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Abstract

Pervasive credit constraints have been seen as major sources of slow growth in developing economies. This paper clarifies a mechanism through which an inefficient financial system can reduce productivity growth. Using a two-sector model, second, we examine the implications for employment and the distribution of income. Both classical and Keynesian versions of the model are considered; saving decisions are central in the classical version while firms' investment and pricing decisions take center stage in the Keynesian version. We find that, although boosting the asymptotic rate of growth, a relaxation of credit constraints may reduce the share of the formal sector, increase inequality and underemployment, and have little or no effect on the medium-run rate of growth.

JEL numbers: O11, O41, E2

Key words: credit constraints, productivity growth, dual economy, underemployment, income distribution

1. Introduction

Poor financial systems and pervasive credit constraints have been seen as major sources of slow growth in developing economies. Mexico is a striking example, and the Mexican experience provides the primary motivation for the analysis in this paper; the general argument, however, may apply more widely.

The Mexican economy has gone through a series of structural reforms since the 1980s. It has been opened to foreign trade and capital flows, state participation in economic affairs has been significantly diminished, and an export-led growth strategy has displaced the earlier import-substitution strategy. Each new round of reforms was introduced with promises of high and sustained growth. The results have been disappointing. The economic growth predicted by the reformers has not materialized. Exports have increased but not yielded growth in the economy as a whole. Macroeconomic stability in the form of low inflation and reductions in the fiscal deficit may have been achieved, but even these achievements should be seen in the context of severe crises in 1982-1983, 1986, 1995, and 2008-2009; Lustig (2001) presents an early assessment of the economic shift; Moreno-Brid and Ros (2009), Hanson (2010) and (2012), and Ros (2013a) and (2015) are more recent studies.

The literature on Mexican slow growth has two broad strands. The dominant strand points to stagnant total factor productivity. An alternative view regards the low rate of capital accumulation as the most important proximate cause of the sluggishness, and considers low productivity growth to be a consequence of low capital accumulation. Both

strands agree that many firms, especially medium and small enterprises, have experienced significant credit constraints and that those constraints have been an important reason for slow growth. In the dominant view, inefficient financial systems contribute directly to low productivity growth; Hanson (2010), and Kehoe and Ruhl (2010), Tinoco-Zermeño and Venegas-Martínez (2014), Bolio et. al. (2014). In the alternative view, credit constraints, may have contributed to the low rates of capital formation, with derived effects on productivity growth; Moreno-Brid, Rivas, and Santamaría (2005), Moreno-Brid and Ros (2009, 2010), Ros (2013a, 2015).¹

This paper contributes a theoretical perspective on the links between credit constraints, labor productivity and macroeconomic growth. We clarify one mechanism through which an inefficient financial system can reduce macroeconomic growth. Using a two-sector model, second, we examine the implications of an improvement in the financial system for employment and the distribution of income. Two versions of the model are considered, a classical version and a Keynesian version. Saving decisions are central in the classical version while firms' investment and pricing decisions take center stage in the Keynesian version. We find that a relaxation of credit constraints may improve productivity growth in the modern sector and boost the asymptotic rate of growth of output. With a slow convergence to the asymptotic state, however, the medium-run effects may be more important, and significant medium-run effects require a positive, direct influence of financial conditions on firms' investment and pricing/output decisions; this direct influence is absent in the classical version of the model. We also find that, if not accompanied by

¹ The distinction is one of degree. The alternative approach does not dismiss productivity issues, and the dominant view acknowledges low investment as part of the explanation of the lackluster economic growth (e.g. Hanson 2012, p. 8-9).

other measures, the alleviation of credit constraints may reduce the share of the formal sector and increase inequality and underemployment. Thus, without taking sides in the larger debate about the fundamental reasons for the ‘Mexican morass’, we show that the direct effects of credit constraints on accumulation are crucial and that additional policies may be needed if the benefits from alleviating the credit crunch are to be reaped by the Mexicans who need them the most.

Despite the emphasis on credit constraints in the applied literature, there has been little theoretical work. To the best of our knowledge Gelos and Werner (1999) is the only contribution on credit constraints and growth in Mexico which, although largely empirical, contains some theoretical considerations. Their model, however, fails to take into account the coexistence of advanced and backwards sectors. By contrast, our model incorporates the existence of a large informal sector, and firm-level differences with respect to productivity and credit constraints are at the center of our analysis.

The formal-informal distinction and the presence of underemployment in the informal sector are accepted features of developing economies like Mexico. Indeed, there is a debate on whether the large levels of informality are cause or consequence of the Mexican slow growth; the presence of informality is not in dispute, however, and all participants in the debate deplore the large levels of informality, whether it is seen as cause (OCDE 2012) or as consequence (Ros 2013a).

Our approach has obvious affinities with the literatures on dual and dependent economies (see Temple (2005) and Ros (2013b) for surveys). The informal sector should not be identified with agriculture. The share of agriculture has declined significantly in Mexico, but the decline has been accompanied by a “massive increase in underemployment

in the tertiary sectors of the economy” (Ros 2000, p. 104; Moreno-Brid and Ros 2009, p. 234). It is important to note, too, that the informal sector is not a self-contained subsistence sector, as in simple versions of the Lewis model. Informal production is market-oriented, and low levels of demand from the formal sector reduce informal-sector income. The model in Razmi et al. (2012) comes closest to the one in this paper. We extend this model by introducing credit constraints and endogenous changes in productivity; to keep the analysis tractable, we simplify the analysis by assuming constant returns to scale in the informal sector and fixed consumption shares.²

The paper is organized as follows. Section 2 outlines some stylized facts and provides a selective survey of the applied literature on credit constraints in the Mexican economy. Section 3 analyzes the effects of credit constraints on technical change in the modern sector. Section 4 presents a two-sector model with financial constraints in the modern sector. Sections 5 and 6 analyze the implications of the model using classical and Keynesian closures, respectively. Section 7 contains a few concluding comments.

2. Economic Growth and Financial Constraints in Contemporary Mexico

2.1 Mexican economic performance

The structural reforms after 1982 have failed to boost economic growth. Using World Bank data we obtain that the average growth rate of per capita GDP in 1961-1981 was 3.75% while the 1982-2015 average, by contrast, is a strikingly low 0.58%.

² The relative price of the informal good (the real exchange rate) is a key variable in Razmi et al. With fixed expenditure shares, this relative price no longer plays the same role as an important component of a strategy for growth.

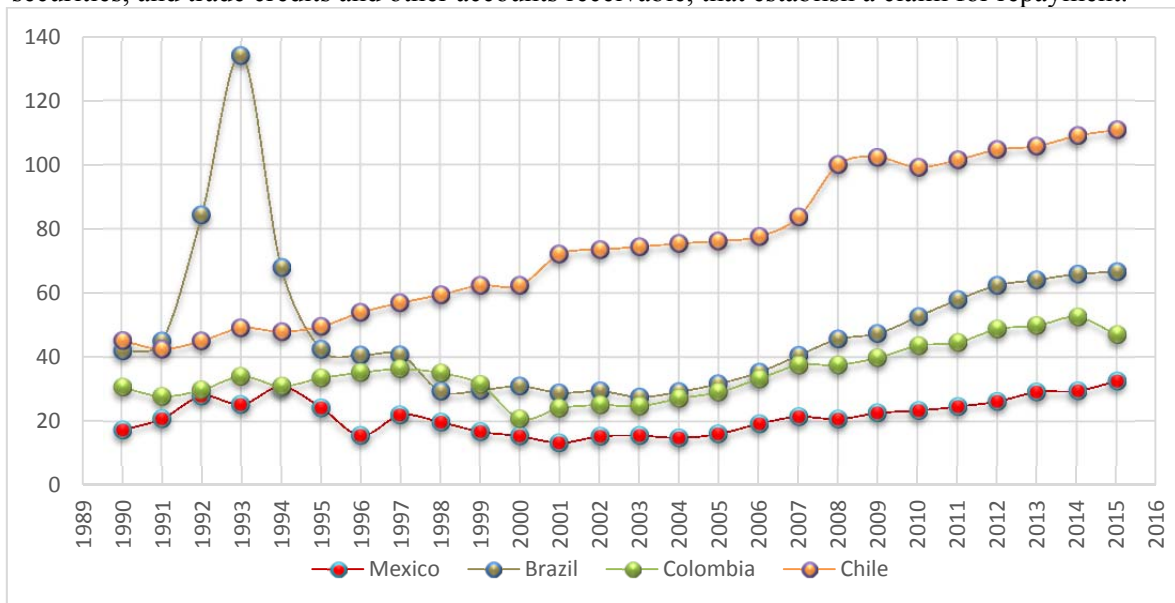
Not surprisingly, virtually all scholars and policy makers agree that the results have been disappointing. There is also widespread agreement that although credit for consumption and housing has increased, finance for productive projects is difficult to obtain, and financial constraints have been an important reason for slow growth. According to Kehoe and Ruhl (2010, p. 2001) “[t]he most popular set of theories for Mexico’s stagnation focuses on its inefficient financial system and lack of contract enforcement”.³ Indeed, in 2013-2014 legal reforms involving changes in more than 30 laws with the explicit purpose of improving access to finance were carried out. Their results are still to be seen.

