Access to Credit and Comparative Advantage*

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Abstract

Access to external funds is crucial for the entry and expansion of entrepreneurial firms and the sectors they predominantly arise in. This paper reports three important results. First, comparative advantage is shaped by factor endowments as well as fundamental determinants of corporate finance. In particular, a larger equity ratio of firms and tough governance standards relax financing constraints, lead to entry of firms at the lower bound of the productivity distribution, and create an endogenous comparative advantage in sectors where entrepreneurial firms are clustered. Second, a small degree of protection in the constrained sector can raise a country's welfare by relaxing financing constraints if terms-of-trade effects are small. Third, a small degree of protection of the financially dependent industry in a financially underdeveloped country might even raise world welfare.

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1 Introduction

Limited access to external finance and a lack of tangible assets as collateral are major obstacles to investment of entrepreneurial firms. These problems do not surface at random but are concentrated in rapidly growing sectors with a significant amount of experimenting by firms and, as a consequence, a high rate of entry and exit. Comparative advantage is thus not only a matter of factor endowments but also hinges upon fundamentals relating to corporate finance and legal institutions (see Kletzer and Bardhan 1987; and Baldwin 1989; for early arguments along those lines).¹ Moreover, such obstacles do not affect all firms symmetrically, not even in financially constrained sectors. They predominantly influence financially weak firms at the lower bound of the productivity distribution. Empirical findings clearly point to the importance of financing constraints rooted in the special characteristics of entrepreneurial firms: they have potentially attractive investment opportunities and are more reliant on external funds than other firms; they have a low proportion of tangible assets with high collateral value; and there is a great degree of asymmetric information between insiders and outsiders such as banks and investors.

While investment subject to financial constraints is a central theme in corporate finance (see Shleifer and Vishny 1997; Holmstrom and Tirole, 1997; and Tirole 2001; 2006), neoclassical trade theory explains countries' production and international trade by 'standard' fundamentals such as relative factor endowment differences and sector-specific pro-

¹There is much empirical work establishing stylized facts about financially constrained firms. Prusa and Schmitz (1992) find that entrepreneurial firms are more likely to introduce new products than others. Kortum and Lerner (2000) suggest that such activity often involves a higher degree of innovations and frequently relies on financing with venture capital, and Hall (2002) reports that entrepreneurial firms face particularly high costs of capital. Aghion, Bond, Klemm and Marinescu (2004) suggest that these costs result from the lack of tangible assets and firms' reliance on external investors who seek to avoid entrepreneurial moral hazard. Aghion, Fally and Scarpetta (2007) show that access to finance matters for the entry of (small) entrepreneurial firms and helps to expand new firms after successful start-up investment. See also Beck et al. (2005), Do and Levchenko (2007), Guariglia (2008), and Hall and Lerner (2010) for further evidence.

ductivity differences across countries. However, there is agreement that those fundamental variables perform only weakly in determining sectoral production and trade patterns (see Baldwin 1971; and Treffer 1993, 1995, for eminent examples; and Feenstra 2004, for a survey). Obvious candidates to explain net trade flows beyond neoclassical factors are market imperfections and institutional characteristics.

The literature on the role of financial frictions in trade is still small. Early theoretical work by Kletzer and Bardhan (1987) and Baldwin (1989) delivered key hypotheses about the tightness of credit constraints (through differences between countries' domestic institutions for credit enforcement) as a source of comparative advantage in the production of goods which require more credit than others. Evidence has been provided by Beck (2002, 2003), Svaleryd and Vlachos (2005), Do and Levchenko (2007), and Manova (2008). The results in Svaleryd and Vlachos (2005) indicate that differences in financial systems may be even more important for specialization than differences in human capital.² Recent work focuses on financing constraints as a specific impediment to exporters and their effects on the volume of trade or multinational activity in one-sector economies rather than the pattern of specialization across sectors (see Chaney 2013; or Manova 2013).³

It is this paper's task to develop a model which integrates endowment- and technology-related aspects in a Heckscher-Ohlin framework of trade and finance. Unlike in previous work, which often takes a reduced form approach in modeling credit constraints, the distribution of financial assets across sectors, the occupational choice of potential

²Related to those arguments, Wynne (2005) points to the importance of the level and distribution of wealth as a determinant of trade in a small open economy where factor prices are fixed.

³Part of the literature focuses on trade and/or capital flows in models with otherwise standard reasons for trade, e.g., Matsuyama (2004, 2005), Antràs and Caballero (2009), Ju and Wei (2010, 2011) and Furusawa and Yanagawa (2012). This work illustrates that trade and capital movements may be complements and that financial capital flows from countries with poor institutions to those with high-quality institutions. It is common to model either the availability of assets, financing constraints, technology, or all of them, to be exogenous. Often, entrepreneurial firms do not differ with regard to their productivity so that financial constraints do not affect the selection of firms into the market, a feature with strong empirical support (see, for instance, Manova 2013).

