol Case
Source: Output from FALSTAFF 2.0

Irrespective of the validity of such assumptions, these differential productivity rates (0.5% in the fast sector, - 0.5% in the slow sector) serve to illustrate the conditions under which the Baumol cost disease is expected to arise. Figure 8 (above) illustrates how labour productivity (measured as output per hour worked) changes in the Baumol Case. The overall labour productivity depends on the evolution of the economy itself under these conditions. Notably economy-wide productivity declines because the real share of the slow sector in the economy rises (from 46% to over 60%), exactly as predicted by Baumol (Figure 9).

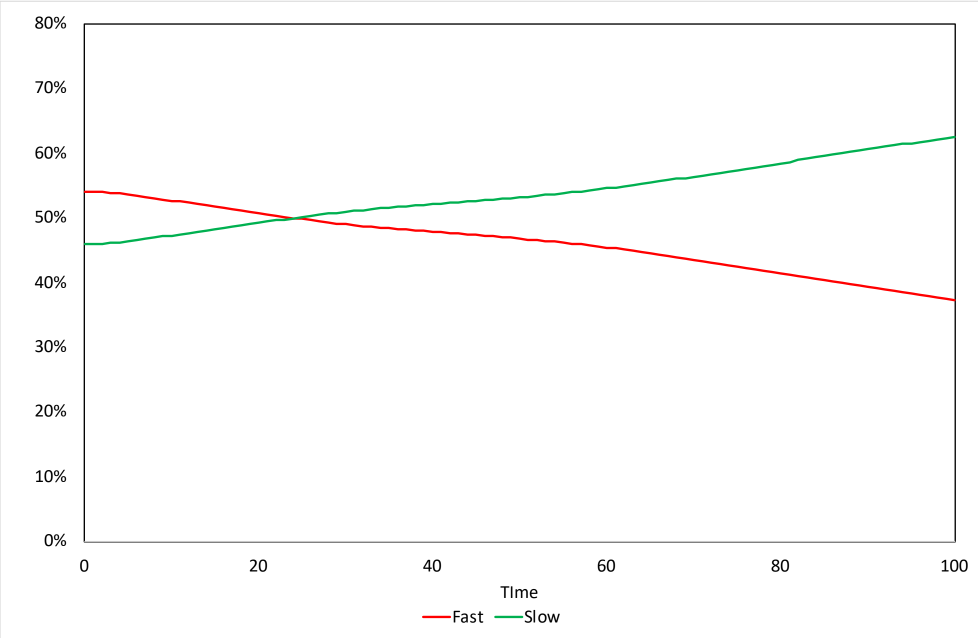

Figure 9 | Shares of real final demand in the Baumol Case
Source: Output from FALSTAFF 2.0

Neoclassical theory supposes that wage rate growth follows labour productivity growth. Typically, therefore we might expect wage rates to grow at the same rate as productivity growth. Baumol's hypothesis suggests that although this may happen in the fast sector, wage rate increases there inflate wage rates across the economy as a whole. Indeed it is this dynamic, in which wage rates in the slow sector rise faster than labour productivity in that sector, which gives rise to the Baumol effect. For the purposes of our *Baumol Case*, we assume (Figure 10) that wages follow labour productivity growth in the fast sector and that in the slow sector wage rate growth falls somewhere between labour productivity growth in the fast sector and labour productivity growth across the economy has a whole.[10]

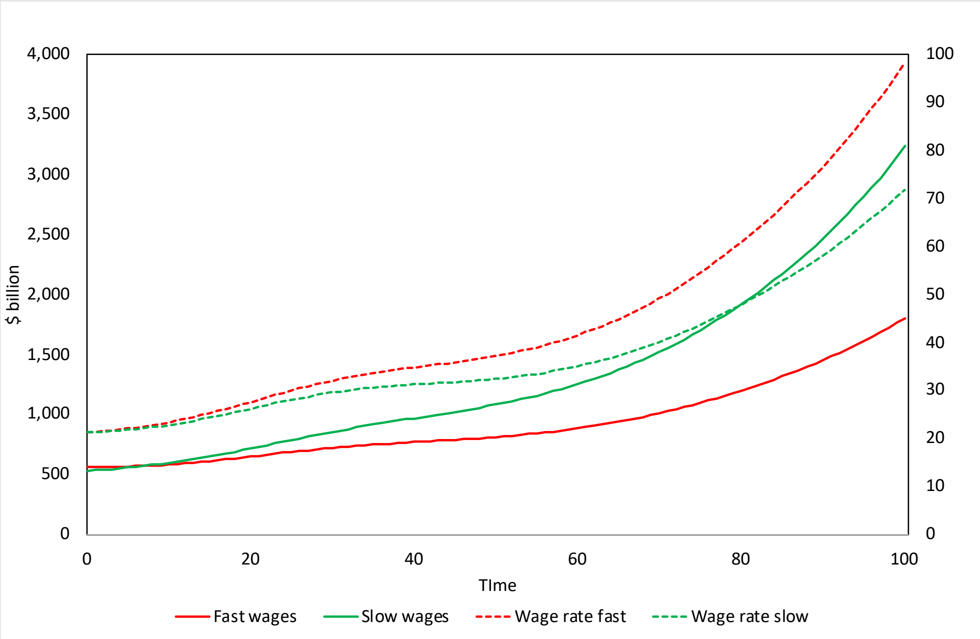

Figure 10 | Wage rates and the wage bill in the Baumol Case
Source: Output from FALSTAFF 2.0

Figure 10 illustrates two important features of the Baumol Case. On the one hand, slow sector wages fall below fast sector wages, either as a result of the poor bargaining power of workers in the absence of labour productivity growth, or else because of a willingness to work at lower wages because of the 'immaterial value' (van der Ploeg 2006) in slow sector professions. On the other hand, the fact that wage growth in the slow sector is faster than labour productivity growth in that sector means that the wage bill rises in real terms across the sector as a whole. Faced with this rise in costs, producers in the slow sector are faced with a choice, either to cut dividends to shareholders, or to cut investment, or else to raise prices. In FALSTAFF 2.0 we assume that investment is driven by expected output (ie independently of margins) and that prices are set explicitly to cover the desired return on investment. It follows that the rising wage bill in Figure 10 has an inflationary impact on price levels, particularly in the slow sector, as illustrated in Figure 11.