Figure 1 presents the evolution of domestic credit to the private sector as a percentage of GDP for the period 1990-2015. This variable is commonly used in the literature as an indicator of financial constraints, and the figure includes data for other Latin American countries. Mexico has the lowest ratio among these countries; the average for the whole period was 21.7%. There has been some progress, and the ratio increased from 17.4% in 1990 to 32.7% in 2015. To put this rise in perspective, however, the only other Latin American OECD member, Chile, saw an increase from 45.3% in 1990 to 110.9% in 2015.

³ Kehoe and Ruhl question this emphasis on the financial system, noting that fast-growing China also had a poorly functioning financial system (p. 1011).

Figure 1. Domestic Credit to Private Sector (% of GDP)

Source: World Bank (<http://data.worldbank.org/>), drawing on International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates. “Domestic credit to private sector” is defined by the World Bank as financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment.

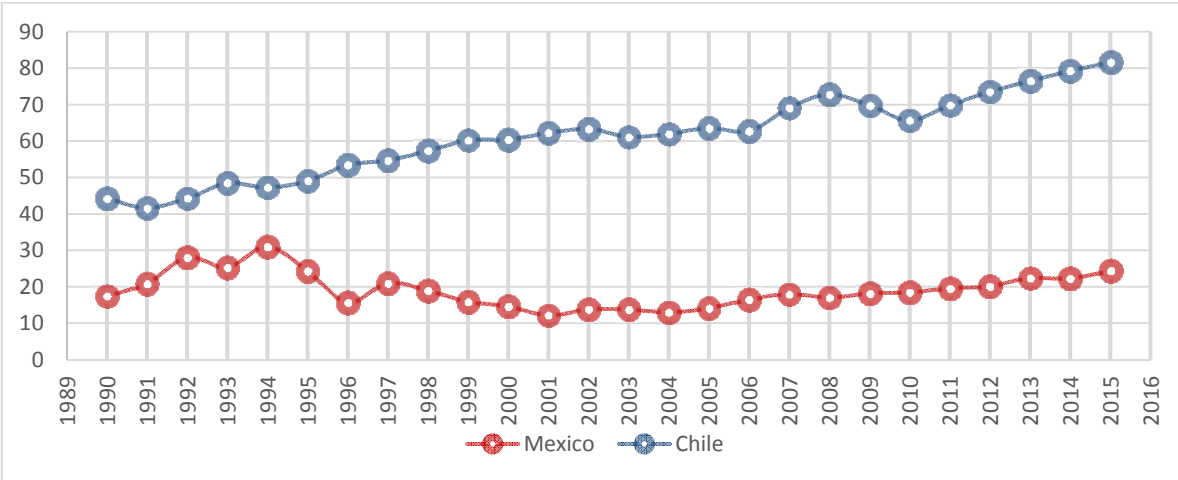


The literature suggests that the lack of credit from the banking system has been particularly important in Mexico; Mantey de Anguiano (2007), Haber (2005) and (2009). Figure 2 shows the evolution of the domestic bank credit to the private sector as percentage of GDP for the years 1990-2015. Again, for comparative purposes we include the evolution of the same variable in the only other Latin American OECD member, Chile. The figure confirms the low level of bank lending in Mexico. In the early 1990s the ratio was around 30%. It then fell steadily, reaching a low of 12.1% in 2001, before recovering to 24.5% in

2015. The average for the whole period was 19%. In Chile, by contrast, the average was 61%, and the ratio went from 44.2% in 1990 to 81.7% in 2015.

Figure 2. Domestic Credit to Private Sector by Banks (% of GDP)

Source: World Bank (<http://data.worldbank.org/>), drawing on International Monetary Fund, International Financial Statistics and data files, and World Bank and OECD GDP estimates. The World Bank defines “Domestic credit to private sector given by banks” as financial resources provided to the private sector by other depository corporations (deposit taking corporations except central banks), such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. For some countries these claims include credit to public enterprises.



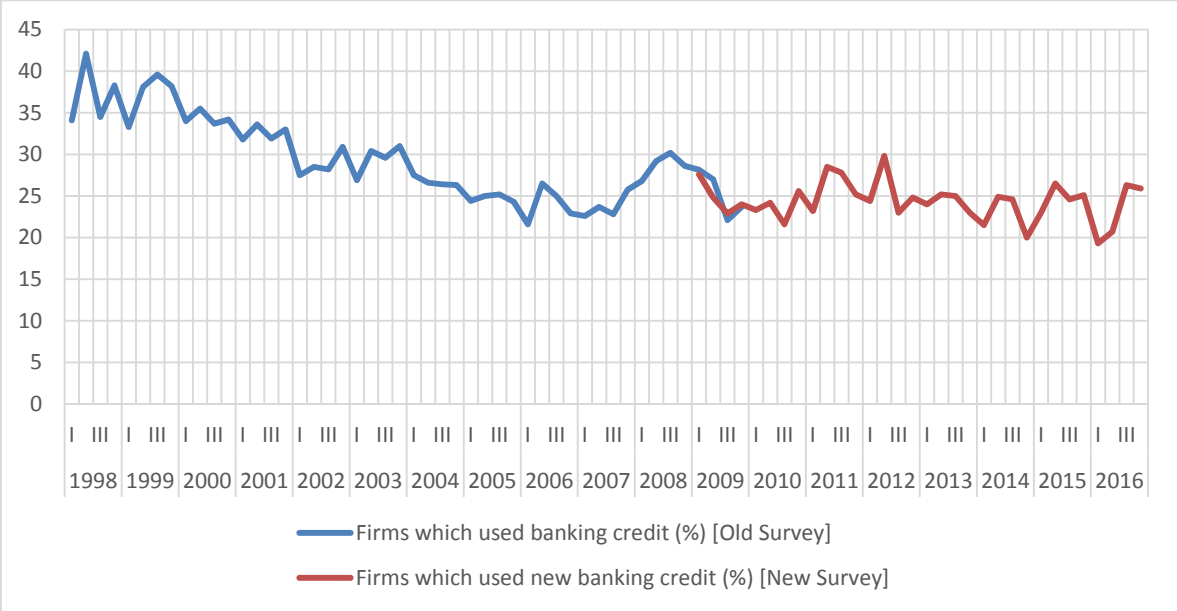
The data in Figures 1 and 2 do not distinguish between credit to firms and credit for consumption, and there is a broad consensus credit that constraints mainly affect firms rather than consumption. Using data from the quarterly “Encuesta de evaluación coyuntural del mercado crediticio” [Quarterly Survey on the State of the Credit Market] carried out by the Mexican Central Bank, figure 3 shows the proportion of firms using bank credit.⁴ From

⁴ Beginning in 2009 the survey started asking about “new” banking credit. During 2009 both the Old and the New Survey questions overlapped. We present both data outcomes.

1998 to 2009 on average only 29.4% of the firms surveyed used banking credit, and the average fell to 24.4% in the period from 2009 to 2016.

Figure 3. Mexican firms which used banking credit (%)

Source: “Encuesta de evaluación coyuntural del mercado crediticio”, Banco de México



2.2. Microeconomic evidence

Several contributions have examined the effect of credit constraints on industrial growth in developing countries. They typically find that the size distribution of firms is characterized by a “missing middle”: most firms are very small and a very small number of firms are very large, and the vast majority of smaller firms face acute credit constraints, due to lack of collateral, among other reasons. The findings suggests that credit constraints may be an important constraint on industrial growth; Banerjee and Duflo (2014), Bigsten et al. (2003),

Galindo and Schiantarelli (2003), Harrison and McMillan (2003), Hericourt and Poncet (2007).