entrepreneurs, and firms' pledgeable earnings and average productivity in the finance-constrained sector are jointly endogenous due to entry and exit of entrepreneurial firms in response to fundamental parameters measuring the quality of financial institutions and the economy-wide abundance of capital and its distribution.⁴ The deeper financial fundamentals co-determine economic activity and welfare and interact with classical determinants of production and trade in general equilibrium. The structural parameters of corporate finance induce changes of the allocation of assets (capital) across sectors,⁵ entry and exit (churning) of heterogeneous firms at the lower bound of the productivity domain and, hence, affect average productivity in the financially constrained entrepreneurial sector. For instance, an increase in the equity ratio as a measure of financial robustness relaxes the financing constraint and allows a margin of firms with positive net value to be active which otherwise would have been denied credit and driven out of the market. Unlike in previous work on financial constraints, comparative advantage, and trade, this affects the rate of churning of entrepreneurial firms and the productivity of the average producers active in the constrained and unconstrained sectors relative to each other.⁶

⁴Unlike in the literature on trade and finance, entrepreneurial firms may be finance-constrained independent of exporting. This is consistent with a prominent literature in finance which reports financially constrained investment opportunities as a sector characteristic (see Rajan and Zingales, 2008; Chaney 2013). In line with recent literature in macroeconomics (see Cagetti and De Nardi 2006; Quadrini 2009), not only capital abundance, but also the distribution of capital across workers and entrepreneurs matters and interacts with financing constraints to determine entry/exit, production, trade, and welfare.

⁵For instance, in Antràs and Caballero (2008), the allocation of capital across sectors is exogenous (as in a specific factors model), which renders (i) the mass of entrepreneurs entering the constrained sector fixed and (ii) own assets as well as external leverage per firm constant.

⁶We abstract from increasing returns and monopolistic competition which is often introduced to analyze extensive margins. Assuming entrepreneurial sector output to be homogeneous is not critical relative to a framework with heterogeneous firms and monopolistic competition in the absence of variety effects (see, e.g., Blanchard and Giavazzi 2003). The present set-up allows sharper analytical predictions for trade and welfare. With monopolistically competitive heterogeneous firms, most of these results could only be obtained through simulation (see, e.g., Bernard, Redding and Schott 2004, for a two-country, two-sector, two-factor model with heterogeneous firms and differentiated goods). Examples of papers emphasizing the role of financial frictions in models with monopolistically competitive firms are Manova

In accordance with the law and finance literature (La Porta, Lopez-de-Silanes, Shleifer and Vishny 1997, 2000, and La Porta, Lopez-de-Silanes and Shleifer 2006), we argue that tough corporate governance as measured by high accounting standards and rights of external investors limit the scope for managerial discretion and moral hazard. In reducing agency costs, they relax firms' financing constraints, increase the support region of active firms with heterogeneous productivity at the lower bound, reduce the churning of firms with low productivity support, and change the pattern of trade directly and indirectly (through firm selection). The fundamental finance parameters generate effects through transmission channels which lead to hitherto unexplored interactions of endogenous finance constraints, firm selection, and comparative advantage, in determining trade patterns, factor price equalization, and welfare.

The most novel contributions of the paper refer to the effects of protection and financial frictions on national and world welfare. Institutional reform such as accounting and reporting standards for increased corporate transparency makes entrepreneurs more accountable to outside investors, raising a firm's pledgeable profit and debt capacity, thereby facilitating entrepreneurial investment with positive net value. A redistribution of capital towards potential entrepreneurs results in a greater equity ratio per firm which similarly relaxes financing constraints. Since the net value of constrained investment is positive, such policies boost welfare by initiating an expansion of the entrepreneurial sector. Policies that could improve the institutional environment and help firms to accumulate more own equity are called for but might be difficult to implement and could take a long time to yield significant gains. At least in a transitory period, protection of the constrained entrepreneurial sector may raise a country's welfare since a higher domestic price boosts earnings and debt capacity and thereby facilitates investment with positive net value. Depending on the interaction between standard terms-of-trade effects and financial fric-

(2008), Furusawa and Yanagawa (2012), and Chaney (2013). This earlier work focuses largely on the effects of financial constraints on the extensive margin of exports. In contrast, the present paper is mainly focused on pattern-of-trade and welfare effects of financial constraints (and their fundamental drivers) as well as of protection for individual countries and the whole world.

tions, we show that protection in the most constrained country that is a net importer of entrepreneurial sector output can even raise world welfare.

The remainder of the paper is organized as follows. Section 2 presents the model. Section 3 analyzes the role of corporate finance for a country's industry structure, explores the impact on goods trade and analyzes the welfare consequences of protection. The paper concludes with a summary of the key findings.

2 A Model of Trade and Finance

2.1 Basic Assumptions

Consider a world with two countries, two sectors, and two factors. The entrepreneurial sector uses a risky, experimental investment technology leading to potentially large returns and is driven by frequent entry and exit. Firms depend on a key, irreplaceable input by their owner-manager who has relatively little own assets and might face difficulties in raising external funds. In contrast, the standard sector consists of firms which use a mature technology with more predictable returns. Raising external funds is not a main problem. We take the distinction to the extreme and assume that entrepreneurial firms are financially constrained and standard firms are not. In line with this, the traditional industry is assumed to be capital-intensive.

Total labor endowment is $L_T = L + 1$, where L refers to natural workers who can only work in the traditional sector. In addition, there is a mass one of potential entrepreneurs who either start a firm (with share E) or work in the traditional sector (with share $1 - E$). Firms are managed by one entrepreneur each. Occupational choice makes labor mobile across sectors but is limited to agents with entrepreneurial skills who can perform both managerial and production tasks. Employment in the traditional sector is $L + 1 - E$, while labor allocated to the entrepreneurial sector is E , equal to the number of firms started. The economy's total capital endowment is unevenly distributed and amounts to

$A_T = A_L L + A$. Potential entrepreneurs are endowed with assets A per capita and all natural workers with A_L . This assumption allows for changes in aggregate capital without changing equity per firm. We can also study the role of capital distribution among workers and potential entrepreneurs for a given total asset endowment.