10 FALSTAFF 2.0 allows the user to set the impact of fast sector labour productivity growth on the wage growth in each sector independently. For the purposes of this scenario, real wage rate growth in the slow sector was set half way between average productivity growth and fast sector productivity growth.

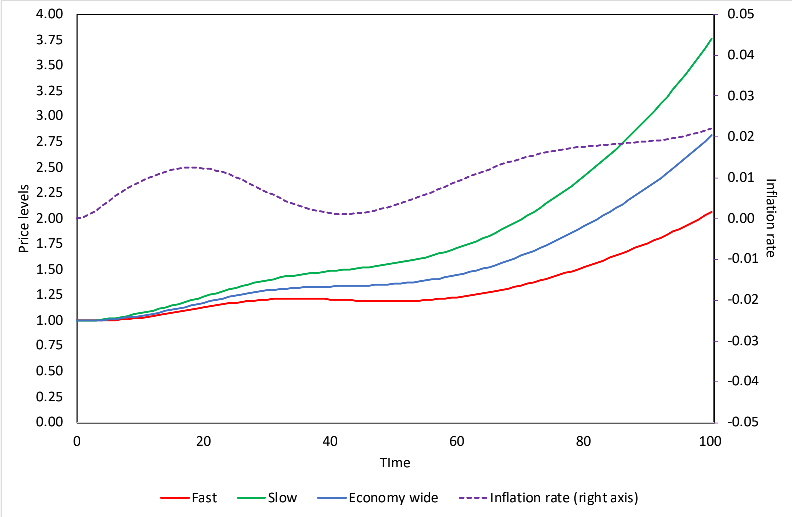

Figure 11 | Price levels and the overall inflation rate in the Baumol Case
Source: Output from FALSTAFF 2.0

There is another notable outcome of the Baumol effect—namely, its impact on government finances. The government typically spends more on slow sector services than on fast sector goods. In FALSTAFF 2.0, we assume that all government purchases are slow sector goods. Consequently, the state finds itself particularly susceptible to real increase in its spending needs. Unless it cuts spending in real terms or raises taxes, the Baumol effect will tend to lead to primary deficits which add to the national debt. In a quasi-stationary state scenario such as this one in which the growth rate remains close to zero (Figure 12), this is likely to increase the debt-to-GDP burden.

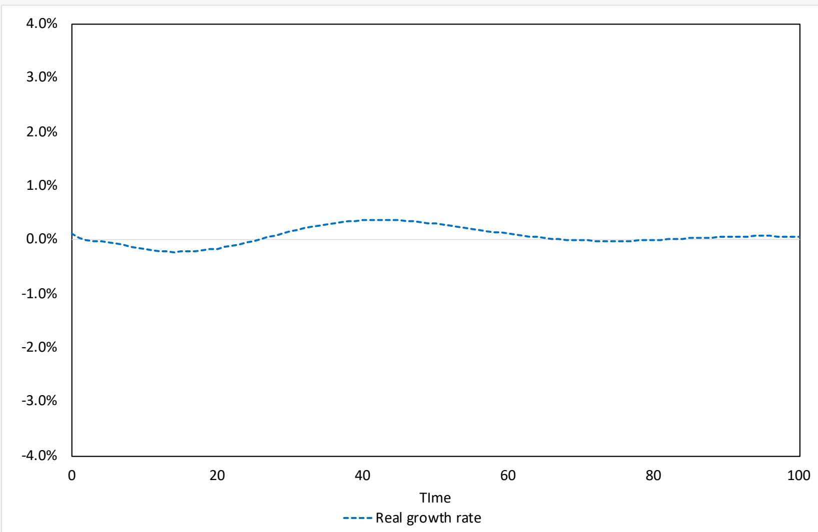

Figure 12 | Growth rate in real GDP in the Baumol Case
Source: Output from FALSTAFF 2.0

Figure 13 illustrates that in the Baumol Case, the debt-to-GDP ratio has risen from 66% to more than 160%, in the absence of either spending cuts or tax rises. Not surprisingly, government spending has also risen in real terms as a proportion of final demand from about 25% to 31% of final demand, because of the rising relative price of slow sector goods. Typically, the Baumol effect tends to increase the influence of the state on the economy. But the extent of this effect depends on other conditions across the economy as it evolves. One of the advantages of SFC modelling is the ability to elucidate these kinds of connections between and across sectors. In later scenarios we shall see that the potentially problematic rise in government debt to GDP is attenuated.

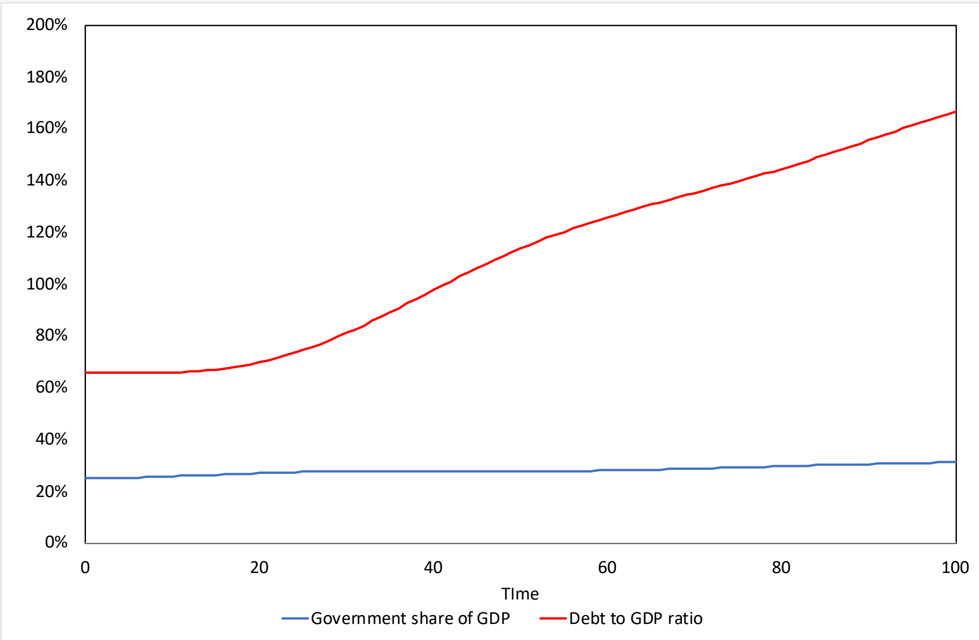

Figure 13 | The impact of the Baumol effect on government in the Baumol Case
Source: Output from FALSTAFF 2.0

4.3. The Service Transition

In the *Baumol Case*, the rising real share of the slow sector is an emergent property of the price effect. Households demand the same quantity of services; but the rising relative cost of these services leads them to occupy a greater share of real final demand. If underlying consumer demand itself were to change, this effect could be exacerbated. For example, in the case of a 'postgrowth' transition towards materially-light, labour intensive human services of the kind envisaged by Jackson (2017) and Jackson and Victor (2020), an even bigger proportion of final demand would be occupied by services—and this would lead potentially to an exaggeration of the Baumol effect.

