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Banks and Economic Growth: The General Theory in a Basic Disequilibrium Model with Five Rationing Regimes*

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ABSTRACT

In this paper, an inductive research methodology and the principle of parsimony are applied to reconsider a central issue in economics and macro-finance, namely the determinants of economic growth and the role of the financial sector. A simple framework is derived, characterised by information imperfections and the absence of market clearing. The literature on rationing has identified the need to consider differing rationing regimes but has not included a banking sector. Such a set-up is presented in this paper, which identifies the link between credit and economic growth under differing rationing regimes, with varying consequences for inflation. The familiar case of money creation resulting in inflation features as a special case within the general framework. Others are the possibility of asset price bubbles and collapses, non-inflationary growth despite full employment, and instability in banking systems. The model is consistent with empirical evidence that has been difficult to reconcile with conventional equilibrium models. It is found that within this simple rationing framework, banks, left to their own devices, do not necessarily deliver stable, non-inflationary growth, and there is no reason to expect their behaviour to optimise social welfare. Some implications for research and policy are discussed.

Keywords: banking; credit; development; equation of exchange; finance and growth; growth; growth accounting; quantity equation

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ОРИГИНАЛЬНАЯ СТАТЬЯ

Банки и экономический рост: базовая модель неравновесия с пятью режимами нормирования

Ричард А. Вернер

АННОТАЦИЯ

Статья посвящена анализу вариантов применения моделирования неравновесия с пятью режимами нормирования. Актуальность этой проблематики обусловлена недостаточно отработанными по сей день механизмами регулирования деятельности коммерческих банков. Кроме того, в литературе по нормированию указывается на необходимость рассмотрения различных режимов нормирования, но не рассматривалось это в отношении банковского сектора. Целью статьи является разработка модели регулирования, оптимальной с точки зрения требований, предъявляемых банкам. В процессе анализа центрального вопроса экономики и макрофинансов, а именно детерминант экономического роста и роли в нем финансового сектора, применялась индуктивная методология исследования и принцип экономии. Автором получена простая структура, характеризующаяся несовершенством информации и отсутствием клиринга рынка. Такая схема представлена в данной статье. В ней определена связь между кредитом и экономическим ростом при различных режимах нормирования с различными последствиями для инфляции. Модель согласуется с эмпирическими данными, которые трудно согласовать с традиционными моделями равно-

* This paper closely follows Werner (2005), and aims to introduce parts of chapter 15 to a wider audience. While any mistakes are my own, I wish to acknowledge the source of all wisdom (Jer 33:3).

весия. Установлено, что в рамках этой простой системы нормирования банки, предоставленные сами себе, не обязательно обеспечивают стабильный, неинфляционный рост, и нет причин ожидать, что их поведение приведет к оптимизации общественного благосостояния. Обсуждаются также некоторые последствия проведенного анализа для дальнейших исследований и политики регулирования банковской деятельности.

Ключевые слова: банковское дело; кредит; развитие; уравнивание обмена; финансы и рост; экономический рост; учет роста; количественное уравнивание; нормирование

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1. Introduction

Since the 2008 banking crisis, criticism of modern macroeconomics has become frequent. “The standard macroeconomic models have failed, by all the most important tests of scientific theory”, argues Stiglitz (2011: 591), criticising, among others, the lack of banks within the models and such “key assumptions, such as market clearing (no credit rationing), rationality, and rational expectations” (p. 605).¹ De Grauwe (2010) likewise criticised the dominant general equilibrium models and their “extraordinary” assumptions. These have been the logical result of the consistent application of the deductive (or ‘hypothetico-deductive’) research methodology. A common defence of the approach often used in macroeconomics is that unrealistic assumptions and a general equilibrium framework are necessary to establish a benchmark to compare reality with. By contrast, it is claimed that “Alternative strategies that have started squarely from a different benchmark have for the most part proved unsuccessful” (Blanchard & Fischer, 1989, p. 27).²

This paper aims to present and apply an alternative research strategy that starts ‘squarely from a different benchmark’ but is successful. It attempts to do so by not adopting the deductive methodology. Instead, it holds, as Werner (1992, 1997, 2005) have done, that there is no good reason

not to adopt the scientific research methodology also in economics. That is the inductive research methodology which this paper relies upon.

The principle of parsimony suggests that models that minimise the number of required assumptions are preferable to models that require a multitude of jointly necessary assumptions. From this follows a framework that dispenses with the canonical but wholly unrealistic assumptions of perfect information, perfect competition, complete markets, flexible and instantaneously adjusting prices, zero transactions costs, infinite lives and no time constraints for the rational selfish-autistic and utility-maximising agents that miraculously survived their infancy (despite nobody caring for them). Without these assumptions holding simultaneously, there cannot be any equilibrium. Hence the much simpler model not requiring these assumptions will be characterised by an absence of equilibrium, also known as disequilibrium or rationing.