The experimental sector requires one unit of entrepreneurial labor and a fixed amount of investment I per firm, or IE in total. Investment is assumed to exceed the entrepreneur's own equity, $I > A$, and requires external financing. The returns are uncertain in two ways. First, investment succeeds with a high or low probability, depending on managerial effort. Second, if successful, the return can be higher or lower, leading to output $x \in [0, \infty)$. Production follows a logic sequence of events: (i) Firms are created, reflecting occupational choice with free entry of entrepreneurs. (ii) Productivity x becomes known. The firm continues if the entrepreneur expects a positive surplus and is able to raise external financing. It closes down if x is too low and credit is denied. (iii) Having obtained the required loan $I - A$, the entrepreneur manages the investment and chooses high or low effort. With high effort, the firm succeeds with probability p and fails with probability $1 - p$. Shirking yields private benefits but results in a low success probability $p_L < p$. (iv) If investment is successful, the firm sells output x at the going market price v and repays external debt. The entrepreneur collects residual profit. If investment fails, banks do not get repaid, and entrepreneurs have zero income. Agents are assumed risk-neutral and are price takers in competitive output, labor, and capital markets.

2.2 Finance Constrained Investment

External Financing: When productivity x becomes known after entry and is sufficiently high, the entrepreneur injects her wealth to start the company. Alternatively, she accepts employment in the traditional sector and invests in the deposit market. The deposit interest factor is $R = 1 + r$, yielding opportunity cost AR . Since investment exceeds own equity, a bank must finance the remaining part $D = I - A$, with cost R per unit of lending. Given a loan rate i , the bank collects repayment $(1 + i)D$, if the firm is

successful, and nothing, if it fails. The firm's total surplus is split according to

$$\pi^e = p(xv - (1+i)D) - AR, \quad \pi^b = p(1+i)D - DR, \quad \pi = \pi^e + \pi^b = pxv - IR. \quad (1)$$

In this simple, two-state model, outside equity and debt are equivalent. Keeping this in mind, we phrase the model in terms of debt. Competitive banks break even by charging a loan rate equal to $(1+i)p = R$. The firm gets the entire surplus. The lending rate exceeds the deposit rate by an intermediation margin which reflects the rate of business failure and consequent credit losses, $i > r$.

In a first-best situation when managerial effort is contractible, firms can raise funds without a financing constraint. Given competitive lending, a firm should continue if investment I yields a positive surplus:

$$\text{First Best: } pxv \geq IR \quad \Rightarrow \quad x \geq x_0^{FB} = IR/(pv). \quad (\text{FB})$$

Credit Analysis: To go ahead with the venture, an entrepreneur must ask for a credit. Banks offer a competitive loan rate of $(1+i)p = R$ but give credit only if the required repayment is incentive compatible. In exerting full effort, the entrepreneur assures a high success probability p but forgoes private benefits, $b = 0$. When she is shirking and enjoying private benefits, $b > 0$, the success probability falls to $p_L < p$. Shirking is avoided only if repayment leaves a large-enough share $\beta^e \equiv xv - (1+i)D$ to the entrepreneur to make effort worthwhile. The incentive constraint is

$$IC^e : \quad p\beta^e \geq p_L\beta^e + b \quad \Leftrightarrow \quad \beta^e \geq \beta \equiv b/(p - p_L). \quad (2)$$

To guarantee high effort, the insider must receive at least $\beta^e \geq \beta$. The incentive constraint limits repayment and, thereby, bank lending to $(1+i)D \leq vx - \beta$ where pledgeable income $vx - \beta$ is the maximum repayment that can credibly be promised to a bank. The lower the productivity draw x , the lower is output and revenue xv , and the lower is pledgeable income. Even if the firm promises the entire pledgeable income $vx - \beta$, it may not be enough to allow the bank to break even. Hence, there is a lowest productivity

draw, x_0 , where the incentive constraint binds. Combining with the bank's break-even condition, the finance (incentive) constraint yields the cut-off productivity

$$x_0 = \frac{p\beta + (I - A)R}{pv}. \quad (3)$$

For any productivity draw $x \geq x_0$, the incentive constraint is satisfied and the firm is given credit. Less profitable ventures with $x < x_0$ are denied credit and are closed down again since the incentive constraint is violated.

Credit rationing can occur only if the financing threshold exceeds the first best level, $x_0 > x^{FB}$, meaning that some profitable projects do not get financed. We assume

$$p\beta > AR \quad \Leftrightarrow \quad x_0 > x^{FB}. \quad (A)$$

By (A), the marginal firm with productivity x_0 earns a strictly positive surplus,

$$\pi_0 = pvx_0 - IR = p\beta - AR > 0. \quad (4)$$

Even the marginal firm thus earns an excess return on capital. An entrepreneur strictly prefers to invest all available assets in the firm rather than on the capital market. For slightly smaller x , the firm would still make a profit but is denied credit. Hence, the weakest firms with lowest productivity are credit constrained.