A number of studies consider the reasons why lenders lend so little for productive projects. Bergoeing et al. (2002) compare Chilean and Mexican bankruptcy laws; Haber (2005) and Haber et al. (2008) focus on the bank privatization process; Mántey de Anguiano (2007) points out that banks make good profits by buying government bonds and engaging in the derivatives market. Haber (2009) offers evidence to suggest that there is little lending because of the oligopolistic banking system and because of the difficulties lenders face in seizing assets from borrowers, if the latter default; Haber and Mussachio (2012) offer a detailed study of the impact of foreign banks entry in Mexico; Tinoco-Zermeño, Venegas-Martínez, and Torres-Preciado (2014) examine the effect of inflation on low rates of bank credit; Chavarín (2015) rejects the idea that low lending is due to problems associated with borrowers who fail to pay back on time.

Other contributions focus on the distributional dimension of credit constraints and offer evidence and/or explanations of why small and medium size firms are more credit constrained than large ones; Garrido and Prior (2007), Lecuona (2009), Clavelina (2013), Padilla-Pérez and Fenton (2013). Relatedly, some contributions have focused on the impact of credit constraints on poverty and informality; Carreón, di Giannatele and López (2007), Niño-Zarazua (2013), Bruhn (2013), Bruhn and Love (2014). Contributions on the gender dimension of credit constraints can also be found; using quasi-experimental data Bruhn and Love (2011) examine how easing credit constraints affects entrepreneurship, employment and income of men and women.

None of the above studies directly address the key issues in the growth debate. The contributions by Villalpando (2014) and McKenzie and Woodruff (2008) are more relevant in this respect. Villalpando offers evidence for the negative effect of financial constraints on productivity. McKenzie and Woodruff show that a relaxation of capital constraints can have positive and significant effects on profits.

The literature on investment effects is limited too. The above-mentioned study by Gelos and Warner (1999) examines whether cash flows affected capital expenditures in manufacturing firms from 1984 to 1994; following the famous methodology introduced by Fazzari et al. (1988) in which a positive relationship between cash flows and investment is an (indirect) indication that credit constraints are deterring investment. Gelos and Werner indeed find that cash flows are significantly related with capital expenditures. Similarly, Sánchez (2001) finds that cash flows had a significant effect on investment in manufacturing establishments during 1984-1999. Castañeda (2003) compares the relationship of cash flows and investment before and after the 1995 crisis, finding that, “contrary to prior expectations” (p. 226) the sensitivity of investment with respect to cash flows was reduced after the crisis; this result, however, is not that surprising once it is noted that the dataset used consists of large enterprises whose “network structure may have reduced agency problems and helped firms to retain their access to external sources of financing” (p. 227).

Credit constraints have become harsher since the mid-1990s (Moreno-Brid and Ros 2009; Haber et al. 2008), and their impact in this more recent period is studied by Cotler and Woodruff (2008), Love and Sánchez (2009), and Gómez-Ramírez (2015). Cotler and Woodruff (2008) examine the effect of micro-lending on physical capital investment and

other measures of the firm's performance. Overall, a positive and significant relationship between obtaining a loan and investment in fixed assets is found. The study uses quasi-experimental data that include both treatment and control groups of similar enterprises, but the focus is on small retailers in suburban areas of Mexico City that may not be representative of the whole country; Cotler and Woodruff are aware of the scope of their findings (p. 848).

Love and Sánchez (2009) examine the existence of credit constraints in rural areas of Mexico. They find evidence that loans to credit constrained agents increase both the number of agents making investment and the quantities of investment. The findings are based on surveys from 1999 (representative at the regional level) and 2001 (representative at the national level). Importantly, however, the study is confined to the rural sector, and about 75% of Mexicans live in urban areas.

Using nationally representative, establishment level data for the years 2005 and 2009-2010, Gómez-Ramírez (2015) finds that capital accumulation has been negatively affected by credit constraints. Using a bivariate probit model to control for the endogeneity of credit constraints, credit constraints reduced the likelihood of investing by 48% in 2005 and by 38% in 2009-2010.

3. Credit constraints and technical change

The microeconomic evidence supports the significance of credit constraints at the firm level. But firm-level evidence should be interpreted with care. It is not obvious why firm-

level credit constraints would affect the average growth rate of productivity.⁵ Misallocation of investment can reduce the average *level* of productivity if low-productivity firms survive because credit constraints prevent the expansion of more efficient competitors. The growth rate of productivity could be affected, too, if credit constraints reduce aggregate investment in R&D and/or produce in inefficient allocation of R&D spending. Large firms typically do not face significant credit constraints, however, and it seems unlikely that formal R&D spending would have played a significant role in small and medium sized Mexican firms, even if these firms had not been credit constrained. While not denying this channel, we therefore examine a different mechanism: the average *level* of productivity suffers if credit constraints prevent investment and production from moving to the most productive firms; the *growth* of average productivity is affected because innovations represent improvements relative to a base level of technology, and the base level depends on average productivity.

3.1. Innovation and diffusion

Consider an economy with a large number of firms, each having a Leontief production function with capital and labor as inputs. Capital productivity, σ , is constant across firms and over time. By contrast, labor productivity, A_{it} , is firm specific and increases over time:

$$y_{it} = \min\{\sigma k_{it}, A_{it} l_{it}\} \quad (1)$$

where y_{it} , k_{it} and l_{it} denote firm i 's output, capital stock and labor input at time t .

⁵ An influential literature (not specifically about the Mexican economy) has discussed whether or not credit constraints affect growth through its effect on overall productivity; Aghion et. al. (2005). Relatedly, influential papers on the impact of monetary policy on the credit supply in the USA acknowledge that substantial firm-level credit constraints do not necessarily imply substantial reductions in the overall economic activity; Kashyap and Stein (2000), Khwaja and Mian (2008).

A firm's productivity is either 'low' or 'high'. Firms that innovate in period t achieve high productivity; firms that do not innovate in period t use the base technology. Formally, we assume that $A_{it} = \exp(a_t + b_{it})$ or, equivalently,

$$\ln A_{it} = a_t + b_{it} \quad (2)$$

where a_t represents the base technology in period t and $b_{it} \in \{0, b\}$ captures innovation by the firm. We assume that all firms share the same base technology a_t , independently of their individual histories of innovation.

Innovations -- the stochastic variables b_{it} -- occur randomly, and we take them to be independent across firms and serially independent for any given firm; that is, b_{it} is independent of $b_{j\tau}$ if $ij \neq j\tau$. Each firm has a probability $x \in [0,1]$ of innovating in any given period. Thus,

$$b_{it} = \begin{cases} b & \text{with probability } x \\ 0 & \text{with probability } 1 - x \end{cases} \quad (3)$$

The base technology in period $t + 1$ depends positively on the average productivity in period t . Formally, we assume that

$$a_{t+1} = a_t + f[\ln A_t - a_t] + g[\widehat{K}]; \quad f' > 0, \quad 1 > g' \geq 0 \quad (4)$$

where $A_t = \frac{\sum_i A_{it} l_{it}}{\sum_i l_{it}}$. The dynamics of the base technology and the f -function, in particular, are central to our argument.

The $f[\cdot]$ function represents diffusion, but in a broad sense that goes beyond the passive adoption of existing techniques. The base technology a_t changes over time as firms

learn from and combine innovations from the previous period.⁶ The process of combination depends on the visibility of the innovations, and the visibility depends on the extent of their use. If each firm observes the technologies used in the previous period by a sample of m other firms and a fraction r of these other firms has innovated, the firm will learn from and combine rm innovations. The higher the fraction r , the more new information is obtained and the larger will be the increase in base productivity. The probability that a firm will become part of the sample depends on its size, and the proportion of output produced by innovating firms is reflected in the difference between average and base technology, that is, in $\ln A_t - a_t$. The difference is equal to b if all production takes place in innovating firms, but equal to zero if all production takes place in non-innovating firms. Thus, we take the speed of diffusion-induced technical change to be an increasing function of $(\ln A_t - a_t)$.

The second term on the right hand side of equation (4) -- the $g[\cdot]$ function -- represents traditional notions of learning by doing (or learning by investment), as exemplified by Kaldor's technical progress function and Verdoorn's law. This term captures a causal link from accumulation to productivity growth; see Skott and Larudee (1998) and Ros (2013a, chapter 1) for an application to Mexico.⁷

3.2. Credit constraints and productivity

The qualitative effect of credit constraints on aggregate productivity growth can be seen most clearly in a stylized setting in which capital depreciates fully after one period and in

⁶ This combination and refinement of different innovations may (but need not) produce a new base productivity that exceeds the productivity of the innovating firms in the previous period (that is, we may have $a_{t+1} > a_t + b$).