The model presented recognises financial sector frictions and the role of banks, and is applied to a central issue in macroeconomics, the determination of economic growth. It is argued that the proposed disequilibrium framework is not unsuccessful in explaining key macroeconomic characteristics that have proven difficult to explain or predict for the familiar models derived through the deductive research methodology and assuming general equilibrium. On the contrary, it is argued that the much simpler disequilibrium model, following in the footsteps of Werner (1992, 1997), explains more. Implications for policy and research are discussed.

2. Economic growth

The topic of economic growth has been well researched, and a number of uncontroversial facts can be readily summarised (see Barro, 1999):

¹ See also Stiglitz (2018), among others.

² Blanchard and Fischer (1989) argue in their influential advanced textbook in macroeconomics: “One of our main choices has been to start from a neoclassical benchmark, with optimizing individuals and competitive markets. As our guided tour indicates, this is not because we believe that such a benchmark describes reality or can account for fluctuations. ... We believe, however, that looking at their effects as arising from deviations from a well-understood benchmark is the best research strategy. Alternative strategies that have started squarely from a different benchmark have for the most part proved unsuccessful” (p. 27).

‘Growth’ or ‘growth theory’ initially refers to the growth of potential output, which is the maximum possible output that can be achieved when (a) all resources are fully mobilised (i.e. when the quantity of endowed factor inputs employed is maximised) *and* (b) when the productivity of their use is maximised (i.e. maximum factor productivity). Thus:

$$(1) Y^* = f(QFI^*; TFP^*),$$

where Y^* stands for potential output, which is a function of the quantity of factor inputs (QFI, normally consisting of land, labour, capital, and technology) and the quality of their use (total factor productivity, TFP). Potential output is the aggregate potential supply of the economy when all factors of production are used, and productivity is maximised. So far, so uncontroversial.

It is less clear how researchers should proceed from this truth to formulate a theory of economic growth that is immediately relevant to the types of economies we observe today. In that case, a scientific approach demands that the science of the method of science — methodology — is first considered to identify a possible and justifiable way forward.

3. Methodology

The most widely used methodology in economics is the *deductive*, or ‘hypothetico-deductive’ one (Whewell, 1840), postulating axioms, making simplifying assumptions and adding boundary conditions and auxiliary assumptions. It goes back to Ricardo (1817) and other classical writers. Based on these assumptions, an economic model or theory is constructed. The main axioms concern individual behaviour (perfect rationality, individual utility maximisation as sole motivation). The standard assumptions include perfect information, perfect competition, complete markets, price flexibility, diminishing returns to factor inputs, and no transaction costs. The fundamental theorem of welfare economics has established that one obtains general market equilibrium under such conditions, as well as full factor utilisation, and the economy is Pareto-efficient. Hence in such a theoretical world, the deductive approach allows one to conclude that

$$(2) Y = Y^*,$$

i.e., that actual output is equal to potential output, rendering equation (1) a description of actual output. There is no role for government intervention in such a world of general equilibrium, as markets have already delivered optimum resource allocation without unemployment or underutilisation of other resources. There is also no direct need to incorporate the financial sector, let alone financial frictions.

However, a growing body of literature has discussed situations where there are information imperfections, transaction costs, incomplete markets, and other circumstances that do not conform to the canonical set of assumptions (for surveys on the work on information asymmetries see, for instance, Riley, 2001; Stiglitz, 2000; Stiglitz, 2002). In each case, it was found that general equilibrium and Pareto efficiency could not be obtained or that equilibrium was of a different kind. In the words of Stiglitz (2011): “With information asymmetries, markets behave markedly different than they do with perfect information: markets may not clear; there can be credit and equity rationing, or unemployment...”

Earlier, Lipsey and Lancaster (1956) and the work spawned by them on the theory of second-best had demonstrated that if only one optimality condition is not satisfied, a move toward greater market perfection may result in a decrease in efficiency elsewhere. Consequently, they argued that it might be optimal for the government to intervene. Thus, an important contribution of the literature on equilibrium and efficiency is that it has demonstrated how restrictive the combination of assumptions is that is required in order to obtain market-clearing, equilibrium, full utilisation of resources, Pareto efficiency and the result that government intervention cannot be welfare-enhancing. Put differently, since the assumptions derived from the deductive approach are not known to hold simultaneously anywhere in the world, one cannot expect to obtain equilibrium, nor the finding that there is no role for welfare-enhancing government intervention.

But ‘relaxing’ the restrictive assumptions of the highly stylised neoclassical ‘benchmark’ model one at a time is not an efficient research strategy. By relaxing one of these assumptions at a time, a multitude of different theoretical worlds (‘models’) may

be postulated, and it is not clear which, if any, are relevant for us. Thus, the deductive methodology has yielded many insights, but it is not clear how they can be used productively in reality. Consequently, scientific progress has been slow in economics.