The *Service Transition* simulates such a scenario. Over the course of the scenario, households are deemed to increase their consumption of services from 35% to 80% of household demand and to reduce their consumption of material goods from 65% to 20% of demand. For the purposes of this working paper, we are not concerned with the precise mechanisms or motivations for this transition. Rather we ask what happens structurally in the economy, if such a transition takes place. But clearly, the provision of services from the slow sector still calls up material demand from the fast sector in two specific ways. Firstly, it's not possible to deliver services without intermediate (material) inputs from the fast sector. Secondly, the delivery of services still requires capital infrastructure which is provided by the fast sector. Assessing the overall impacts of such changes is one of the benefits of a simulation model such as FALSTAFF.

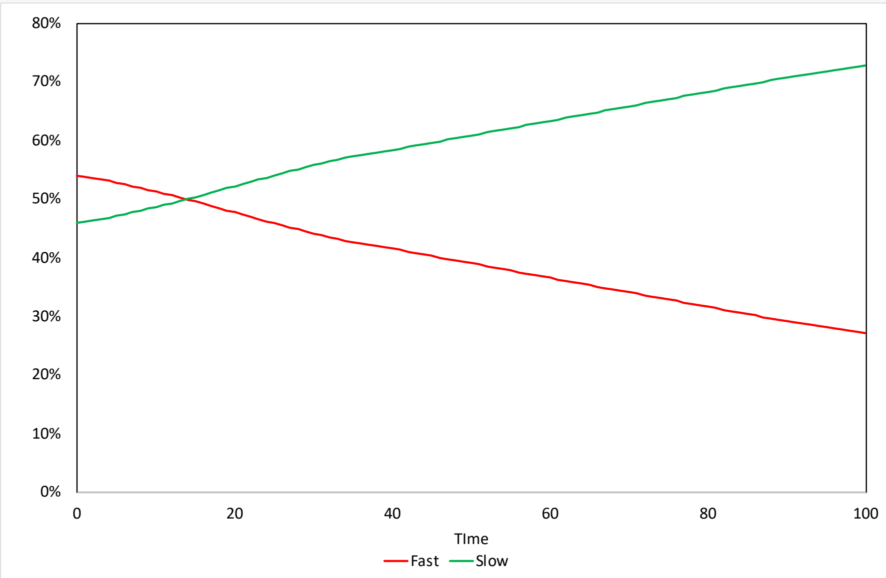

Figure 14 | Shares of real final demand in the Service Transition
Source: Output from FALSTAFF 2.0

Figure 14 illustrates what happens to shares of real final demand under the *Service Transition*. The demand for fast sector goods falls to 27% will the demand for slow sector goods rises to 73%. Interestingly, the impacts of this scenario are slightly better in terms of the relative price of slow sector goods (Figure 15), the wage bill for slow sector firms (Figure 16) and the financial position of the government sector (Figure 17). The reason for this is that as the fast sector reduces its size, the impact of the pull of higher fast sector wages on the economy as a whole is diminished. Paradoxically then, the Baumol effect becomes less intrusive rather than more intrusive in an economy which is moving more towards services.

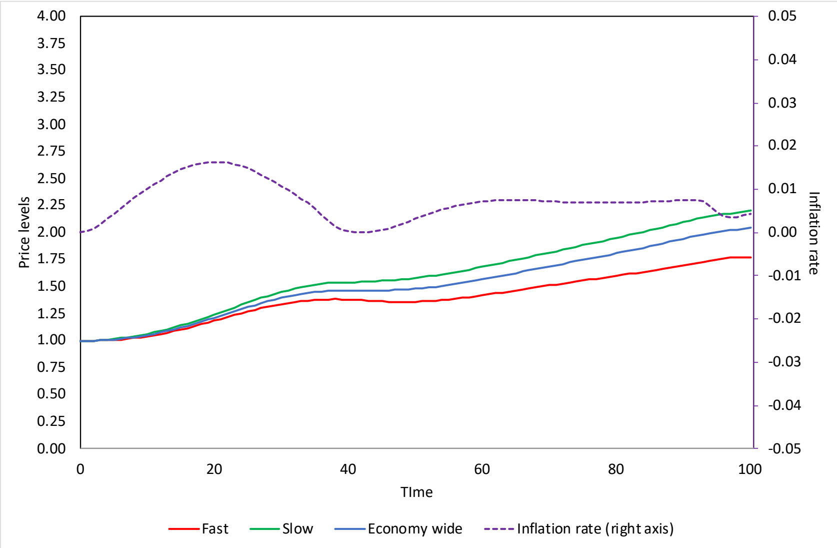

Figure 15 | Price levels and the inflation rate in the Service Transition
Source: Output from FALSTAFF 2.0