⁷ The large literature on Verdoorn's law includes Dixon and Thirlwall (1975), McCombie (1982) and Setterfield (1997).

which a firm knows, when it makes its investment decision in period t , whether it will be an innovator in period $t + 1$. It would be straightforward to relax the second assumption and assume merely that the firm receives an imperfect signal about its probability of successful innovation. A relaxation of the first assumption would complicate the analysis but not, we believe, affect the qualitative conclusions.

We consider two polar cases with respect to the financial system. In the first case firms cannot obtain external funding; there are no financial markets, and each firm's investment is constrained by its own operating profits. In the second case financial markets are perfect, and finance flows to the innovating firms; non-innovating firms, which would have low profitability, do not invest.

Consider first the case without financial markets. If all firms invest the same proportion of their profits, the proportion x of the total capital stock K_t will be operated by innovating firms; the fraction $1 - x$ will be operated by non-innovating firms and, assuming a uniform utilization rate of capital, the average labor productivity in the modern sector is given by⁸

$$A_t = \frac{\sum_i A_{it} l_{it}}{\sum_i l_{it}} = \frac{u\sigma K_t}{\frac{xu\sigma K_t}{\exp(a_t + b)} + \frac{(1-x)u\sigma K_t}{\exp(a_t)}} \\ = \frac{\exp(a_t + b)}{x + (1-x)\exp(b)}$$

Thus,

$$\ln A_t = a_t + b - \ln(1 + (1-x)(\exp b - 1))$$

and, for small values of b ,

$$\ln A_t \approx a_t + xb \tag{5}$$

⁸ By assumption, the distribution of innovations is random across the population of firms: the fraction x of all firms innovates in any one period, and innovation in any one period is independent of past innovation history.

Using equations (4) and (5) we now get an expression for the growth rate of average productivity in the case in which firms cannot obtain external funding (using ‘hats’ to denote growth rates):

$$\hat{A}_t = \ln\left(\frac{A_{t+1}}{A_t}\right) = \ln A_{t+1} - \ln A_t = a_{t+1} - a_t$$

or

$$\hat{A}_t = f[xb] + g[\hat{K}] \quad (6)$$

The derivation of (6) assumed uniform rates of saving and utilization. The analysis can be generalized to the case in which innovating firms have higher rates of saving and utilization; as shown in Appendix A, the results are similar.

The expression for the growth rate of productivity in equation (6) changes if perfect capital markets ensure that all investment goes to innovating firms (which offer a higher rate of profit). Given the assumption of full depreciation, we now have that $K_t^{high} = K_t$ and $K_t^{low} = 0$. Using the same steps as in the derivation of equation (6), we obtain the growth rates of productivity and employment under perfect financial markets:

$$\hat{A}_t = f[b] + g[\hat{K}] \quad (7)$$

Comparing equations (6) and (7), there is an unambiguous increase in productivity growth when the credit constraints are removed.

The analysis has focused on two polar cases with respect to the financial system (complete self-financing and perfect capital markets). The intuition, however, is straightforward, and the qualitative result is likely to be robust: credit constraints and poor financial markets reduce the share of high-productivity, innovating firms in total capital and output, and the share of innovating firms in turn affects the visibility of innovations. The

intuition and likely robustness suggest a general specification in which productivity growth depends on q , where q is an indicator of the allocative efficiency of the financial system (an inverse indicator of the degree of credit constraints). Formally,

$$\hat{A}_t = f[q] + g[\hat{K}]; \quad f' > 0, 1 > g' \geq 0 \quad (8)$$

4. A dual economy

Assuming that credit constraints affect productivity growth, the key questions concern the implications for investment, modern sector employment and aggregate economic growth. We use a two-sector model in which a modern, formal sector interacts with an informal sector to analyze these issues.

Let Y_N and Y_M denote output in the informal and modern sector. Taking the price of the modern good as the numeraire, real output (in terms of modern goods) is given by

$$Y_t = p_{Nt}Y_{Nt} + Y_{Mt} \quad (9)$$

where p_{Nt} is the relative price of the informal good.

We assume that the total labor force L_t grows at the exogenous rate n :

$$\hat{L}_t = n \quad (10)$$

4.1. The modern sector

The modern sector produces a tradable good which can be exported or used for domestic investment or consumption. The technology in this sector is as described in section 3.

Disregarding labor hoarding and using $K_t = \sum_i k_{it}$, $L_{Mt} = \sum_i l_{it}$ and $A_t = \frac{\sum_i A_{it}l_{it}}{L_{Mt}}$ to denote aggregate capital, aggregate employment and average labor productivity, equation (1) implies that

$$Y_{Mt} = u_t \sigma K_t = A_t L_{Mt} \quad (11)$$

where u_t is the average utilization rate of capital. Labor productivity in the sector grows in accordance with equation (8).

4.2. The informal sector and the labor supply

Workers who fail to get modern-sector jobs move into the informal sector, that is,

$$L_{Nt} = L_t - L_{Mt} \quad (12)$$

where L_{it} denotes employment in sector i . This assumption, however, does not imply full employment. Workers in the modern sector earn higher wages, and the informal sector is characterized by underemployment: informal workers may be employed only a fraction of the time; obvious examples include street vendors with few customers, or day laborers who do not find jobs every day.

The informal sector produces a non-tradable consumption good using labor as the only input; this assumption represents a stylized version of the fact the informal sector has lower capital intensity than the formal sector. The production function is linear. If E_t denotes the effective employment, production in the informal sector is given by:

$$Y_{Nt} = E_t = e_t L_{Nt} = e_t (L_t - L_{Mt}) \quad (13)$$

where $e_t = \frac{E_t}{L_{Nt}} \leq 1$ is the effective employment rate. Assuming, for simplicity, that all income in the informal sector goes to workers,⁹ the average ‘wage’ in terms of modern goods is

$$\omega_{Nt} = e_{Nt} p_{Nt} \quad (14)$$

⁹ The Mexican informal sector is large and it may include small scale firms with owners and workers. For present purposes, however, we are mainly interested in the influence of informal-sector incomes on formal-sector wages. This influence does not depend on the absence of profit income in the informal sector, and the assumption simplifies the exposition.

4.3. Demand structure, wages and profits

In Mexico, as in most developing economies, workers save little. Thus, we assume that all income in the informal sector is spent on consumption, that the same applies to wage income in the formal sector, and that a fraction of formal-sector profits is saved. Formally,

$$S_t = s\pi_t Y_{Mt} \quad (15)$$

where S , s , and π denote private savings, average saving rate out of profits, and the profits share of the modern sector, respectively.

Domestic consumption is split between informal and formal goods. To simplify, we assume that a fixed proportion, $1 - \alpha$, of domestic consumption expenditure goes to the informal good (corresponding to a Cobb-Douglas utility function). The informal good is used only for domestic consumption, and we have the following equilibrium condition for the informal sector:

$$p_{Nt} Y_{Nt} = (1 - \alpha)(p_{Nt} Y_{Nt} + (1 - s\pi_t) Y_{Mt}) \quad (16)$$

or, using (11)-(14),

$$p_{Nt} Y_{Nt} = \omega_{Nt} (L - L_{Mt}) = \frac{1-\alpha}{\alpha} [(1 - s\pi_t) u_t \sigma K_t] \quad (17)$$

Dividing through by $A_t(L_t - L_{Mt})$ and using $A_t L_{Mt} = u_t \sigma K_t$, yields an expression for average income in the informal sector:

$$\frac{\omega_{Nt}}{A_t} = \frac{1-\alpha}{\alpha} (1 - s\pi_t) \left(\frac{u_t \sigma K_t}{A_t L_t - u_t \sigma K_t} \right) = \frac{1-\alpha}{\alpha} (1 - s\pi_t) \left(\frac{\frac{u_t \sigma K_t}{A_t L_t}}{1 - \frac{u_t \sigma K_t}{A_t L_t}} \right)$$

or

$$\frac{\omega_{Nt}}{A_t} = (1 - s\pi_t) v \left[\frac{u_t \sigma K_t}{A_t L_t} \right]; \quad v' > 0 \quad (18)$$

The formal sector is the prime source of demand for informal goods and, thereby, the determination of average incomes in the sector (equations (17)-(18)). Conditions in the informal sector, in turn, influence wage setting and profitability in the formal sector. The wage in the modern sector typically exceeds the average income in the informal sector, and we assume that

$$\omega_{Mt} = \mu \omega_{Nt}; \quad \mu > 1 \quad (19)$$

where ω_M is the real wage (in terms of modern goods) per worker in the modern sector and μ represents the wage premium. Thus, we have¹⁰

$$\pi_t = \pi \left[\frac{\omega_{Nt}}{A_t} \right]; \quad \pi' < 0 \quad (20)$$

Combining (18) and (20), the profit share in the modern sector and the informal-sector equilibrium wage can be written as functions of $\frac{uK}{AL}$ and s :¹¹

$$\pi = \varphi \left[\frac{uK}{AL}, s \right]; \quad \varphi_1 < 0, \varphi_2 > 0 \quad (21)$$

$$\frac{\omega_N}{A} = \psi \left[\frac{uK}{AL}, s \right]; \quad \psi_1 > 0, \psi_2 < 0 \quad (22)$$

Equilibrium in the informal sector ensures that the formal sector will also be in equilibrium if the aggregate IS condition holds. This condition requires that

$$I = S + (T - G) + (M - X) \quad (23)$$

¹⁰ The general specification in equation (20) does not require a constant wage premium. The wage aspirations and bargaining strength of formal-sector workers arguably depend positively on the profit share; that is, we may have $\mu = \mu[\pi]$ with $\mu' > 0$. The average profit share in the modern sector is given by $\pi_t = 1 - \frac{\omega_{Mt}}{A_t}$, and using equation (19) and the implicit function theorem, the profit share will be a decreasing function of $\frac{\omega_{Nt}}{A_t}$, as in (20).