While widespread in the economics literature, the deductive approach is, however, not commonly used in the natural sciences. Instead, the majority of scientific disciplines follow the *inductive* methodology. Here, the research process does not begin with axioms and assumptions. Instead, it starts with and is based on facts and data, which are initially collated and examined in order to detect patterns. Hypotheses are then formulated as to how the obtaining patterns could be linked or explained. In further work, these hypotheses are tested, refined, and built into a model or coherent theory. For scientific progress to occur, hypotheses also need to be falsifiable. Consequently, models and theories are continuously subjected to empirical tests and altered, sometimes drastically, as the reality represented by empirical data requires.

It stands to reason that the consistent application of the inductive (or scientific) research methodology should also be possible in economics. The purpose of this paper is to apply the inductive approach to a central aspect of macroeconomics, namely growth theory.⁵

The inductive methodology is also commonly characterised by adopting a further methodological principle used in science and already widespread in econometrics (see the general-to-specific methodology developed by Hendry and others, such as in Hendry & Mizon, 1978), the principle known as “Ockham’s Razor”. Named after the high medieval British philosopher William of Ockham, it is also known as the ‘principle of parsimony’ or ‘principle of the economy’. Proposed by Aristotle in his *Physics*, this generally accepted ontological principle says that researchers should not postulate unnecessary assumptions or propositions.⁴ Necessity is defined by Ockham as either

⁵ This does not exclude deductive processes. The inductive method also employs deductive logic (such as mathematics), when necessary, but it places priority on empirical data and has sequenced research tasks such that empirical work is allowed to lay the foundation for the development of theories, which are then tested, suitably modified, and applied to reality. Likewise, the deductive method often refers to important empirical facts. Thus, the difference consists mainly in the differing starting point (is it axioms and assumptions, or empirical facts) and the overall dominance of the method.

⁴ Pluralitas non est ponenda sine necessitate.

being self-evident or known from experience.⁵ Specifically, Ockham argued that “One ought not postulate many items when he can get by with fewer” (Loux, 1974, p. 74) and that “What can happen through fewer [principles] happens in vain through more.”⁶ In our context, this means that parsimonious theories or models that rely on fewer restrictive assumptions are preferable to those that require more. As a result, in this paper, pains were taken to present the simplest and most basic model dispensing with the canonical assumptions that could, nevertheless, explain important macroeconomic scenarios.

4. An Inductive Model of Growth

4.1. Key Features

The determinants of economic growth are examined following the inductive methodology. No restrictive assumptions are made concerning information, market structure, price flexibility, transactions costs, or individuals’ motivation. However, for market clearing to be obtained, a number of assumptions must jointly hold, including perfect information (see Cukierman, 1984). Since neither perfect information nor any other conditions for equilibrium are assumed to hold in our model, we do not expect any market to clear. Rationing is thus pervasive.

Rationed markets are determined by the *short-side principle*: whichever quantity of demand or supply is smaller determines the outcome (as it is the smallest common denominator for transactions to take place; see Muellbauer & Portes, 1978).⁷ Disequilibrium and rationed markets create circumstances that immediately bring economics and politics together: the short side of any rationed market has allocation powers.⁸ In other

⁵ This paper does not consider the third justification that Ockham recognized. According to him “nothing ought to be posited without a reason given, unless it is self-evident or known by experience or proved by the authority of Sacred Scripture” (William of Ockham. *Scriptum in librum primum Sententiarum* (Ordinatio), Distinctiones XIX–XLVIII. In Etzkorn & Kelly, 1979, p. 290).

⁶ Ockham. *Scriptum in librum primum Sententiarum*. In *Opera Theologica*, vol. IV, p. 157, op cit.

⁷ On rationing or disequilibrium in a political context, see von Furstenberg and Spangenberg (1996); Ordeshook (1980) and Riker (1980). On growth of government in a disequilibrium model, see Henrekson and Lybeck (1988).

⁸ This may indeed explain economists’ general hesitation to contemplate rationed markets: the issue of ‘power’ is usually avoided.

words, the short side has the *power* to pick and choose with whom it is doing business and how resources are allocated, irrespective of the transaction price. In equilibrium, it is apparently neutral market forces that produce politically palliative outcomes. In disequilibrium, the reality of discrete and arbitrary decisions by allocators becomes visible — allocators who can, if they wish, exploit their selection power to extract non-market benefits or ‘rents’ (a recent ready example is the labour market for Hollywood actors and the kind of conditionality extracted for being selected).

Applying the inductive methodology and thus expecting disequilibrium in all markets also means that the markets for money and credit are rationed. For a number of reasons, we can expect the supply of money and credit to constitute the short side: Money or credit are necessary in order to engage in market transactions and for final settlement of liabilities, thus ensuring ready demand, as long as there is demand for anything else requiring money or credit to defray. Further, limited liability of directors generates skewed incentive structures in favour of borrowing money (Stiglitz & Weiss, 1981). Due to information imperfections, especially small firms and individuals in the informal sector will experience higher risk premia and credit rationing (Jaffee & Russell, 1976). In other words, since money is unusually useful, its aggregate demand is likely to exceed supply (Schumpeter, 1912; Keynes, 1930). This was empirically demonstrated by Jimenez et al. (2012) in a landmark and large-scale empirical study on Spain.