Free Entry: At the first stage, productivity is not yet known. Firms face a distribution $G(x) = \int_0^x g(x') dx'$ with density $g(x)$. A fraction $G(x_0)$ of new firms will be stopped, either by the bank or because the entrepreneur is unwilling to continue. We write in short $G_0 \equiv G(x_0)$ and $g_0 \equiv g(x_0)$. For all $x > x_0$, profits are strictly positive, $\pi(x) = vpx - IR$, and rise in x . Expected profit, conditional on getting financed, is

$$\bar{\pi} = \int_{x_0}^{\infty} \pi(x) \frac{dG(x)}{1 - G_0} = vp\bar{x} - IR, \quad \bar{x} = \int_{x_0}^{\infty} x \frac{dG(x)}{1 - G_0}. \quad (5)$$

Entrepreneurs with firms that are shut down, have already forgone a wage income but are still able to earn AR by investing their assets in the deposit market. With probability $1 - G_0$, productivity is high enough to warrant continuation.

To warrant entry, expected net value must exceed alternative wage earnings w ,

$$\bar{\pi}_e = (1 - G_0) \cdot \bar{\pi} \geq w. \quad (6)$$

Since $\pi(x)$ is a surplus over AR , expected end-of-period wealth from setting up a firm is $\bar{\pi}_e + AR$. Employment in the standard sector yields $w + AR$. Entrepreneurs start a new venture as long as $\bar{\pi}_e \geq w$. Free entry eliminates rents, making the inequality binding.

2.3 Standard Sector

Firms use a linear homogeneous technology combining capital and labor. In the absence of financial frictions, production is analyzed in the standard way. Cost minimization $u(w, R) = \min wl + Rk$ subject to $f_0 k^\alpha l^{1-\alpha} \geq 1$ yields unit capital and labor demands $k = f_0^{-1} \left(\frac{\alpha}{1-\alpha} \frac{w}{R} \right)^{1-\alpha}$ and $l = f_0^{-1} \left(\frac{\alpha}{1-\alpha} \frac{w}{R} \right)^{-\alpha}$, respectively. Normalizing $f_0 = \alpha^{-\alpha} (1 - \alpha)^{-(1-\alpha)}$ implies $u = R^\alpha w^{1-\alpha} = 1$. With zero profit, unit cost must be equal to one when the standard good is the *numeraire*. Hence, the factor-price frontier is $w = R^{-\alpha/(1-\alpha)}$. Since $du/dw = l$ and $du/dR = k$, the slope $w'(R) = -k/l$ is equal to the capital-labor ratio. Substituting w into unit demands and introducing a sectoral index N yields,

$$k_N = \alpha_N / R, \quad l_N = (1 - \alpha_N) / w(R), \quad w(R) = R^{-\alpha_N/(1-\alpha_N)}, \quad w'(R) = -k_N / l_N. \quad (7)$$

2.4 Demand

Agents consume two goods and supply effort. We assume preferences to be linear homogeneous in commodity consumption and separable with respect to effort cost. Linear homogeneity implies risk-neutrality with respect to income. Linear separability simplifies the effort problem. Effort (foregone private benefits b_j) and income y_j are conditional on the type and sectoral activity of the agent. The consumer problem is

$$u_j = \max_{c_{jN}, c_{jE}, b_j} u(c_{jN}, c_{jE}) + b_j \quad s.t. \quad c_{jN} + v c_{jE} \leq y_j, \quad (8)$$

where subscripts N, E denote demand by agent j for standard and entrepreneurial sector output, respectively. Since the standard good (consumption c_{jN}) is the *numeraire*, v is the relative price for entrepreneurial goods. We specify

$$u(c_{jN}, c_{jE}) = u_0 \cdot (c_{jN})^{1-\gamma} (c_{jE})^\gamma, \quad (9)$$

implying constant expenditure shares, $vc_{jE} = \gamma y_j$ and $c_{jN} = (1 - \gamma) y_j$. None of the agents consumes private benefits in equilibrium. Hence, welfare of agent j is measured by real income, $u_j = y_j / v_c(v)$, where $v_c(v)$ is the price index.

2.5 Equilibrium

Aggregate output X_E in the entrepreneurial sector is the number of continuing entrants $(1 - G_0) E$, times their average productivity $\bar{x}$, times the fraction p surviving to the production stage. The total value of production then is

$$Y = X_N + v \cdot X_E, \quad X_E \equiv p\bar{x} \cdot (1 - G_0) E. \quad (10)$$

Supply and demand in the market for loanable funds reflect entry and survival of firms, $A_L L + A(1 - E) + AG_0 E = (I - A)(1 - G_0) E + k_N X_N$. Potential entrepreneurs who prefer employment, invest assets A in the deposit market, giving a supply $(1 - E) A$. A part E starts a firm in the entrepreneurial sector. A fraction G_0 must give up again and supply A in the deposit market while $(1 - G_0) E$ continue, invest equity A in their own firm and demand credit $I - A$. Rearranging gives $A_T = (1 - G_0) IE + k_N X_N$. Dividing capital demand by total output in the entrepreneurial sector in (10) yields unit capital demand k_E . Full employment implies $L_T = E + l_N X_N$.⁷ Defining unit factor demands l_E and k_E gives the resource constraints

$$\begin{aligned} A_T &= k_E \cdot X_E + k_N \cdot X_N, \quad k_E \equiv I / (p\bar{x}), \\ L_T &= l_E \cdot X_E + l_N \cdot X_N, \quad l_E \equiv 1 / [(1 - G_0) p\bar{x}]. \end{aligned} \quad (11)$$

⁷A part L always works in the standard sector and is immobile. A mass 1 of agents is mobile. A part E starts a firm which reduces labor supply in the standard industry. Sectoral employment $l_N X_N = L + 1 - E$ and $l_E X_E = E$ thus reflects occupational choice of entrepreneurial agents.