¹¹ From equations (18) and (20) we have

$$\frac{\omega_{Nt}}{A_t} = \left(1 - s\pi_t \left[\frac{\omega_{Nt}}{A_t} \right] \right) v \left[\frac{u_t K_t}{A_t L_t} \right]$$

Using the implicit function theorem, $\frac{\omega_{Nt}}{A_t}$ is increasing in $\frac{u_t K_t}{A_t L_t}$ and decreasing in s . From (20) it now follows that the profit share is decreasing in $\frac{u_t K_t}{A_t L_t}$ and increasing in s .

where I , S , T , G , M and X denote investment, private saving, taxes, government consumption, imports and exports, all measured in terms of formal goods. The equilibrium condition for the informal (non-traded) good is independent of the trade balance, given the level of formal sector output. It would be affected, however, by taxes that influence disposable incomes as well as by any government consumption that is not exclusively targeting the modern, traded good. To avoid these complications, we assume that taxation takes the form of a sales tax on the formal sector and that government consumption contains no informal goods.

We examine the properties of two versions of this economic system, a classical version and a Keynesian version.

5. A classical closure

In this classical version there is full utilization of capital, the profit share in the modern sector is given by equation (21), and investment is determined passively by saving, that is, by the right hand side of the IS relation (23). To get a determinate outcome, the model is closed by introducing assumptions about the budget deficit and the trade balance. Taking the sum of the government budget and the trade account to be proportional to the capital stock, the IS condition can be written

$$\dot{K} + \delta K = I = S + \tau K \quad (24)$$

where δ denotes the capital depreciation rate, and $\tau K = T - G + M - X$. The special case in which both the government budget and the trade account are balanced – perhaps a reasonable long-run constraint – corresponds to setting $\tau = 0$.

Equations (11), (15), and (24) imply that

$$\widehat{K} = \frac{s}{K} - \delta = s\pi u\sigma - (\delta - \tau) \quad (25)$$

and, using equation (21) and $u=1$, we obtain a general expression for the equilibrium accumulation rate:

$$\widehat{K} = F \left[\frac{K}{AL}, s, \tau \right]; F_1 < 0, F_2 > 0, F_3 > 0 \quad (26)^{12}$$

The mechanisms and intuition behind equation (26) are straightforward. An increase in the ratio of capital to the total labor supply in efficiency units implies an increase in the share of modern-sector workers. As a result, the demand for informal goods will rise and be spread over a smaller number of informal sector workers. But the associated rise in informal sector income per worker in turn affects formal sector wages and squeezes profits, with negative effects on saving and accumulation. A rise in the saving rate out of profits or in public/foreign saving has a direct positive effect on saving and accumulation. A rise in the saving rate out of profits has an additional, indirect effect: it reduces the demand for informal goods which reduces informal sector income per worker, weakens formal sector workers and raises the profit share.

5.1. Dynamics

The share of employment in the modern sector is given by $\frac{LM}{L} = \frac{u\sigma K}{AL}$. The utilization rate and the technical coefficient σ are both constant, and from (8), (10) and (26) it follows that

$$\begin{aligned} \widehat{\left(\frac{K}{AL}\right)} &= \widehat{K} - \widehat{A} - \widehat{L} = F \left[\frac{K}{AL}, s, \tau \right] - f[q] - g \left[F \left[\left(\frac{K}{AL}, s, \tau\right) \right] \right] - n \\ &= \chi^c \left[\frac{K}{AL}, q, s, \tau \right]; \chi^c_1 < 0, \chi^c_2 < 0, \chi^c_3 > 0, \chi^c_4 > 0 \end{aligned} \quad (27)$$

¹² Of course, F is a function of the exogenous parameters δ and σ as well. These parameters play no role for our argument, however, and we leave them out to simplify the notation. The same omission is made in equations (34) and (35) below.

The differential equation (27) has at most one positive stationary solution for given values of q , s , and τ . The existence of a positive solution for $\frac{K}{AL}$ requires that its growth rate is positive as its level tends to zero, $\lim_{K/AL \rightarrow 0} \chi^c \left[\frac{K}{AL}, q, s, \tau \right] > 0$, and that its growth rate is negative as its level tends to infinite, $\lim_{K/AL \rightarrow \infty} \chi^c \left[\frac{K}{AL}, q, s, \tau \right] < 0$. The second of these conditions is satisfied for all economically reasonable specifications. If the first condition fails to be satisfied, a low profit share (even when the modern sector is small), and low saving rates prevent accumulation from keeping up with the growth in the labor force in efficiency units. Modernization/industrialization becomes impossible, and the share of the formal sector converges to zero, $\frac{K}{AL} \rightarrow 0$. This ‘development trap’ may apply to some economies, but not, perhaps, to middle income countries that have already achieved a certain degree of industrialization. Thus, we assume the existence of a well-defined, non-trivial stationary solution.

The sign of χ^c_1 ensures that the stationary solution is stable for given values of q , s , and τ , and we have

$$\frac{K}{AL} \rightarrow \phi^c[q, s, \tau]; \quad \phi^c_1 < 0, \phi^c_2 > 0, \phi^c_3 > 0 \quad (28)$$

Using the expressions for \hat{A} and \hat{L} (equations (8) and (10)), and the convergence result for $\frac{K}{AL}$, the accumulation rate associated with the stationary solution satisfies the condition

$$\hat{K} - g[\hat{K}] = f[q] + n \quad (29)$$

The g -function describes the Verdoorn effect and, by assumption, $g' < 1$. Thus, the left-hand side of equation (29) is strictly increasing in \hat{K} , and it follows that¹³

$$\lim_{t \rightarrow \infty} \hat{Y} = \lim_{t \rightarrow \infty} \hat{Y}_M = \lim_{t \rightarrow \infty} \hat{K} = \theta[q]; \quad \theta' = \frac{f'}{1-g'} > 0 \quad (30)$$

Substituting the result (30) into equation (10) and using the aggregate production function (11) and equation (29), we get (asymptotic) expressions for \hat{A} and \hat{L}_M :

$$\lim_{t \rightarrow \infty} \hat{A} = f[q] + g[\theta[q]]; \quad f' > 0, \quad \frac{dg}{dq} > 0 \quad (31)$$

$$\lim_{t \rightarrow \infty} \hat{L}_M = n \quad (32)$$

The profit share can be derived using equations (25) and (30). We have

$$s\pi\sigma - (\delta - \tau) = \theta[q] \quad (33)$$

Hence,

$$\pi = \frac{\theta[q] + \delta - \tau}{s\sigma} = G^c[q, s, \tau]; \quad G^c_1 > 0, G^c_2 < 0, G^c_3 < 0 \quad (34)$$

and (since $\frac{w_N}{A}$ is inversely related to the profit share),

$$\frac{w_N}{A} = H^c[q, s, \tau]; \quad H^c_1 < 0, H^c_2 > 0, H^c_3 > 0 \quad (35)$$

The share of modern-sector employment is equal to $\frac{\sigma K}{AL}$, and the asymptotic value of $\frac{K}{AL}$ is given by (28). The underemployment rate in the informal sector and the average, economy-wide unemployment rate have been left open, however. The average income in the informal sector is determined by the equilibrium condition (18). But ω_N is the product of the price p_N and the effective employment rate e . If the value of $\frac{p_N}{A}$ is constant, all adjustments in wage ratio $\frac{w_N}{A}$ happen through variations in the employment rate e . A

¹³ The first equality – the result for the growth rate of aggregate real output -- follows from the constancy (asymptotically) of the profit share. This constancy implies that the value of output in the informal sector grows at the same rate as that of the formal sector (equation (19)).

constant value of the employment rate e , by contrast, implies that informal-sector prices absorb all variations in $\frac{w_N}{A}$. Neither of these extremes is likely to be accurate; an increase in $\frac{w_N}{A}$ may be expected to raise both the employment rate and the price of the informal good.