We empirically observe that modern economies all feature money and banks. Money or credit are necessary to engage in monetary transactions. Thus the inductive approach yields as a second major departure from the neoclassical benchmark that models must include money and banks. Indeed, empirical observation establishes that money and banks are linked in a unique way to each other and to the economy: In most countries, only up to 5 per cent of the money supply is created and distributed by the central bank. Commercial banks create the vast majority of the money supply through credit creation (MacLeod, 1855/56; Wicksell, 1898; Schumpeter, 1912; Hahn, 1920; Bank of England, 2014; empirically first demonstrated by Werner, 2014, 2016). In our model, we thus feature a money supply that is created by the banking system through bank credit creation.

That this feature has been missing in the conventional models has also recently been criticised.⁹

What is the relationship between money (bank credit) and economic growth? We follow the common convention of measuring economic growth by the growth of GDP. Since money is a nominal variable, we first seek to identify the link between money (bank credit) growth and nominal GDP growth. Nominal economic growth is the increase in nominal GDP compared to the previous period (such as the last year). For the transactions that make up nominal GDP to increase, an increased amount of money must have changed hands to pay for these transactions (Fisher, 1911, and others). It raises the question of what sort of money is mainly used for transactions.

The relationship between the value of transactions (PQ) and the amount of money used to pay for them is commonly expressed in the so-called quantity equation or ‘equation of exchange’:

$$(3) M \times V = P \times Q.$$

It has conventionally been proxied by the ‘quantity equation’ that uses nominal GDP (PY) to substitute for the value of transactions during the observation period:

$$(4) M \times V = P \times Y.$$

In practice, economists have employed money supply figures as the measure of money changing hands for transactions. This has several disadvantages: (1) the monetary aggregate approach suffers from the empirical problem that with unstable velocity, there is no reliable relationship between any chosen monetary aggregate consisting almost entirely of bank deposits or similar (M1, M2, M3, etc.) and nominal GDP (for an overview, see, for instance, Goodhart, 1989); (2) as Friedman (1956) conceded, the focus on deposits means that it is not clear where to draw the line between different types of private sector assets held in the financial system; (3) as Friedman also conceded (*ibid.*), their use cannot

⁹ Benes and Kumhof (2012), in their influential IMF working paper write: “bank liabilities are money that can be created and destroyed at a moment’s notice. The critical importance of this fact appears to have been lost in much of the modern macroeconomics literature on banking, with the exception of Werner (2005)”. See also Werner (1997, 2016).

disaggregate deposits — they are actually savings; and, most importantly, (4) money is inappropriate in the equation of exchange, equation (1) above, which is about the amount of money actually used for transactions, because money supply measures consist of deposits and hence measure money that at the moment of measurement is *not* in circulation.

These problems can be overcome by employing the credit counterparts approach (see, Werner, 1992, 1997; Bank of England, 1996). Werner (2005) and Ryan-Collins et al. (2012) show that the majority (over 95 per cent in industrialised economies) is credit money produced by banks through the process of credit creation.

Thus, let credit creation be represented by Δc , the differenced natural logarithm of the stock of credit (or the percentage growth rate). It can then be divided into credit creation used for non-GDP transactions, Δc_F (financial transactions; Werner, 1997), and credit used for GDP or national income-based transactions (the ‘real economy’) (Δc_R). It was shown that the observed ‘velocity decline’ prior to this disaggregation was due to an increase in credit creation for asset purchases, which affects asset prices, but not nominal GDP (Werner, 1997). Following this disaggregation into those transactions that are part of GDP and those that are not, a stable link between a suitable monetary aggregate and nominal GDP is re-established. As a result, the equation of exchange for the ‘real economy’ can then be expressed in growth terms as follows:

$$(5) \Delta p_R + \Delta y = \Delta c_R,$$

where Δp_R stands for the differenced logarithm of the GDP deflator, Δy for the differenced logarithm of real output, and Δc_R for the differenced logarithm of nominal credit creation used for GDP transactions. Shortly, equation (5) says that for nominal GDP (i.e., the value of transactions that make up nominal GDP) to grow, there must be an increase in credit creation used to fund this growth.

Since the framework does not assume any of the long lists of joint conditions for equilibrium to hold, there can also be no expectation for equation (2) to hold. Hence the actual output is unlikely to be equal to potential output. Likewise, actual growth cannot be expected to be equal to poten-

tial growth. Equation (5) is a disequilibrium or rationing equation.