The L workers earn a wage w and interest on asset wealth, giving end-of-period income $w + A_L R$ per capita. Active entrepreneurs earn $\bar{\pi}_e + AR$ per capita where $\bar{\pi}_e$ is the expected surplus over asset wealth. Part of the potential entrepreneurs prefer employment and get $w + AR$. Occupational choice with free entry implies $w = \bar{\pi}_e$ and yields aggregate income $Y = (w + A_L R) L + (w + AR) (1 - E) + (\bar{\pi}_e + AR) E$, or

$$Y = w \cdot L_T + R \cdot A_T. \quad (12)$$

Aggregate income equals the value of output in (10). To see this, we first note the sectoral zero-profit conditions. Free entry implies $\bar{\pi}_e = w$. Use (5)-(6), multiply by E , divide by sectoral output in (10), and note the definition of unit factor demands in (11) to get⁸

$$v = wl_E + Rk_E, \quad 1 = wl_N + Rk_N. \quad (13)$$

Replacing endowments in (12) by (11) and using zero-profit conditions proves (10). National income is equal to the value of traditional and entrepreneurial sector output.

Commodity demand follows from (8)-(9) and depends on individual income. Since demand is linear in income, agent heterogeneity does not matter. Demand depends only on aggregate income and is $C_N = (1 - \gamma) Y$ and $C_E = \gamma Y / v$. The income-expenditure identity $C_N + vC_E = Y = X_N + vX_E$ yields the trade balance of an open economy,

$$(C_N - X_N) + v \cdot (C_E - X_E) = 0. \quad (14)$$

In the absence of international capital flows, as assumed throughout the paper, a trade surplus in entrepreneurial goods must be offset by a deficit in traditional commodities.

⁸Cost shares are then $\alpha_N = Rk_N$ and $1 - \alpha_N = wl_N$ as well as $\alpha_E = Rk_E / v = RI / (vp\bar{x})$ for capital and $1 - \alpha_E = wl_E / v = \bar{\pi} / (vp\bar{x})$ for ‘entrepreneurial labor’.

3 Trade, Protection and Welfare

3.1 Supply Changes

The paper explores how changes in a country's financial and legal environment and other more standard scenarios affect credit constraints and thereby influence trade patterns. We thus consider an increase in inside equity A which determines the financial strength and robustness of entrepreneurial firms, keeping constant the total capital endowment A_T . The scenario considers an increase in A which is compensated by a reduction in A_L . The experiment may also be interpreted as moving to a more uneven distribution of the capital endowment among workers and potential entrepreneurs. We find that not only the level but also the distribution of wealth is important for outcomes which is in line with a recent literature in macroeconomics (see Cagetti and De Nardi 2006, and Quadrini 2009). Regarding legal institutions, the law and finance literature has emphasized the importance of tight investor protection, accounting standards and the quality of commercial law. These regulations determine the quality of governance which limits managerial autonomy and discretion, makes managers more accountable to outside stakeholders, and facilitates external financing. We interpret better governance as a reduction of parameter β which relates to private benefits of shirking.

To establish how financial frictions affect trade and welfare, we start with a small open economy taking world prices as given. Proposition 1 reestablishes a modified Stolper Samuelson theorem in an economy with finance-constrained firms:

Proposition 1 (*Stolper Samuelson*) (a) *If the entrepreneurial sector is intensive in (managerial) labor ($\lambda_\alpha > 0$), a higher price reduces interest and raises wages: $\hat{R} < 0 < \hat{w}$.* (b) *Increased financial strength (own equity $\hat{A} > 0$) and better governance (agency costs $\hat{\beta} < 0$) change factor prices qualitatively in the same way.*

Proof. See (A.7) in Appendix A.1, where $\lambda_\alpha \equiv \alpha_N - \alpha_E - (1 - \alpha_N)\mu\delta\alpha_E$, $\delta \equiv \frac{I-A}{I}$ and $\mu \equiv \frac{\pi_0}{vp} \frac{g_0}{1-G_0}$. If $\alpha_N > \alpha_E$ and credit rationing is small ($\mu \rightarrow 0$), then $\lambda_\alpha > 0$. ■

How an increase in the world price v of entrepreneurial sector output affects factor prices is well explained by standard trade theory while the role of corporate finance is less obvious. Note that the statement about financial strength is one about the *distribution of wealth* in the economy. We simultaneously reduce asset wealth of workers when considering increased own funds of entrepreneurs, $\hat{A} > 0 > \hat{A}_L$, such that total capital endowment remains constant. The importance of this distributional result is new in trade theory. Assuming that it is the more wealthy people who start a firm, a more unequal wealth distribution boosts wages and reduces interest.