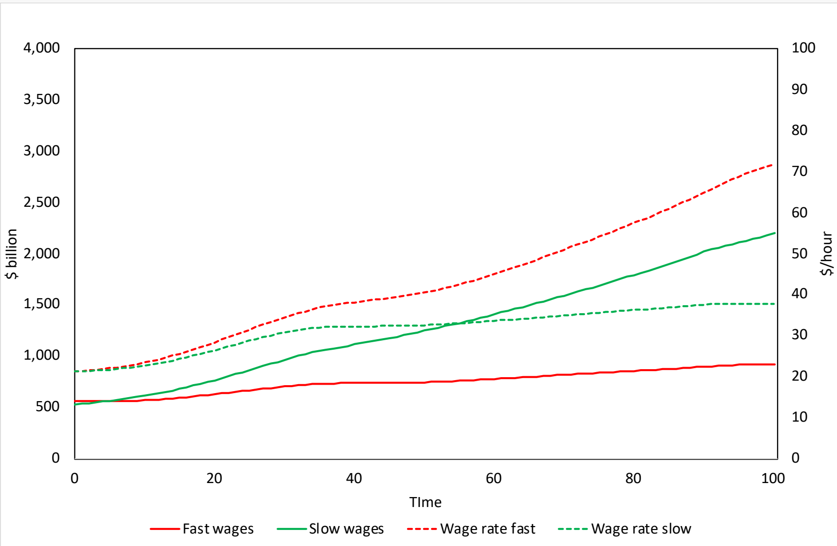

Figure 16 | Wage rates and the wage bill in the Service Transition
Source: Output from FALSTAFF 2.0

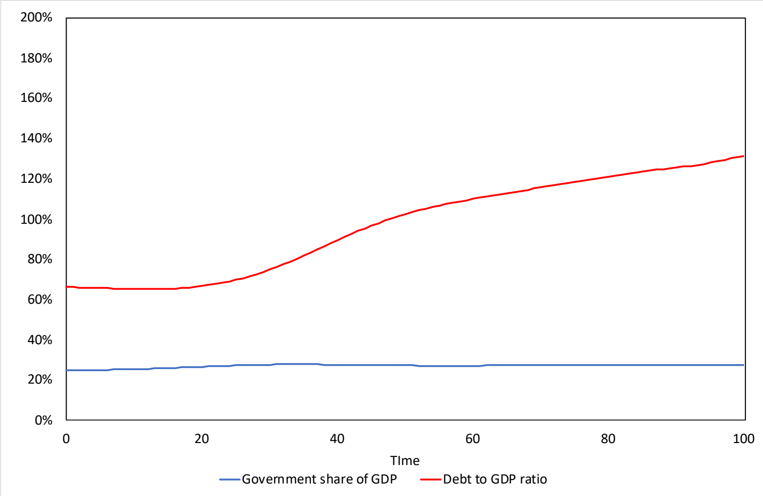

Figure 17 | The impact of the Baumol effect on government in the Service Transition
Source: Output from FALSTAFF 2.0

4.4. The Postgrowth Transition

In the final scenario we model a *Postgrowth Transition* with a couple of additional characteristics, over and above the greater demand for services and lower demand for material goods. First, we assume that labour productivity growth rates in both sectors converge towards zero. Labour productivity in (slow sector) services stops declining as the demand for greater labour intensity is satisfied and labour productivity growth in (fast sector) material goods production attenuates further. Secondly, we model a steady decline in the desired profit rate in the fast sector, so that by the end of the scenario period, the profit rate in both sectors is equal (Figure 18).

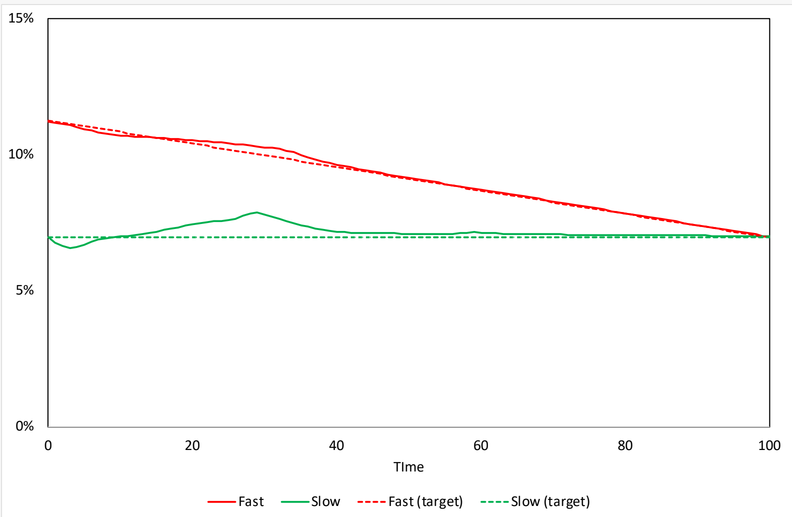

Figure 18 | Rate of return on capital (profit rate) in the Postgrowth Transition
Source: Output from FALSTAFF 2.0

Again, we don't speculate here on motivations or mechanisms. The idea of a long term decline in labour productivity growth at the margin has been mooted for a variety of reasons (Gordon 2016, Jackson 2019). The use of new technological ways of delivering services to improve labour productivity—or prevent its decline—is a recurrent theme in the literature on the future of work (Mair et al 2018). The point of the exercise in this working paper is to explore the evolution of prices, the stability of the economy, and the impact of the Baumol effect under different conditions. In particular, we are interested in its impact under postgrowth conditions when growth in the GDP remains close to zero (Figure 19).

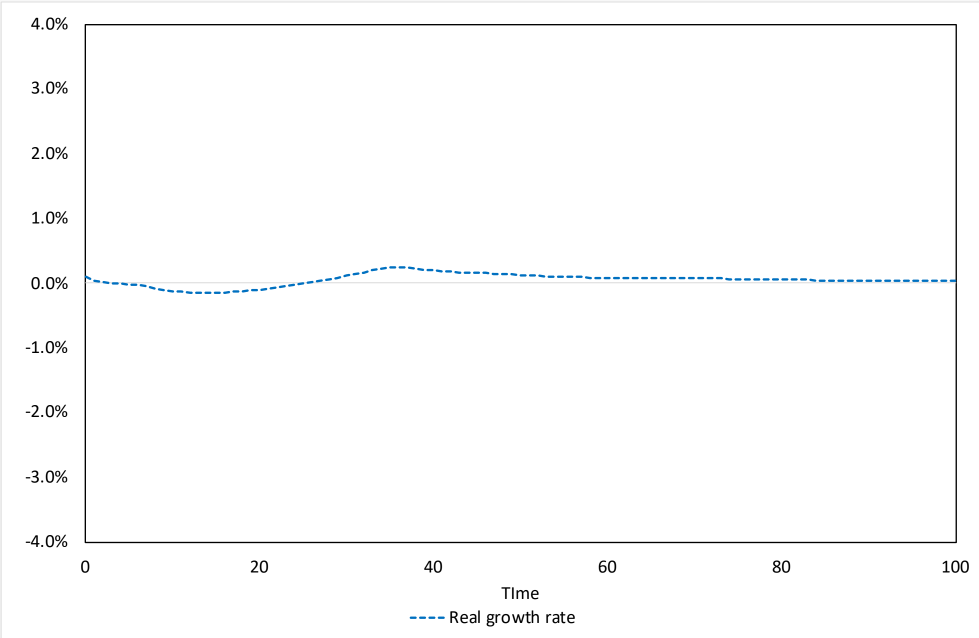

Figure 19 | Real GDP growth rate in the Postgrowth Transition
Source: Output from FALSTAFF 2.0