In this intermediate case, we have

$$e = l \left[\frac{w_N}{A} \right] = l [H^c[q, s, \tau]]; l'H^c_1 < 0, l'H^c_2 > 0, l'H^c_3 > 0 \quad (36)$$

The effective employment rate in the economy as a whole (ε) is determined by the degree of underemployment in the informal sector and the share of workers in the informal sector:

$$\begin{aligned} \varepsilon &= \frac{L_M + E}{L} = \frac{L_M}{L} + e \left(1 - \frac{L_M}{L} \right) \\ &= \sigma \phi^c[q, s, \tau] + l [H^c[q, s, \tau]] (1 - \sigma \phi^c[q, s, \tau]) \end{aligned} \quad (37)$$

5. 2. Asymptotic effects

The asymptotic effects of changes in the value of q can be found using the results in (30)-(37). A relaxation of credit constraints, a rise in q , unambiguously raises the long-run rate of growth of the modern sector --equation (30)-- and boosts productivity growth --equation (31). Faster productivity growth, in turn, generates faster growth in real wages. There are also effects on income distribution and unemployment, however, and these effects are less benign.

The profit share increases --equation (34)--, and both the wage share in the modern sector and the employment rate fall. The fall in the wage share follows directly from the rise in the profit share. The decline in the employment rate follows from the negative impact of q on both the employment share in the modern sector and the effective employment rate in the informal sector --equations (36)-(37)--. The rise in the profit share,

finally, may increase wage inequality by raising the wage premium in the modern sector -- equation (20) and footnote 11.

The distribution and employment effects are quite intuitive. If the growth rates of labor productivity and output increase, capital accumulation has to keep pace, and this requires an increase in the profit share. An increase in the profit share, in turn, requires a weakening of the bargaining position of formal-sector workers. This weakening is achieved through a decline in the proportion of the labor force that works in the formal sector, and as workers get pushed into the informal sector, the rate of underemployment tends to rise.

Strong firm-level evidence that credit constraints influence investment need not imply macroeconomic effects on the level of aggregate saving and investment. In this classical model, however, a rise in the saving rates --the private rate s and/or the public/foreign rate τ -- could counteract the negative effects on distribution and employment. The private saving rate has been taken as invariant in the face of changes in financial constraints. That need not be accurate. The saving rate could receive a stimulus from the relaxation of credit constraints if innovating firms have a relatively high saving rate. But a relaxation of households' credit constraints could also raise consumption and reduce the saving rate, and a priori there is no reason to expect that the net effect on saving will be positive.

As an alternative, public or foreign saving could adjust; the value of τ could increase. Insofar as persistent trade deficits become unsustainable, the rise in τ would have to come via reductions in the budget deficit (increases in $(T - G)/K$). Adjustments of this kind in the government deficit are possible but depend on policy; they do not happen automatically.

5. 3. Medium-run effects

The asymptotic effects in section 5.2 can be a poor guide to the short- and medium-run effects, especially for economies whose initial position is far from the stationary solution.

The financial indicator q does not appear in the expression for the rate of accumulation --equation (26)--, and the increase in the asymptotic accumulation rate is brought about by the reduction in the stationary value of the share of modern sector employment and the associated higher value of the profit share. Thus, the rate of accumulation does not respond immediately to changes in q , and if the profit share responds slowly to the change in productivity growth, the medium run-effect on accumulation will be modest. This slow response is likely in economies with a small share of modern-sector employment and high rate of underemployment. The profit share increases because faster productivity growth gradually pushes workers into the informal sector, putting downward pressure on informal sector incomes. If the employment share in the formal sector is small, however, even large increases in productivity will generate only a minor proportional increase in the number of workers in the informal sector (see Appendix B for a formal analysis of this result).

The growth of output is of greater importance than the accumulation rate from a welfare perspective, but the conclusion is similar. The growth rate of real output (in terms of modern goods) is given by

$$\hat{Y} = \frac{p_N Y_N}{Y} (\widehat{p_N Y_N}) + \frac{Y_M}{Y} \hat{Y}_M \quad (38)$$

Equation (17) can be used to derive the following expression for the growth rate of the informal sector:

$$\widehat{p_N Y_N} = \frac{-s}{1-s\pi_t} \dot{\pi}_t + \widehat{Y}_M \quad (39)$$

Using $\widehat{Y}_M = \widehat{K}$, and substituting (39) into (38), thus, we have

$$\widehat{Y} = \frac{p_N Y_N}{Y} \frac{-s}{1-s\pi_t} \dot{\pi}_t + \widehat{K} \quad (40)$$

Equation (40) implies that the growth rate of output will follow accumulation closely as long as the profit share remains roughly constant; that is, an alleviation of credit constraints may have little or no effect on the growth rate in the medium run.

6. A Keynesian closure

Different from the classical version, in which investment is determined passively by saving, firms make active investment and pricing decisions in the Keynesian version of the model. We assume that profit motives drive the decisions.

Firms want to invest only if they expect that adding extra capacity will increase their profits. This condition, which holds independently of whether or not firms are credit constrained, fails to be satisfied if firms have undesired excess capacity. Credit constraints do not prevent a fall in investment, and firms would reduce their accumulation rates if utilization rates were to stay below their desired rate; credit constrained firms, however, could be forced to operate at high utilization rates. As a first approximation the profit condition can be expressed, therefore, as a relation between the long-run average rate of utilization and the performance of the financial system (as measured by q). Formally,

$$u = u[q]; \quad u[q] \geq \bar{u}, \quad u' < 0 \quad (41)$$

where \bar{u} is the desired rate in the absence of credit constraints.

Harrodian models typically produce local instability of the warranted path, but our focus in this paper is on medium- and long-run growth, and we shall assume that although

local instability may generate fluctuations, the fluctuations take place around the warranted path.¹⁴ Given this assumption, both our classical and Keynesian closures treat average utilization as structurally determined in the long run; it is equal to one in the classical version and determined by financial conditions (and other structural features, including the firm-level volatility of demand and the degree of competition) in the Keynesian version.

The critical difference between the two closures shows up in the pricing/output decision. A constant utilization rate implies that the rate of accumulation is equal to the rate of growth of output, and output growth is determined passively in the classical model so as to satisfy the IS condition. In Keynesian/Kaleckian/Kaldorian theories, by contrast, firms make active pricing/output decisions.

A Kaleckian benchmark model has a fixed markup, but pricing/output decisions, more generally, can take the form of a positive relation between the growth rate and the markup (Skott 1989, Skott and Zipperer 2012),

$$\hat{Y}_M = h[\pi, \dots]; \quad h_1 > 0 \quad (42)$$

The specification in (42) includes a fixed Kaleckian markup as a limiting, special case: let $h[\pi_0, \dots] = 0$ and $h_1 \rightarrow \infty$ for $\pi \rightarrow \pi_0$, where $\pi = \pi_0$ is the profit share associated with the fixed markup. The positive relation between the growth rate and the profit share (the markup) may reflect adjustment costs associated with fast growth (including Penrose effects derived from limited managerial capabilities) as well as the alleviation of financing constraints when profits are high.

¹⁴ The instability may be curtailed by economic policy, an elastic demand for exports or some other mechanism. Alternatively, multiple equilibria and a stable high-growth equilibrium are possible in dual economies; see Nakatani and Skott (2007) for an analysis along these lines of Japanese growth in the early post WW2 period when the Japanese economy had large amounts of hidden unemployment.

The growth relation (42) may contain additional variables, including a measure of the credit constraints: insofar as credit constraints hold back the expansion of some firms (the flip side of the inverse relation between q and the utilization rate), improvements in the financial system (increases in q) also stimulate growth.¹⁵ Thus, let the growth rate of output be given by

$$\hat{Y}_M = h[\pi, q]; \quad h_1 > 0, h_2 > 0 \quad (43)$$

From equation (43) and the equality between \hat{Y}_M and \hat{K} it follows that (except by fluke) the ex ante IS condition will no longer be consistent with an exogenously given value of τ and the determination of the profit share by equation (21). Formally,

$$\hat{Y}_M = h[\pi, q] \cong \frac{s}{K} - (\delta - \tau) \quad (44)$$

The ex post accounting relation must hold --we must have $I = S + (T - G) + (M - X)$ -- and if the profit share is determined by equation (21), there are two possibilities.