How exactly does financial robustness change factor prices? When new firms in the experimental industry come with more equity, they need less external funds to finance the required capital investment. Therefore, some marginal firms which were previously denied credit, are now able to obtain a loan. When more firms at the low productivity margin are added, average productivity $\bar{x}$ declines and capital demand per unit of output, $k_E = I/(p\bar{x})$, rises. When credit rationing is relaxed, entrepreneurs are able to continue more often and, thus, produce more output per unit of labor. Equivalently, labor demand per unit of output falls. With unit capital demand rising and unit labor demand falling, unit cost equaling the output price v in zero-profit equilibrium can only remain constant when interest falls and wages rise.

When a country enforces better governance standards, agency costs β decline. It becomes cheaper to compensate entrepreneurs for their managerial effort. When pledgeable income and debt capacity increase, banks extend credit to some additional firms. By the same arguments as above, lower productivity raises wages and reduces interest. Figure 1 illustrates how shocks relating to corporate finance shift the zero-profit condition in the

constrained entrepreneurial sector.

Fig. 1: Financial Robustness, Agency Costs, and the Stolper Samuelson Theorem

Next, we consider an increase in total capital endowment, A_T , keeping constant inside equity per firm, A . In this scenario, the endowment comes from more assets of workers which does not directly affect the borrowing needs of entrepreneurial firms. We establish a modified version of the Rybczynski theorem in the presence of credit rationing and compute supply changes resulting from changes in factor endowments, prices, and determinants of financing constraints:

Proposition 2 (Rybczynski) (a) *A larger labor endowment expands the entrepreneurial sector (using managerial labor intensively) and shrinks the standard sector.*

(b) *Entrepreneurial sector output expands when the price rises, firms become financially more robust, and corporate governance improves. Expansion shifts from the extensive to the intensive margin of production.*

Proof. See the derivation of (A.12) in Appendix A.1. ■

To verify the last statement, observe that aggregate supply importantly depends on the number of entrants E and of mature firms $M \equiv (1 - G_0) E$ which are continued beyond the initial start-up phase. Using (10-11), we can relate the changes in firm numbers to changes in aggregate supply according to $E = l_E X_E$ and $M \cdot I = k_E X_E$, yielding $\hat{E} = \hat{l}_E + \hat{X}_E$ and $\hat{M} = \hat{k}_E + \hat{X}_E$. First, pure endowment effects at a constant output price v leave factor prices and unit demands unchanged. Therefore, a larger labor endowment leads to an expansion of the experimental industry which exclusively occurs at the extensive margin, raising both the number of entrants and mature firms. The cut-off and average productivities remain constant. How does a higher market price expand the entrepreneurial sector? By the Stolper Samuelson theorem, interest declines while the wage rate rises. The adjustment of both the output price and the interest rate relaxes the financing constraint as in (A.1), allows more firms with low productivity to proceed with investment and, thereby, reduces average productivity. By (A.3), a lower cut-off productivity, implying more frequent investment per entrepreneur, raises unit capital demand and squeezes unit labor demand, $\hat{k}_E > 0 > \hat{l}_E$. Clearly, a higher output price raises the number of mature firms while the impact on the number of entrants becomes ambiguous. Hence, the expansion is shifted from the extensive (number of entrants) to the intensive margin (increased continuation rate, less churning, and higher probability of production per entrant). The same adjustments occur when firms are endowed with more own assets (higher A) and the institutional environment improves (lower β).

3.2 Income, Trade, and Welfare

The classical analysis is completed by computing changes in aggregate income resulting from endowment shocks and deriving the impact on aggregate demand. We then get the impact of financing constraints on excess demand, the trade pattern, and welfare. Consumer demand for entrepreneurial sector output is $C_E = \gamma \cdot Y/v$ and depends on aggregate income as noted in (12). Given an asset income share $\omega \equiv RA_T/Y$, higher factor income raises aggregate spending by $\hat{Y} = \omega \left(\hat{R} + \hat{A}_T \right) + (1 - \omega) \left(\hat{w} + \hat{L}_T \right)$. Using

the factor-price frontier given in (A.7) yields

$$\hat{Y} = \omega \cdot \hat{A}_T + (1 - \omega) \cdot \hat{L}_T - \theta \cdot \hat{R}, \quad \theta \equiv \frac{\alpha_N - \omega}{1 - \alpha_N} > 0. \quad (15)$$

The sign of θ reflects our factor intensity assumptions. When the traditional industry is capital intensive, we must have $\alpha_N > \omega > \alpha_E$. To see this, multiply (11) by R , use factor shares in (13), and note $RA_T = \alpha_E v X_E + \alpha_N X_N$. Divide by Y , use sectoral GDP shares $\gamma_s \equiv v X_E / Y$ and $1 - \gamma_s \equiv X_N / Y$, and get $\omega = \gamma_s \alpha_E + (1 - \gamma_s) \alpha_N$. Hence, the income share of capital is larger in the traditional sector. The average share, in turn, exceeds the share of capital income in the entrepreneurial sector where most of the income is a reward for entrepreneurial inputs. The factor-price frontier reflects cost minimization in the traditional sector. Given the factor intensity assumption, a higher interest and, correspondingly, a lower wage rate erode aggregate income. Substituting the interest rate from (A.7) and noting elasticities defined there yields

$$\hat{Y} = \omega \cdot \hat{A}_T + (1 - \omega) \cdot \hat{L}_T + \theta \varepsilon_{Rv} \cdot \hat{v} - \theta \varepsilon_{R\beta} \cdot \hat{\beta} + \theta \varepsilon_{RA} \cdot \hat{A}. \quad (16)$$