In disequilibrium economics, the main purpose of a growth model is not the establishment of the conditions for equilibrium, the identification of some ‘steady state’, nor the calibration of an equilibrium model. Instead, the disequilibrium literature analyses different rationing regimes that may describe the economy under different circumstances (Muellbauer & Portes, 1978; and others). Likewise, we can now identify several different rationing regimes, which deliver different outcomes concerning the relationship between credit, output, and prices. The nature of the credit supply and the state of the economy indicate which rationing regime is relevant at any moment. The simple framework presented here is examined to see whether in principle it can account for some of the key ‘anomalies’ that conventional macroeconomic models have not been able to explain (the greater role of monetary quantities than interest rates, the special role of banks, the velocity decline, asset price bubbles and the recurring banking crises, to name a few; for a comprehensive list with literature, see Werner, 2012). Future research can put the model to focused empirical tests, and link observed data and time periods to particular rationing regimes.¹⁰

4.2 Disequilibrium Regimes

4.2.1 Regime 1: Full employment, classical case

If the real economy expressed in equation (5) operates at full employment of all factor inputs, then for given productivity, positive Δc_R must raise prices. It is this case that classical and neo-classical models are concerned with, and which is here revealed as a special case. It can be represented as follows:

$$\begin{aligned} &\text{If } Y = Y^* = \text{constant} \\ &\quad \text{and } \Delta c_R > 0 \\ &\quad \text{then with } \Delta y = 0 \\ &\text{we obtain } \Delta c_R = \Delta p_R. \end{aligned}$$

¹⁰ For an overview of relevant past empirical tests consistent with this empirical model, see Werner (2012), as well as specific studies, such as Werner (1997), Jorda et al. (2013), Ryan-Collins et al. (2016), Bezemer et al. (2016).

As the entire increase in C_R is reflected in an increase in the GDP deflator, real GDP Y will remain unchanged. The increase in nominal GDP will entirely be reflected in price rises. For instance, a 5 per cent increase in credit creation used for GDP transactions will result in a 5 per cent increase in prices.

4.2.2 Regime 2: Less than full employment

If the actual output is below potential output, then in principle, there is no reason for increases in credit creation used for GDP transactions (Δc_R) to produce inflation. In the pure case of no price rises, the disequilibrium model yields:

$$\begin{aligned} &\text{If } Y < Y^* \\ &\text{and } \Delta c_R > 0 \\ &\text{then with } \Delta p_R = 0 \\ &\text{we obtain } \Delta c_R = \Delta y. \end{aligned}$$

In words, when not all resources are fully mobilised, or when there are productivity gains, new credit creation used for GDP transactions (Δc_R) may result in new real output and income without causing inflation. The increase in nominal GDP (PY) will be entirely due to rises in real GDP (Y). Japan in the two decades since ca. 1997 may be such a case of output below potential, underutilisation of factor inputs (and thus unemployment, idle factories etc.).

4.2.3 Regime 3: Full employment, consumptive credit

Nominal national income PY is disaggregated into its components:

$$(6) \text{ PY} = C + I + G,$$

where C, I and G stand for nominal consumption, nominal private-sector investment and nominal government spending. Likewise, we can now disaggregate credit used for GDP transactions C_R further into credit used for consumption, credit used for investment, credit used for government expenditure (the model can be extended for an open economy by adding net exports NX, with exports being exogenous and imports a function of income; however, for expositional purposes, a closed economy is considered). Hence:

$$(7) C_R = C_c + C_i + C_g.$$

If banks create new purchasing power and lend it for consumption purposes (C_c), then the amount of output will stay unchanged since consumption does not produce new output of goods or services. Thus, when output is at or close to the full employment level and more purchasing power is created through 'consumptive credit creation', more transactions will occur, laying claim to a given amount of output. This consumptive credit creation C_c must translate into higher consumer goods prices. It is a restatement of the slightly less specific first regime above. Thus:

$$\begin{aligned} &\text{If } Y^* = Y = \text{constant} \\ &\text{and } \Delta c_c > 0 \\ &\text{such that } \Delta c_R > 0 \\ &\text{we obtain } \Delta c_R = \Delta p_R. \end{aligned}$$

Shortly, a 5 per cent increase in consumptive credit creation will push up consumer prices by 5 per cent. The rise in total real circulation credit creation C_R will push up the GDP deflator proportionately. Consumptive credit creation is inflationary. This regime is identified as the special case that the orthodox classical and neoclassical literature usually treats as a generally applicable result (referred to as the 'quantity theory of money', see Friedman, 1956).

4.2.4 Regime 4: Asset credit

If banks create new purchasing power and lend it for financial asset transactions, including stock and real estate transactions (C_f), then the amount of output will stay unchanged. However, this will not lead to consumer price inflation since the extra purchasing power is not used to lay claim on output that is part of GDP. Since it is used for financial transactions, it is their nominal value that must rise. At least in the case of short-term assets and fixed assets, such as real estate, it must result in asset price rises. Thus:

$$\begin{aligned} &\text{If } Y^* = Y = \text{constant} \\ &\text{and } \Delta c_f > 0 \\ &\text{such that } \Delta c_R = 0 \\ &\text{we obtain } \Delta c_R = \Delta p_R = \Delta y = 0 \\ &\text{However,} \\ &\Delta p_f + \Delta q_f = \Delta c_f. \end{aligned}$$