The Baumol effect is still in evidence. Relative prices are higher in the slow sector (Figure 20) and the wage bill is higher (Figure 21). But by comparison with both the *Baumol Case* and the *Service Transition*, there is less disparity between sector prices and less inflationary pressure overall. Consequently, there is also less pressure on public finances. The debt to GDP ratio (Figure 22) has stabilised at a lower level by the end of the run and the share of government spending in the economy is no higher than it was at the start of the scenario.

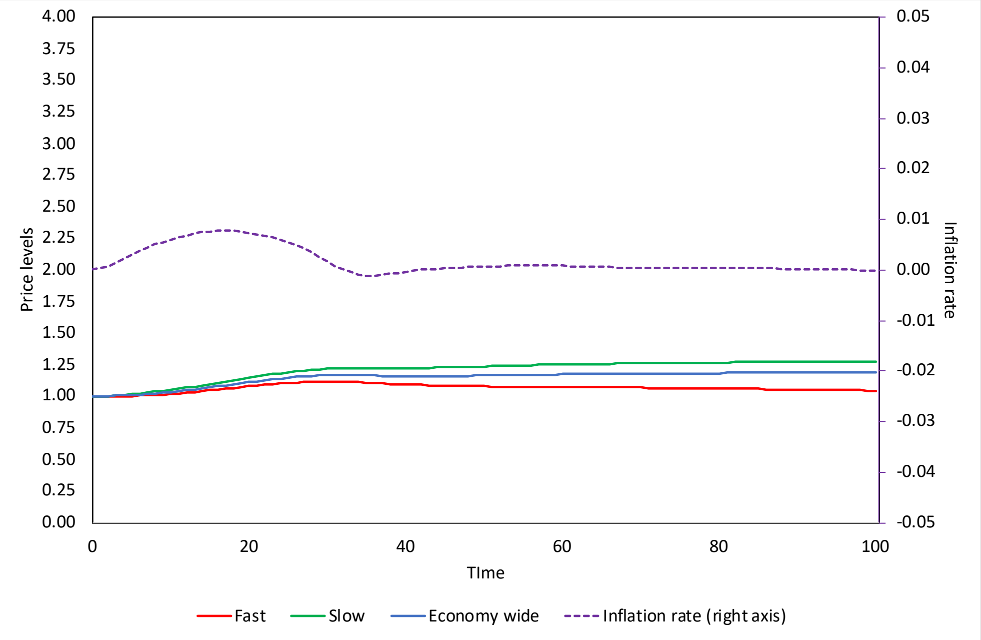

Figure 20 | Price levels and the inflation rate in the Postgrowth Transition
Source: Output from FALSTAFF 2.0

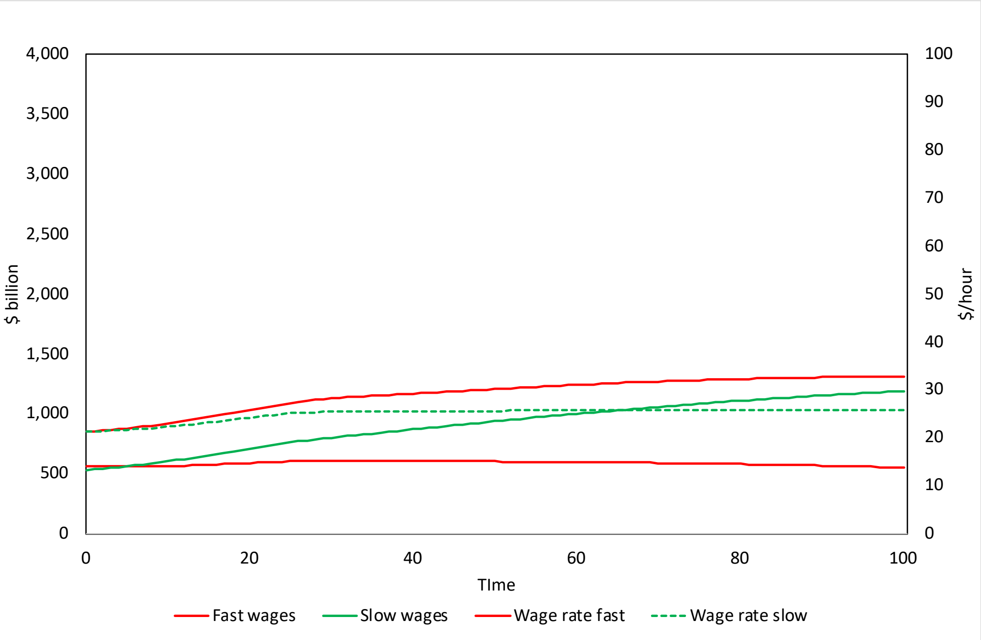

Figure 21 | Wage rates and the wage bill in the Postgrowth Transition
Source: Output from FALSTAFF 2.0