A higher world price for entrepreneurial goods raises aggregate income. Part of it reflects the fact that a higher price boosts pledgeable income and helps the expansion of finance-constrained firms. The elasticity ε_{Rv} in (A.7) is magnified by the parameter $\mu = \frac{\pi_0}{vp} \frac{g_0}{1-G_0}$ which parameterizes the tightness of credit constraints. This parameter would be zero in a first-best world where continuation occurs until profit of the marginal firm is driven down to zero. Similarly, the equity ratio of firms and agency costs are relevant only in a constrained economy with $\mu > 0$. In the first best, the interest elasticities $\varepsilon_{R\beta}$ and ε_{RA} would be zero, making corporate finance irrelevant for aggregate income.

Given that the weakest firms in the entrepreneurial sector are credit rationed, a larger equity ratio of firms (higher A for given A_T) raises aggregate income. A stronger balance sheet facilitates external funding of investments with positive net value ($\pi_0 > 0$ at the margin). Bad legal institutions also reduce aggregate income. Inadequate corporate governance standards make insiders more autonomous and less accountable to outside investors. Such institutions invite managerial opportunism and, thereby, raise agency

costs of investment, β , in sectors that rely intensively on entrepreneurial inputs. Higher agency costs reduce pledgeable income and, thereby, the debt capacity of these firms which limits the leveraged expansion of the entrepreneurial sector.

We are interested in how the trade pattern responds to changes in the novel fundamental parameters: the abundance of total assets A_T , the financial robustness of firms measured by A at given A_T , and agency costs as captured by β . The trade balance deficit in the entrepreneurial sector corresponds to sectoral excess demand, $\zeta_E \equiv C_E - X_E$. Measuring the change in excess demand by $\hat{\zeta}_E \equiv v d\zeta_E / Y$, we get $\hat{\zeta}_E = \gamma \hat{C}_E - \gamma_s \hat{X}_E$. The Appendix computes

$$\hat{\zeta}_E = \varepsilon_{ZA_T} \cdot \hat{A}_T - \varepsilon_{ZL} \cdot \hat{L}_T - \varepsilon_{Zv} \cdot \hat{v} - \varepsilon_{ZA} \cdot \hat{A} + \varepsilon_{Z\beta} \cdot \hat{\beta}, \quad (17)$$

where all coefficients are defined positive, see (A.13). Under these conditions, when the economy gets richer in financial assets, it runs a surplus in the standard capital intensive sector while the sector relying intensively on entrepreneurial inputs records a trade deficit. Given that demand declines in its own price ($1 > \theta \varepsilon_{Rv}$), a higher price expands output and results in a trade surplus of the entrepreneurial sector. Finally, higher agency costs lead to an entrepreneurial sector trade deficit. When firms are endowed with stronger balance sheets, the entrepreneurial sector expands, resulting in a surplus there.

Financial development and trade protection can have important consequences for welfare per capita. In studying trade protection, we assume the country to be a *net importer* in the entrepreneurial sector. In light of Proposition 2 and the results noted in (17), such a situation might emerge because underdeveloped institutions or weak balance sheets of firms in the entrepreneurial sector create difficulties in raising external funds. When firms are financially fragile and the entrepreneurial sector records a trade deficit, a country might introduce (non-tariff) trade barriers $\tau > 1$ to restrict imports and protect its infant industry. Domestic consumers pay v on domestic goods and τv^* for imports. No-arbitrage dictates $v = \tau v^*$. Since a small open economy cannot affect the world-market price v^* , import protection raises the domestic price by $\hat{v} = \hat{\tau}$. Noting (9), aggregate welfare is equal to real income and changes by $\hat{U} = \hat{Y} - \hat{v}_c$, where the consumer-price index rises in

proportion to the demand share for entrepreneurial sector output, $\hat{v}_c = \gamma \hat{v}$. Substituting the income gain in (16), and noting the coefficients θ , ε_{Rv} , ω and λ_α yields

$$\hat{U} = (\theta \varepsilon_{Rv} - \gamma) \cdot \hat{v} - \theta \varepsilon_{R\beta} \cdot \hat{\beta} + \theta \varepsilon_{RA} \cdot \hat{A}, \quad (18)$$

where the welfare effect of the price increase is

$$\theta \varepsilon_{Rv} - \gamma = \mu \cdot \frac{\gamma_s (\alpha_N - \alpha_E) x_0 / \bar{x} + \gamma (1 - \alpha_N) \alpha_E \delta}{\lambda_\alpha} - (\gamma - \gamma_s) \cdot \frac{\alpha_N - \alpha_E}{\lambda_\alpha}.$$

The welfare consequences of import protection reflect two offsetting effects. On the negative side, the deterioration of the terms-of-trade reduces welfare in proportion to $\gamma - \gamma_s$. If the country is a net importer, the demand share exceeds the supply share of the entrepreneurial good, $\gamma > \gamma_s$. Since the country consumes more than it produces, a higher price raises household spending by more than it increases income so that welfare falls. However, when finance constraints are binding ($\mu > 0$), the higher price strengthens earnings and pledgeable income of firms and thereby relaxes finance constraints. The country is able to realize more projects with positive net value which magnifies the income gains of a higher price. The coefficient μ shows that this welfare gain is proportional to the ‘excess return’ π_0 on unexploited investment opportunities. Hence, if the trade deficit is small and the finance constraint relatively tight, welfare in the importing country must rise despite of a negative terms-of-trade effect!