Induced shifts in the h -function, first, may adjust the rate of growth of output and ensure that $h[\pi, q] = \frac{s}{K} - (\delta - \tau)$; policy makers, for instance, may react to weak aggregate demand and sluggish growth by offering investment subsidies or by interventions that increase the degree of competition. Whatever the adjustment mechanism, this scenario effectively recovers the classical closure: accumulation is determined by the saving function on the right hand side of (44).

Adjustments in the elements on the right hand side of (44), second, may allow accumulation to be determined by the h -function. The simplest way for this to happen is to

¹⁵ Skott (1989) includes the employment rate as an indicator of labor market conditions and determinant of growth. In the model in this paper, however, the profit share reflects conditions in the labor market, and including the share of formal-sector employment as an additional variable in the h -function would not affect the qualitative analysis.

have the trade balance do the adjusting. In this case, the domestic saving rate remains unchanged, and the IS relation simply serves to determine the trade balance; that is, $X - M = S - I + T - G = S - h[\pi, q]K + T - G$. Alternatively, an accommodating domestic saving rate can be the result of induced changes in taxes and the government budget or of interventions that affect the private saving rate (restrictions on consumer lending, for instance). The equilibrium condition for the informal good (and thereby the determination of informal-sector wages and the profit share in the formal sector) is unaffected as long as the structure of taxes and government consumption takes the form described in section 4.3.¹⁶

6.1. Dynamics

As in section 5.1, we examine the dynamics for the employment share $\frac{L_M}{L} = \frac{u(q)\sigma K}{AL}$. The profit share in the formal sector is still given by equation (21), and if q and hence u are constant, we have

$$\begin{aligned}
\left(\frac{\widehat{u[q]K}}{AL}\right) &= \widehat{K} - \widehat{A} - \widehat{L} = h[\pi, q] - f[q] - g[h[\pi, q]] - n \\
&= h\left[\varphi\left[\frac{u[q]K}{AL}, s\right], q\right] - f[q] - g\left[h\left[\varphi\left[\frac{u[q]K}{AL}, s\right], q\right]\right] - n \\
&= \chi^k\left[\frac{u[q]K}{AL}, q, s\right]; \quad \chi_1^k < 0, \chi_2^k = h_2 - f' - g'_2 h_2 \geq 0, \chi_3^k > 0 \quad (45)
\end{aligned}$$

¹⁶ Non-zero values for the trade and/or public deficit will generate movements in the stocks of foreign and public debt. In a more elaborate model, these movements in financial stocks produce feedback effects on the private sector's saving decisions. High (low) private sector saving rates are associated with trade surpluses and public deficits (trade deficits and public surpluses), and the resulting gradual increase (decrease) in the private sector wealth to income ratio will tend to reduce (raise) the private saving rate. Ryoo and Skott (2013) analyze stock-flow adjustments of this kind for a closed, one-sector economy.

As in the classical case, there is a negative feedback from the level of $\frac{u[q]K}{AL}$ to its rate of change, and the differential equation (45) has a unique, stable solution:

$$\frac{u[q]K}{AL} \rightarrow \phi^k[q, s]; \quad \phi_1^k \geq 0 \text{ iff } h_2 - f' - g_2' h_2 \geq 0, \phi_2^k > 0 \quad (46)$$

Following the same steps as in the analysis of the classical case, we have $\hat{K} - g[\hat{K}] = f[q] + n$ at the stationary solution. Hence,

$$\lim_{t \rightarrow \infty} \hat{Y} = \lim_{t \rightarrow \infty} \hat{Y}_M = \lim_{t \rightarrow \infty} \hat{K} = \theta[q]; \quad \theta' > 0 \quad (47)$$

$$\lim_{t \rightarrow \infty} \hat{A} = f[q] + g[\theta[q]]; \quad f' > 0, \frac{dg}{dq} > 0 \quad (48)$$

$$\lim_{t \rightarrow \infty} \hat{L}_M = n \quad (49)$$

The results in (47)-(49) for technical change and the growth rates of output, capital and employment are identical to those for the classical case. The implications for income distribution and unemployment can be qualitatively different in the Keynesian model, however. Asymptotically we have

$$h[\pi, q] - g[h[\pi, q]] = f[q] + n \quad (50)$$

Hence, using the implicit function theorem,

$$\pi = G^k[q] \text{ where } G^{k'} \geq 0 \text{ if } f' \geq h_q - g'h_q \quad (51)$$

and

$$\frac{wN}{A} = H^k[q] \text{ where } H^{k'} \geq 0 \text{ if } h_q - g'h_q \geq f' \quad (52)$$

Still following the same reasoning as in section 5.1, the effective employment rate in the informal sector and the overall employment rate are given by

$$e = l \left[\frac{w_N}{A} \right] = l [H^k[q]]; \quad l' H^{k'} < 0 \quad (53)$$

$$\varepsilon = \phi^k[q, s] + l [H^k[q]] (1 - \phi^k[q, s]) \quad (54)$$

6.2. Asymptotic effects

Unlike in the classical case, an increase in the performance of the financial system --a rise in q -- may lead to improvements in employment and income distribution, as well as to an increase in the rate of growth. Comparing (52), (53) and (54), the same crucial condition ensures that both the employment rate and the distribution of income improve following a rise in q :

$$h_q > f' + g' h_q \quad (55)$$

Intuitively, the effect of a rise in q on the growth rate of output and accumulation must be larger than the effect on productivity growth. The partial derivative h_q describes the effect on output growth and accumulation. The effect on productivity is the sum of the direct diffusion effect (f') and the indirect effect via Verdoorn's law ($g' h_q$). The condition (55) can be re-written as

$$h_q > \frac{f'}{1-g'} \quad (56)$$

Expressed in this way, the condition says that employment and income distribution suffer if a weakening of workers is needed in order to raise the growth rate of output in the modern sector to the new equilibrium level.

In the Keynesian scenario, the saving rate plays no role in the determination of the distribution of income and the effective employment rate in the informal sector (equations (51)-(53)). This result may seem surprising: the saving rate influences the demand for informal goods, and one might expect this influence to feed into an effect on the average income in the informal sector. The influence, however, is neutralized by the endogenous determination of the composition of employment. An increase in the saving rate, which reduces demand for the informal good, is associated with a reduction in the share of informal-sector employment, which raises average income in the informal sector. The two forces offset each other in this model; the net effect, however, need not be zero with a different specification of functional forms (a relaxation, for instance, of the fixed composition of domestic consumption with a constant share going to informal goods). The saving rate does influence the overall rate of employment. A rise in s increases overall employment: it raises the share of workers in the modern sector and underemployment is concentrated in the informal sector.

6.3. Medium-run effects

Firms' pricing/output decisions are critical in the Keynesian version of the model and the growth function (43), which describes the pricing/output decisions, includes the financial variable q . Thus, unlike in the classical closure, a rise in q provides an immediate boost to the growth rate of modern-sector output and thereby accumulation. This effect applies independently of any additional, gradual effects via the induced changes in employment shares and the profit share.

The combined public/ foreign saving rate acts as the accommodating variable in the Keynesian closure. Persistent trade deficits are likely to provoke a foreign exchange crisis – the Mexican experience provides several examples – and sustainable growth therefore may require adjustments in fiscal policy. Specifically, an increase in the growth rate, whether caused by an alleviation in credit constraints or other exogenous shifts, should be accompanied by medium-run policies to reduce the fiscal deficit. This conclusion, which may seem ‘non-Keynesian’, is perfectly consistent with ‘functional finance’.¹⁷ There may be underemployment in our medium-run Keynesian version of a dual economy, but the underemployment is the result of shortages of capital. Aggregate demand policy may be needed for short-run stabilization (a potentially complicated task that we have deliberately abstracted from, focusing instead on medium- and long-run positions with utilization at the desired rate) but to avoid unsustainable trade deficits, fiscal policy must make space for any increase in accumulation; the medium-run fiscal deficit must be smaller, the higher is the growth rate.

7. Concluding Comments

A large literature has identified credit constraints as a key source of sluggish economic growth in Mexico, and several studies, including Gómez-Ramírez (2015), offer firm-level evidence showing that credit constraints have reduced investment. But the firm-level data do not necessarily imply adverse effects for aggregate investment and productivity, and despite the emphasis on credit constraints in the literature, there has been little theoretical work. This paper contributes to filling this lacuna.

¹⁷ Skott (2016) discusses functional finance in a mature, labor-constrained economy.