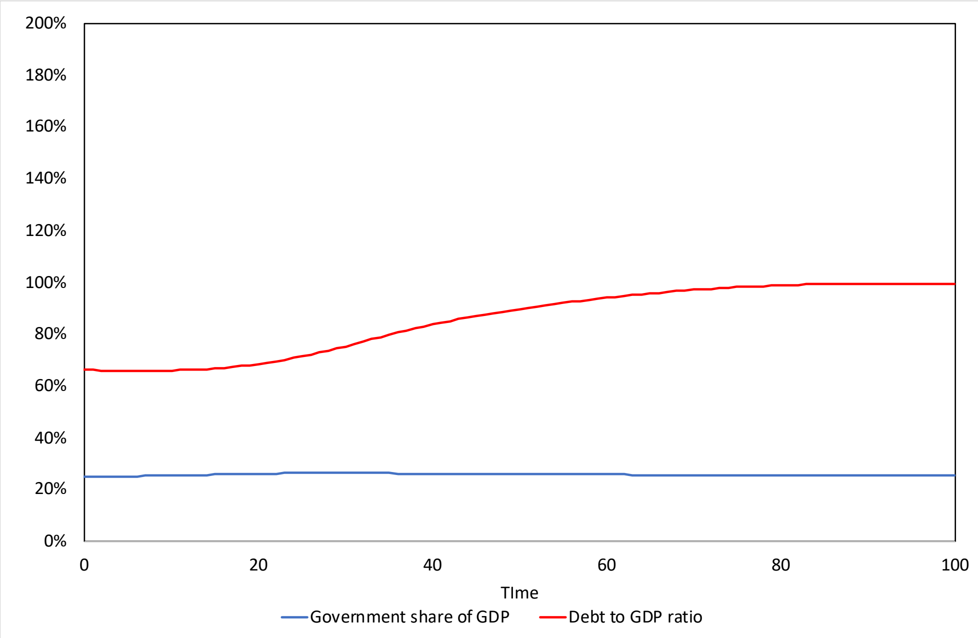

Figure 22 | The impact of the Baumol effect on government in the Postgrowth Transition
Source: Output from FALSTAFF 2.0

A strict requirement of SFC modelling is that the sum of the net lending positions is equal to zero. A key indicator of financial stability (as intimated in Section 3) is that the net lending positions of the different sectors do not diverge significantly over time. Figure 23 illustrates both of these requirements for the case of the *Postgrowth Transition*. There is clearly some divergence in net lending—specifically households run a surplus while governments run a deficit—in the early stages of the scenario. However, in relation to the scale of the economy as a whole, this difference in net lending positions is unlikely to lead to financial instability. Moreover, from around a third of the way through the scenario, the net lending positions converge until by the end of the run, they are almost entirely balanced. On a closer inspection of the firms sectors, it can be seen that the net lending positions of the fast and slow sectors are diverging over the run. Not surprisingly, the slow sector is borrowing in order to expand as a proportion of the economy while the fast sector is divesting as it contracts. As the economy reaches a quasi-stationary state, these differences would also be expected to abate. But they may require some fiscal mechanisms—some form of tax or subsidy to support the slow sector—during the transition.

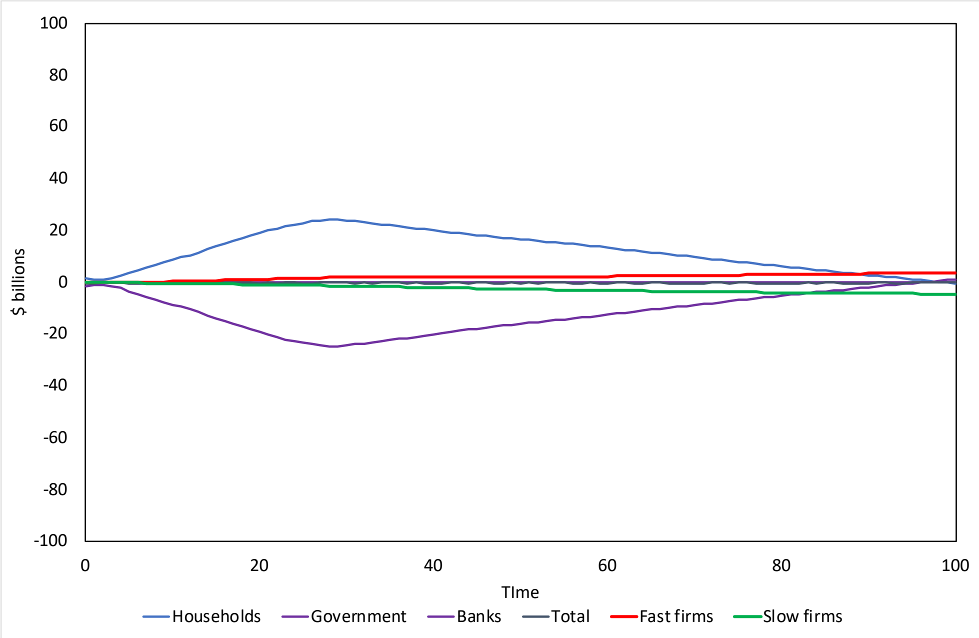

Figure 23 | Net lending by sector in the Postgrowth Transition
Source: Output from FALSTAFF 2.0

5. Discussions and Conclusions

One of the most extraordinary conceits of modern economics is its insistence only on exploring in depth the economics of growth-based economies. The idea of a 'postgrowth economics' is so much an anathema to most economists that barely a handful of attempts exist to explore how economies might work when they are not designed to be growing indefinitely. If economic growth were guaranteed or if it could be shown unequivocally that infinite growth is compatible with a finite planet, such hubris might be forgivable. Neither of these things pertain. It is entirely questionable that the world can achieve its climate goals—for instance to remain within 1.5 degrees temperature rise above the pre-industrial average—or its aims to reverse biodiversity loss by 2030—while still expanding the economy relentlessly year on year. But perhaps even more striking is that growth rates have been declining on trend for several decades—particularly in the advanced economies. In a world where growth is absent—for whatever reason—the failure of conventional economists to explore the dynamics of a 'postgrowth economy' is nothing short of dangerous.

This working paper is part of a long-standing project to rectify that deficiency. In an earlier paper Jackson and Victor (2015) demonstrated the feasibility, under certain conditions, of a stationary or quasi-stationary state economy, even in the presence of capitalistic institutions such as credit money creation. This paper builds on the FALSTAFF model developed there to explore the feasibility of postgrowth economies in the presence of the Baumol effect, which appears to penalise the materially-light, service-based activities on which a transition to a sustainable prosperity depends. Our aim was neither to provide an exhaustive account of the postgrowth economy nor to ground the exploration rigidly in empirical data. Rather, the intention was to elaborate on the extensions to the original FALSTAFF model and to demonstrate its suitability to address the challenge posed by the Baumol effect. In brief, we wanted to simulate what happens when an economy shifts towards labour-intensive, service-based activities and away from materially-intensive, high productivity activities.