Therefore, such asset or ‘speculative’ credit creation may result in asset price inflation, while output and prices may not be affected. This regime explains asset price ‘bubbles’ but also their collapse. Rises in C_p/C or C/Y can be considered as an indicator that an asset ‘bubble’ is being formed. All expansions in financial credit creation are unsustainable, since they are not based on productive activity yielding income streams that can be used to service and repay the original asset-based loans C_p , but instead are aimed at capital gains. However, the capital gains are a function of a continued increase in credit for financial transactions. The model shows that income streams cannot in aggregate be sufficient to service the previously extended speculative credit when aggregate speculative credit creation slows. In this case, bankruptcies and non-performing loans in the banking system must follow as soon as credit creation for asset purchases ceases. Since another institutional fact is that banks are highly leveraged, with large banks recording capital significantly below 10 per cent of assets, a mere drop in bank asset values of 10 per cent results in *banka rotta*. Since banks often act in a herd-like fashion, a banking crisis is then likely. Therefore, a policy implication to avoid asset cycles and instability in the banking system is to monitor C_p/C (or C/Y) closely and take policies to prevent a significant rise.

4.2.5 Regime 5: Productive credit

If the banks (or their regulatory authority) can ensure that new credit creation is used specifically for that type of activity that will enhance the potential economic growth rate, such as credit creation for productive investment, then even with output at the full employment level, additional credit creation will remain non-inflationary and results in higher output — beyond the former full employment level.

The allocation of credit organises and mobilises the factors of input, which may boost the potential growth rate itself. In other words, potential growth is not a given, but instead a function of credit creation for productive investment. As Schumpeter (1912) described, credit allows the implementation of research and development, resulting in the invention of innovations and new technologies. New technologies — in effect, recipes to combine given inputs in a new way

that produces products valued highly by buyers (Romer, 1990)—enhance total factor productivity. Credit can also enable entrepreneurs or firms to implement new technologies. In this case, both the mobilisation of factor inputs and total factor productivity can be enhanced through the direction of credit to productive uses. Since the credit market is always rationed and supply-determined, banks are already engaged as allocators who engage in more or less arbitrary discrimination of loan applicants (due to imperfect information). This otherwise arbitrary allocation power can be harnessed to benefit economic growth. Thus, it is possible (though not necessarily always the case) that the following functions will hold true:

$$(8) \text{QFI} = g(C_1; \dots),$$

$$(9) \text{TFP} = h(C_1; \dots).$$

In other words, the creation of new credit for productive investment C_1 (‘productive credit creation’) may help mobilise factors of production that the borrowing firm would otherwise not have been able to mobilise (enhancing QFI), while at the same time it may allow the invention of new recipes and their implementation (raising TFP). These new technologies will therefore increase the potential growth rate. It follows that even when the economy is in a situation where actual output is at the full employment level, it is possible for new credit creation to be non-inflationary and instead boost growth further by raising the full employment level of output through the implementation of new technologies (such disembodied recipes are not limited by the physical constraints that limit other factors of production).

A dynamic disequilibrium model is necessary to represent this process. To keep it parsimonious and as tractable as the above relationships, a number of simplifying assumptions are now made, for instance, that the boost to potential output (in money terms) is as large or larger than the cost in terms of productive credit creation ($\Delta Y^*P_R \geq \Delta C_R$). It is a plausible assumption since new technology is often characterised by increasing returns to scale and has other unusual features and positive externalities which economics models usually have difficulties expressing (some of these features of the technology are that it is a non-rival, non-exclusive, reproducible good to which the

second law of thermodynamics does not apply; because it is pure knowledge, words that can be stored, accumulated, re-used without diminishing and without limiting the simultaneous use by others; see Romer, 1990). Moreover, we assume that the full employment level of output allows for frictional or natural unemployment, which provides leeway for the temporary mobilisation of resources without immediate inflationary pressure. We further assume that credit creation takes one time period to affect nominal GDP (either prices or output), just as the implementation of new technologies takes one time period:

$$(10) \Delta p_{Rt+1} + \Delta y_{t+1} = \Delta c_{Rt},$$

$$(11) Y_{t+1}^* = f(QFI_t^*; TFP_t^*).$$

Thanks to the productive credit creation C_1 in time period 1, the rise in nominal output PY (due to greater C_1 and C_R) is matched by higher real output in period 2, made possible due to the productivity gains implemented due to credit creation C_1 . During this time period 2, prices would rise in reaction to the increased purchasing power created in time period 1 if output had not increased. However, this incipient rise is neutralised, and price pressure disappears as potential output rises in the second time period. Thus:

Time period t:

$$Y_t^* = Y_t$$

$$\text{and } \Delta c_{Rt} = 0.$$

Time period t+1:

$$\text{If } \Delta c_{It+1} > 0$$

$$\text{so that } \Delta c_{Rt+1} > 0,$$

but since in the previous period there was no increase in credit, we obtain

$$\Delta p_{Rt+1} = 0$$

$$\text{and } \Delta y_{t+1} = 0$$

$$\text{hence } \Delta \ln(P_R Y)_{t+1} = 0.$$

Time period t+2:

$$\Delta \text{tfp}_{t+2} > 0 \text{ (due to } \Delta c_{It+1} > 0)$$

$$\text{so that } \Delta y_{t+2}^* > 0 \text{ (according to eq. (6)); with}$$

$$\Delta Y^* P_{Rt+2} \geq \Delta C_{Rt+1})$$

$$\text{and } \Delta y_{t+2} > 0$$

$$\text{with } Y_{t+2}^* \geq Y_{t+2}$$

$$\text{then } \Delta y_{t+2} = \Delta c_{Rt+1}$$

$$\text{and } \Delta p_{Rt+2} = 0,$$

Although the economy initially already operated at the full employment level, an increase in productive credit creation increases productivity and thus boosts output without stirring inflation. We therefore find that it is possible to boost output even in an economy that is already at full employment without inflation if the new credit creation is used for activities that enhance the maximum potential and actual output. This proposition may be what German economists, including Schumpeter (1912), referred to frequently in the late 19th century and the first half of the 20th century when they suggested that ‘productive credit creation is non-inflationary’.¹¹

This regime may initially surprise, as it suggests the possibility of non-inflationary growth despite resources already being fully employed. However, it may describe the situation of high-growth economies that nevertheless managed to keep inflation in check, such as Japan during the 1960s, Korea and Taiwan subsequently and China since the 1980s. It is noted that in these countries, the ‘guidance’ of bank credit indeed played a significant role (IBRD, 1993; Werner, 2002, 2003, 2005). It is this role of banks as providers of such development finance that Schumpeter (1912) had in mind.

“Banks do not, of course, ‘create’ legal-tender money and still less do they ‘create’ machines. They do, however, something — it is perhaps easier to see this in the case of the issue of banknotes — which, in its economic effects, comes pretty near to creating legal-tender money and which may lead to the creation of ‘real capital’ that could not have been created without this practice”. Schumpeter (1954, p. 1114) (emphasis as in original).

5. Some Results and Limitations

In this paper, a parsimonious rationing framework is presented, which identifies credit creation as a key determinant of actual growth but potentially also a factor in raising potential growth via the implementation of new technologies. By examining five rationing regimes, the model is found to be consistent with empirical evidence that has been difficult to reconcile with conventional equilibrium models.

¹¹ Schumpeter was of course Austrian by nationality, although his writings were more in the spirit of his German colleagues at the German universities where he worked between 1925 and 1932, than that of the ‘Austrian School’.

The model seems consistent with the empirical evidence on credit, disaggregated credit and its link to the economy (see footnote 11). It is seen that money or credit creation resulting in inflation is but one special case. An important factor in determining the balance between growth and inflation is the use to which newly created credit (money) is put. Banks make the decision concerning its allocation. However, in most countries there is no indication that banks' allocation decisions are made with any reference to the macroeconomic (or 'systemic') objective to enhance growth and minimise inflation. Regulators certainly have not encouraged the type of allocation of bank credit that we find would be preferable for social welfare: productive credit creation. Instead, it is a well-documented trend since the 1980s that bank credit has increasingly been created for asset purchases (regime 4, asset credit), and this has been tolerated by regulators.¹²

Given the limitations of the stylised rationing regimes mentioned in this paper, further work is necessary both on theoretical foundations and empirically testing the model. Below I would like to speculate on the directions that needed further research may take.

5.1 Further Disaggregation of Investment Credit

For maximisation of economic growth, a further disaggregation of nominal investment I into different types of investment may be called for, and hence a further disaggregation of C_1 . For instance, it will make a difference to economic growth, whether new claims on finite resources are created by banks and handed over to those who use them for investment in research and development, investment in the application of research results, or investment in the replacement of machinery, etc. Thus, a further disaggregation could attempt to classify investments into those in low-value added industries and those in high-value added industries, etc. Our model raises the need for much further research into methods to identify *ex ante* different productivity levels of investment projects. Moreover, the

definition of productivity could include environmental impact etc.

5.2 Credit Guidance

In the present model of non-Walrasian rationing market regimes, there is no indication that the market, left on its own devices, will allocate credit in a way that is optimal for overall social welfare. Since the credit market is supply-determined and the decision about whether and how much to lend to and who to lend to is made by the banks, a public goods function that affects the entire economy is performed by them. They create the majority of purchasing power in the economy; they also decide who will use it for what purposes. A rationed market means that some loan applicants are accepted while others are rejected. There is no guarantee that the choice made by individual banks is consistent with the allocation that would maximise social welfare. Given the pervasiveness of imperfect information, it would be a mere coincidence if the banks' decisions were welfare optimal.

Indeed, the incentive structure of loan officers may produce behaviour that is oriented towards other goals than what would be in the interest of the overall population (for instance, they may favour large-scale firms in established industries, as this may minimise risk to their own job security; they may favour 'unproductive' credit extension to consumers or speculators, which will result in consumer price inflation and asset price inflation, without counter-veiling positive results for social welfare).