Economies with full employment need an increasing labor supply in efficiency units in order to grow. There is no such requirement under conditions of pervasive hidden unemployment. In a dual economy, economic growth does not require productivity growth in the modern sector. The presence of underutilized resources in the informal sector, implies that fast growth in per capita income can be achieved by mobilizing these resources: average incomes go up if the accumulation of capital makes previously underemployed workers move into the formal sector. In this sense, accumulation is the proximate source of economic growth, and arguably the most formidable task facing developing economies is to mobilize underemployed resources.¹⁸

Our analysis has shown how an alleviation of credit constraints can raise long-run growth through their impact on productivity growth in the modern sector. But we also find that employment in the formal sector may fall and inequality increase, even in the long run. Moreover, in the classical version of the model the growth rate need not rise in the short and medium run, and in the Keynesian version additional policies may be needed to prevent balance of payments problems. These medium-run results arguably are of greater real-world relevance than the asymptotic results. It should be noted also that other factors may affect the growth function and the rate of accumulation, and an exclusive focus on financial constraints as the impediment to growth may be misguided. An increase in the degree of goods market competition, for instance, will tend to raise the growth rate associated with any given profit share (Skott 1989).

¹⁸ The East Asian countries were spectacularly successful in this respect, sustaining high growth rates for several decades, despite having “estimated total factor productivity growth rates that are closely approximated by the historical performance of many of the OECD and Latin American economies” (Young 1995, p. 641).

It would be nonsensical to advocate credit constraints and slow productivity growth because of the potential benefits for employment and income distribution. The point is different. Our analysis suggests that a relaxation of credit constraints needs to be supplemented by other policies in order to simultaneously achieve faster economic growth in the medium run, reductions in inequality and underemployment, and a sustainable trajectory for the trade balance.

The saving rate is of particular importance in the classical model but also plays a role in our Keynesian model. An increase in saving out of profits is beneficial in a classical model because it frees up resources that can be used to expand the modern sector. In a Keynesian model, concerns about the effects of an increase in saving rates out of profits on aggregate demand would be valid if luxury consumption were the only way to boost demand. This is not the case. If private investment does not fill the gap after an increase in saving, aggregate demand can be maintained through much-needed public investment in infrastructure and education (with added benefits in terms of crowding in of private investment as well as productivity growth).

The analysis has obvious limitations. Three areas, in particular, call for further work. Our neglect of investment in the informal sector, first, may be misleading. The informal sector is less capital intensive than the formal sector, but it does use capital, and credit constraints may bite particularly hard in the informal sector.¹⁹ The delineation of informal and formal sectors, second, changes over time. Retailing activities, for instance,

¹⁹ If credit constraints in small, informal sector businesses are critical, reductions in inequality could help alleviate the credit constraints. Relatedly, some contributions seem to take as granted that inequality/poverty have been deterring human capital accumulation in contemporary Mexico; Levy (2006), Levy and Walton (2009), Esquivel (2015). This possibility (and its natural extension to physical capital), however, has not been thoroughly examined in the Mexican literature. Formal models of the interaction between inequality and human capital formation have been developed by Galor and Zeira (1993) and Benabou (1996), among others.

move from street vendors to supermarkets and department stores as the economy develops. These shifts have implications for the sectoral composition of consumption. Our assumption of fixed expenditure shares may be reasonable as a first approximation for the short and medium run, but changes in the delineation of the sectors make it less appealing for the long run.

A growth strategy, third, may need to consider not just the prevalence of credit constraints and the overall growth of the modern sector. The manufacturing sector in Mexico is mainly export-oriented and it has grown rapidly in terms of gross output, especially after the post-reform era (as even contributions somewhat critical to the reform process have recognized; Moreno-Brid and Ros (2009), de Souza and Gómez-Ramírez (2017)). The shares of imported intermediate inputs in the overall economy and in the manufacturing sector in particular, however, have been increasing even more dramatically in the post-reform period, and this trend has reduced the growth rate of value added. The Mexican economy, from this perspective, has suffered from market-induced de-linking of the modern export sector from the rest of the domestic economy; there has been a “Mexican paradox of exports boom without growth” (de Souza and Gomez-Ramirez (2017)). Sectoral disaggregation is potentially important for other reasons too. Externalities and the scope of increasing returns to scale may differ across subsectors, and markets may misallocate investment, particularly in a developing economy (Skott and Larudee (1998) consider the Mexican case). National development banks may provide part of the solution (Levy (2007), Moreno-Brid (2013)). A formal analysis of these important questions would require further disaggregation of the traded sector.

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Appendix A: Effects of differential saving and utilization rates

Innovating firms may differ from their non-innovating counterparts with respect to both saving and utilization rates. Innovating firms, first, have better prospects for future profits and may invest a higher proportion of their current profits. If s^h and s^l are the investment (=saving) shares in innovating and non-innovating firms, and K_t^{high} and K_t^{low} denote the capital stock in high and low productivity firms, we have:

$$K_t^{high} = \tilde{x}K_t \quad (A1)$$

$$K_t^{low} = (1 - \tilde{x})K_t \quad (A2)$$

where $\tilde{x} = \frac{xs^h}{xs^h + (1-x)s^l}$ and $K_t = \sum_i k_{it}$.

Innovating firms, second, may want to expand fast and are likely therefore to be affected more strongly by credit constraints. The average utilization rates may therefore be different for innovating and non-innovating firms. If u^l and u^{NI} denote the utilization rates for innovators and non-innovators, the production function (11) and equations (A1)-(A2) imply that average labor productivity in the modern sector is given by

$$\begin{aligned} A_t &= \frac{\sum_i A_{it} l_{it}}{\sum_i l_{it}} = \frac{\tilde{x}u^l \sigma K_t + (1 - \tilde{x})u^{NI} \sigma K_t}{\frac{\tilde{x}u^l \sigma K_t}{\exp(a_t + b)} + \frac{(1 - \tilde{x})u^{NI} \sigma K_t}{\exp(a_t)}} \\ &= \frac{\exp(a_t + b)}{\tilde{x} + (1 - \tilde{x})\exp(b)} \end{aligned}$$

where $\tilde{\tilde{x}} = \frac{\tilde{x}u^l}{\tilde{x}u^l + (1 - \tilde{x})u^{NI}} < 1$.

Appendix B: (In-) sensitivity of the profit share to changes in modern sector productivity

Consider the simple case with a constant wage premium. We have

$$\pi_t = 1 - \frac{\omega M_t}{A_t} = 1 - \mu \frac{1-\alpha}{\alpha} (1 - s\pi_t) \left(\frac{\frac{u_t \sigma K_t}{A_t L_t}}{1 - \frac{u_t \sigma K_t}{A_t L_t}} \right) \quad (\text{B1})$$

or

$$\pi_t = \frac{1 - \mu \frac{1-\alpha}{\alpha} \left(\frac{\frac{u_t \sigma K_t}{A_t L_t}}{1 - \frac{u_t \sigma K_t}{A_t L_t}} \right)}{1 - s\mu \frac{1-\alpha}{\alpha} \left(\frac{\frac{u_t \sigma K_t}{A_t L_t}}{1 - \frac{u_t \sigma K_t}{A_t L_t}} \right)} \quad (\text{B2})$$

If u is constant ($u = 1$ in the classical case and $u = u[q]$ in the Keynesian case), equation (B2) implies that

$$\begin{aligned} \dot{\pi} &= \frac{\partial \pi}{\partial \frac{u_t \sigma K_t}{A_t L_t}} \frac{\partial \frac{u_t \sigma K_t}{A_t L_t}}{\partial t} = \frac{\partial \pi}{\partial \frac{u_t \sigma K_t}{A_t L_t}} \frac{u_t \sigma K_t}{A_t L_t} (\hat{K} - \hat{A} - \hat{L}) \\ &= - \left\{ \frac{(1-s)\mu \frac{1-\alpha}{\alpha}}{\left[1 - s\mu \frac{1-\alpha}{\alpha} \left(\frac{\frac{u \sigma K_t}{A_t L_t}}{1 - \frac{u \sigma K_t}{A_t L_t}} \right) \right]^2} \frac{1}{\left(1 - \frac{u \sigma K_t}{A_t L_t} \right)^2} (\hat{K} - \hat{A} - \hat{L}) \right\} \frac{u \sigma K_t}{A_t L_t} \quad (\text{B3}) \end{aligned}$$

The term in curly brackets is bounded, and the expression for $\dot{\pi}$ goes to zero if $\frac{u \sigma K_t}{A_t L_t}$ goes to zero.