The scenarios in Section 4 were designed to demonstrate the ability of the model: 1) to reproduce a stationary state economy with two firms sectors and differing labour productivities (*Stationary Case*); 2) to illustrate various aspects of the Baumol effect (such as the increased wage burden on the slow sector) in the presence of differential labour productivity growth (*Baumol Case*); 3) to explore the impact of intensifying the service-orientation of the economy (*Service Transition*); and 4) to understand how elements of a postgrowth transition (such as a less intense focus on profit maximisation) might mitigate some of the Baumol impacts (*Postgrowth Transition*).

It goes without saying that this exercise—and the underlying model—is subject to numerous caveats and limitations. The FALSTAFF 2.0 economy is closed—it does not account for international trade or currency exchange issues that may impose additional challenges on the postgrowth transition. The scenarios presented here take no account of demographic challenges to pension or welfare provision. There is no inflationary impact from high employment rates.[11] No taxes are imposed on firms in the scenarios shown in Section 4—though the model has the potential to impose them. We have not attempted here to model environmental impacts of the transition such as the reduction in carbon emissions or the impact of stranded assets. Finally, we have not explored the distributional implications of the scenarios simulated here—though again, FALSTAFF 2.0 has the potential to explore these in some degree. All of these aspects of postgrowth economics are currently being explored further in projects under the CUSP portfolio[12].

11 Some versions of the model employ a Philips curve to reflect the impact of higher or lower employment on wages. But in the scenarios presented here it is not used. Working hours are endogenously altered to ensure a stable rate of unemployment.

12 For further details see: www.cusp.ac.uk. See in particular: Corlet Walker and Jackson 2022; Jackson and Jackson 2021; Jackson and Victor 2020; Jackson and Victor 2021.

Doubtless further challenges will arise as these projects progress. Postgrowth economics may be in its infancy. But that is no justification, in our view, for ignoring its importance to society, particularly under current conditions.

In summary, this working paper has described certain extensions to the FALSTAFF model and illustrated its ability to assess the feasibility (under certain conditions) of achieving a broadly stationary state economy in the presence of the Baumol effect. We have demonstrated that under certain conditions, the slow sector may find itself penalised by rising wages driven by productivity growth in the fast sector. But we have also shown how, under certain conditions these penalties are attenuated. In short, the Baumol cost disease requires attention from policy but it does not, in principle, rule out the potential for a stationary or quasi-stationary post growth economy.

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Appendix A | Glossary of Terms

	Roman alphabet
$\underline{A}$	Matrix of technical coefficients
a_{ij}	Technical coefficient—goods required by sector *i* from sector *j* to produce a unit of goods from sector *i*
B, B^h, B^b, B^{cb}	Nominal total government bond stock, of households, of banks, of the central bank
B	Nominal target bond holdings by banks
$B_{purchase}$	Nominal bond purchases by banks
C, C_S, C_F	Nominal household consumption: total, fast, slow
c, c_S, c_F	Real household consumption: total, slow, fast
CAR	Capital adequacy ratio
D, D^f, D^h	Nominal stock of deposits: total, firms, households
E, E^b, E^f	Nominal stock of equities: total, banks, firms
$F^f, F^{fd}, F^{fr},$	Nominal profits of firms: total, distributed, retained
F^b, F^{bd}, F^{br}	Nominal profits of banks: total, distributed, retained
FD, FD_S, FD_F	Nominal final demand: total, slow sector, fast sector
G	Nominal government spending
$GCFC$	Aggregate demand for gross fixed capital formation
GDP, GDP_e, GDP_i	Nominal gross domestic product, expenditure terms, income terms
gdp	Real gross domestic product
H, H_S, H_F	Total hours worked, in the slow sector, in the fast sector
h	Hours per worker per annum
I_i, I_i^{net}	Nominal gross (net) investment of sector *i*
IP_S, IP_F	Nominal intermediate purchases by sector: slow, fast: note these also represent the intermediate sales by sector: fast, slow (respectively)
INT_{B^h}	Nominal interest paid (eg) on bonds held by households
INT_{L^h}	Nominal interest on (eg) household loans
INT_{D^h}	Nominal interest paid on (eg) household deposits
INT_f^{net}	Nominal net interest paid (eg) by firms
IP_i	Intermediate purchases by sector *i*
K, K_S, K_F	Nominal capital stock, of the slow sector, of the fast sector
k, k_S, k_F	Real capital stock, of the slow sector, of the fast sector
$\underline{L}$	Leontief inverse matrix
L, L^f, L^h	Nominal stock of loans: total, firms, households
$M_S, M_F, M_S^\tau, M_F^\tau$	Mark-up over costs: slow sector, fast sector, target slow, target fast
N	Total number of workers in the labour force
NL^h	Nominal net lending of (eg) households
NW^h	Nominal net worth of (eg) households
nw^{he}	Real expected net worth of (eg) households
$\bar{P}, P_S, P_F$	Price levels: average, slow sector, fast sector
R	Nominal bank reserves
r_B, r_D, r_L, r_δ	Interest rate paid on government bonds, on deposits, on loans, rate of depreciation of capital
S, S_S, S_F	Nominal sales: total, slow sector, fast sector
s, s_S, s_F	Real sales: total, slow sector, fast sector
T^h	Total household income tax
U	Unemployment rate
UC_S, UC_F	Unit cost of production: slow sector, fast sector
W, W_S, W_F	Nominal wage bill: total, slow sector, fast sector
X, X_s, X_f	Nominal output: total, slow sector, fast sector
Y^h, Y^{hd}	Nominal household income, disposable income
y^h, y^{hd}, y^{hde}	Real household income, disposable income, expected disposable income