Without 'guidance' from the perspective of social welfare, the collective action of banks is likely to increase inequality and result in sub-optimal growth. Thus there is a case for government intervention at various levels: Firstly, the government can intervene to implement an institutional design for the banking system, which will give loan officers incentives that will align their individual behaviour more with the social welfare goal. For instance, a banking sector dominated by small-scale local and not-for-profit banks, as was the case for many decades in Germany, may result in less credit creation for asset purchases and more credit creation for SMEs using the funds for productive business investment. Secondly, the government or other delegated authority (such as the central bank) may enhance welfare by inter-

¹² This is also a view taken by influential policymakers, such as the UK's former chairman of the Financial Services Authority, Lord Adair Turner, in Turner (2012).

vening in the decision-making process concerning the decision of how much to lend in aggregate (i.e., how much total credit should be created) and who to lend to (which industrial sector, etc.). It can take the form of either formal or informal direction or ‘guidance’ by the central bank of private sector bank lending, whereby the central bank calculates by how much total credit creation should increase in the economy (quantitative credit controls) and whereby it decides how the increase (or decrease) in credit creation will be allocated across different industries and sectors of the economy (qualitative credit controls). In contrast, purely unproductive credit (for consumptive or speculative purposes) is suppressed.¹⁵

The relevance of the above disequilibrium model which has presented the ‘general theory of credit’ (as opposed to the special case known as the traditional ‘quantity theory’) may be examined by testing the hypothesis that many central banks could be expected to engage in or have engaged in direct guidance of bank credit to the differing broad types of activity identified. Such credit controls have indeed been implemented by most central banks all over the world (see Goodhart, 1989). Credit controls have at one stage been used by, among others, the Bank of England, the Bank of France, the Bank of Japan, the Bank of Korea, the Bank of Thailand, the US Federal Reserve, the German Reichsbank, the Austrian National Bank, the Reserve Bank of India, the central banks of Malaysia, Indonesia, Taiwan, China and many central banks of developing countries. Developing countries have often been open to the use of directed credit. The World Bank’s study of the East Asian ‘Economic Miracle’ (IBRD, 1993) concluded that intervention in the direction of credit had played a substantial role in achieving superior economic performance.¹⁴

Even the IMF has, throughout its existence, engaged in ‘direct guidance’ of bank credit to specific sectors of the economy. Polak (1997) describes a typical IMF exercise in ‘financial programming’ of the kind that the IMF has regularly implemented in numerous countries over the

past decades. According to Polak, information about credit creation in a client country is disaggregated by IMF staff. The specific allocation of credit creation to different parts of the economy is made subject to IMF conditionality. Credit creation for “non-productive expenditures” receives the IMF’s “frowning” and is dealt with through the enforcement of “financial restraint” (p. 9), i.e. credit rationing. Much more evidence can be gleaned from the (often confidential) structural adjustment programmes implemented by the IMF worldwide in over a hundred cases over the past sixty years. Applying the principle of ‘revealed preference’ (Samuelson, 1938) to central banks and the IMF, one can say that they have favoured disequilibrium economics and its policy corollary, intervention in the allocation of credit.

5.3. Shaping the Structure of the Banking Sector

An entirely different, and possibly preferable, alternative exists, which would not require any regular intervention in the credit markets via some form of ‘guidance’. This alternative requires an intervention in the design of the banking structure. If, for instance, the banking structure was dominated by banks that are neither able nor prone to allocate credit for harmful purposes — particularly financial transactions — then the probability of the banking sector allocating resources in a Pareto-efficient way rises substantially. Here, the German banking sector structure comes to mind, which is dominated by thousands of small, locally headquartered banks that tend not to lend for financial transactions but to households and SMEs (Schmidt et al., 2016). As a result, they weathered the financial crisis well, and also overall credit growth did not suffer the kind of collapses that have depressed growth in the UK, Ireland, Portugal, Spain or Greece. Thus further research is necessary into the growth implications of particular features and characteristics of different banking structures.

5.4 Monetary Reform

Another alternative is to change core aspects of the current institutional design. Instead of allowing banks to create the money supply, re-assign this prerogative to the sovereign, or else render it open to market competition

¹⁵ This is in line with the work on financial repression, especially in East Asia, by Hellmann, Murdoch, and Stiglitz (1998). On credit guidance in East Asia, see IBRD (1993) and Werner (2002).

¹⁴ The subsequent dismal performance in many countries should not detract from this success.

and allow decentralised and competing local currencies. A number of recent such reform initiatives have been suggested, including by Benes and Kumhof (2012), and the results of this paper throw new light on this possibility. However, more research is needed into how the likely differing behaviour of alternative money creators would affect the quantity and allocation of money creation in order to ensure that money creation is steered towards the desirable forms of transactions (creating

value and income streams, i.e. ‘productive credit creation’) and indeed is used for productive purposes. The historical record seems to suggest that highly centralised systems of money creation, for instance via only the central bank (such as in the Soviet Union) are inefficient and decentralised systems of money creation with many small banks are more able to support SMEs, create jobs, deliver growth and more resilient (Werner, 2013a, b; Mkhai-ber & Werner, 2021).

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