Appendix B | Table of Initial Input Values

Variable	Variable description	Value	Justification
a_{FF}	Intermediate consumption (fast to fast parameter)	0.4	Based on partition of the UK IO tables (Gallant 2023, Table 6)
a_{FS}	Intermediate consumption (fast to slow parameter)	0.2	Based on partition of the UK IO tables (Gallant 2023, Table 6)
a_{SF}	Intermediate consumption (slow to fast parameter)	0.02	Based on partition of the UK IO tables (Gallant 2023, Table 6)
a_{SS}	Intermediate consumption (slow to slow parameter)	0.05	Based on partition of the UK IO tables (Gallant 2023, Table 6)
α_1	Propensity to consume from income	0.85	Typical of values used in SFC models, eg Jackson and Victor 2015 Jackson et al (2016) estimate value for Canada of 0.89
α_2	Propensity to consume from wealth	0.04	Typical of values derived in SFC models, eg Jackson and Victor 2015. Jackson and Victor (2016) estimate value for Canada of 0.04.
β	Partial adjustment coefficient for markup	0.5	Reasonable assumption that firms adapt relatively quickly to discrepancy from target returns.
C	Consumer spending	\$1.2 tr	Typical proportion of final demand for an advanced economy like the UK
c_S/c	Initial share of spending on services (slow sector)	35%	Based on partition of UK data
δ	Initial depreciation	\$0.3 tr	Using depreciation rate of 6%.
FD	Initial final demand	\$2 tr	Loosely based on final demand in the UK in 2020
G	Initial gov spending	\$0.5 tr	Typical proportion of final demand for an advanced economy like the UK
g_S/g	Initial share of gov spending on slow sector	100%	We assume that government is mainly purchasing services
γ	Partial adjustment coefficient for investment	0.1	Typical for SFC models (eg Lavoie and Godley 2001, Jackson and Victor 2015)
h	Initial hours worked per year per worker	1700	Average hours worked in the OECD in 2021 was 1716 (OECD 2023)
I	Initial gross investment	\$0.3 tr	By construction to be equal to initial depreciation.
K	Initial capital stock	\$5 tr	Based on size of capital stock in the UK in 2020.
$\kappa^{\tau}_{F,S}$	Initial capital to output ratio in fast, slow sectors	1.64, 1.48	Average capital to output ratio based on initial capital and initial output is 1.59. Fast sector deemed to have higher, slow sector lower capital to output ratio.
$\mu_{F,S}$	Initial wage rate in fast, slow sector	\$21/hr	Calculated to give approximate proportion of wages in income-based GDP (UK data)
$\eta_{F,S}$	Initial labour productivities in fast, slow sectors	\$81/hr \$41/hr	In the UK in 2015 labour productivity of the fast sector 41 (£/hour) and the labour productivity of the slow sector is 27 (£/hour) (Gallant 2023, Table 4.3)
$\hat{\eta}_{F,S}$	Initial labour productivity growth (except in stationary case).	+0.5%, -0.5%	By construction in Baumol case. Labour productivity growth in the UK has been close to zero for several years. (Jackson 2019)
P	Initial price levels	1	Abstraction for convenience

$\rho^{\tau}_{F,S}$	Target profit rates in fast, slow sector	11.2%, 7%	The rate of return on private non-financial companies varied between 10.1% and 9.3% in 2019 (ONS 2020)
r_b	Bond rate	2%	Interest rates on government bonds varied between a maximum of 5.32% and a minimum of 0.37% for the UK between 2000 and 2021.
r_δ	Depreciation rate on capital	6%	Oulton and Wallis (2015) estimate UK depreciation rate as varying from 4.82% to 6.17% between 1995 and 2010.
r_l	Loan rate	5%	Loans to small and medium sized enterprises were in the range 3.5 - 5% in 2022. (Bank of England 2022)
r_d	Deposit rate	1%	Reasonable approximation: Interest rates on fixed time deposits ranged from 0.64% to 1.58% in the UK in 2022. (Bank of England 2022).
θ	Initial household tax rate	30%	By construction (see Section 3.5). OECD (2021) reports an average income tax rate of 24.6% across the OECD in 2021.
ψ	Banks desired reserve ratio	5%	Reserve ratios vary widely according to economic conditions. Between 2005 and 2005 they varied between 4% and 6% in OECD countries (OECD 2018).
X	Output	$3.2 tr	Calculated from final demand using A matrix

Appendix C | Initial Balance Sheet and Transaction Flow Matrices

Balance Sheet

	Households	Fast firms	Slow firms	Banks	Central Bank	Government	Totals
Net Financial Assets	4320	-2100	-900	0	0	-1320	0
Assets	6320	1400	600	4860	225	0	13405
Deposits	2500	1400	600				4500
Loans				4500			4500
Firms equities	2500						2500
Banks equities	360						360
Bonds	960			135	225		1320
Reserves				225			225
Liabilities	2000	3500	1500	4860	225	1320	13405
Deposits				4500			4500
Loans	2000	1750	750				4500
Firms equities		1750	750				2500
Banks equities				360			360
Bonds						1320	1320
Reserves					225		225

Transaction Flow Matrix

	Households	Fast firms		Slow firms		Banks		Central Bank	Government	Totals
		Current	Capital	Current	Capital	Current	Capital			
Consumption F	-780.0	780.0								0.0
Consumption S	-420.0			420.0						0.0
Gov spend F		0.0							0.0	0.0
Gov spend S				500.0					-500.0	0.0
Wages F	563.0	-563.0								0.0
Wages S	533.8			-533.8						0.0
Taxes on households	-521.9								521.9	0.0
Net intermediate sales		159.9		-159.9						0.0
Dividends F	393.4	-393.4								0.0
Dividends S	104.7			-104.7						0.0
Dividends Banks	182.7					-182.7				0.0
Deposit interest	25.0	14.0		6.0		-45.0				0.0
Loan interest	-100.0	-87.5		-37.5		225.0				0.0
Bond interest	19.2					2.7			-21.9	0.0
Net retained F		0.0	0.0							0.0
Net retained S				0.0	0.0					0.0
Net retained (banks)						0.0	0.0			0.0
Depreciation F		-210.0	210.0							0.0
Depreciation S				-90.0	90.0					0.0
Investment F		90.0			-90.0					0.0
Investment S		210.0	-210.0							0.0
Net lending	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Change in deposits	0.0		0.0		0.0		0.0			0.0
Change in loans	0.0		0.0		0.0		0.0			0.0
Change in Equities F	0.0		0.0							0.0
Change in Equities S	0.0				0.0					0.0
Change in Equities B	0.0						0.0			
Change in Bonds	0.0						0.0	0.0	0.0	0.0
Change in Reserves							0.0	0.0		0.0
Totals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0