If for some reason a country cannot implement other policies to overcome financial frictions, trade protection can substitute for these policies as long as terms-of-trade effects are not too damaging. Another policy more directly targeted to financial frictions is institutional reform for better corporate governance ($\hat{\beta} < 0$). Such an initiative facilitates access to external funds and promotes the expansion of the entrepreneurial sector. Better governance helps constrained firms to realize profitable and previously unexploited investment opportunities. This is reflected in the elasticity $\varepsilon_{R\beta}$ being proportional to μ which, in turn, reflects the ‘excess return’ π_0 on the last project that is implemented. Strengthening own equity A of constrained firms boosts welfare by the same arguments.

Proposition 3 (*Domestic Welfare*) (a) *Financial development (more own equity of firms and better institutions) boosts welfare.* (b) *In a constrained country with a small trade deficit of the entrepreneurial sector, protection relaxes finance constraints and can improve welfare despite of a negative terms of trade effect.*

3.3 The World Economy

3.3.1 Factor Price Equalization

A key result of classical trade theory is that free trade ensures factor price equalization when both countries have identical production technologies. The classical result is retrieved when setting $\mu = 0$ in (A.6-A.7). When financing constraints are binding ($\mu > 0$), we still get factor-price equalization, *provided that both countries have the same intermediation technology*, i.e., β and A (as opposed to A_T) are identical, and production technology including the distribution $g(x)$ in the entrepreneurial sector, is symmetric as well. To see this, note that the cut-off x_0 in (3), the profit of the marginal firm π_0 in (4), and the average productivity $\bar{x}$ in (5) all depend on v and R , and so does the parameter μ in (A.6). Hence, the solution in (A.7) of factor prices in both countries depends in exactly the same way on the common world-market price which extends the symmetry conditions for factor-price equalization.

Obviously, factor-price equalization breaks down when technologies and, thereby, factor productivities become different. This also applies to the ‘financial intermediation technology’ as characterized by the two parameters A and β , i.e., financial robustness of firms and the quality of institutions. Starting with a symmetric equilibrium, if one country becomes financially more developed relative to the other, i.e., if it becomes more productive and technologically superior in financial intermediation (higher A and lower β), wages in that country will rise and interest will fall relative to the other country, see (A.7). Figure 1 illustrates this argument.

Proposition 4 (*Factor-Price Equalization*) *Free trade leads to factor-price equaliza-*

tion as long as both production and intermediation technologies are identical. Differences in financial development lead to factor-price differences.

3.3.2 Comparative Advantage

Autarky: Under autarky, $\zeta_E = \hat{\zeta}_E = 0$. Using this in (17) results in

$$\hat{v} = \frac{\varepsilon_{ZA_T}}{\varepsilon_{Zv}} \cdot \hat{A}_T - \frac{\varepsilon_{ZL}}{\varepsilon_{Zv}} \cdot \hat{L}_T - \frac{\varepsilon_{ZA}}{\varepsilon_{Zv}} \cdot \hat{A} + \frac{\varepsilon_{Z\beta}}{\varepsilon_{Zv}} \cdot \hat{\beta}. \quad (19)$$

If trade is balanced in the initial equilibrium ($\gamma = \gamma_s$), then $\varepsilon_{ZA_T} = \varepsilon_{ZL}$, see (A.14), and the price change $\hat{v}$ is homogeneous of degree zero with respect to a ceteris paribus proportional change $\hat{A}_T = \hat{L}_T$ of capital and labor endowments. This holds despite of the fact that the number of *potential* entrepreneurs is held fixed. However, while natural workers can only be employed in the traditional sector, entrepreneurs can perform both tasks. In an interior equilibrium, more entrepreneurship implies less employment in the traditional sector and conversely. The occupational-choice condition means that (entrepreneurial) labor is reallocated freely across sectors, and so is financial capital. A ceteris paribus increase in own equity of new firms, $\hat{A} > 0$, relaxes the financing constraint and expands the entrepreneurial sector, leading to excess supply and requiring a lower relative price.⁹ Lower agency costs in financing entrepreneurship ($\hat{\beta} < 0$), for example due to improved corporate governance standards or financial institutions, favor expansion of the entrepreneurial sector and also reduce the relative price.

Openness With Many Countries: Let us focus on parameter domains with imperfect specialization so that both goods are produced in all countries also after some shock. Suppose that protection and other shocks are limited to the home economy. Hence, v^* is the common world-market price, and $v = \tau v^*$ is the price in the domestic economy. We assume that there are no trade frictions at the outset, $\tau = 1$ and $v = v^*$. In discussing

⁹Note that $\hat{A} > 0$ at $\hat{A}_T = 0$ reflects a redistribution of wealth from workers to entrepreneurial agents and thereby relaxes the financial constraints for a given total capital endowment.

trade protection, we assume the home economy to be an importer of entrepreneurial goods so that $\hat{v} = \hat{v}^* + \hat{\tau}$. Foreign countries may be either net importers or net exporters. Excess demand in foreign countries changes only in response to a world price shock, $\hat{\zeta}_E^j = -\varepsilon_{Zv}^j \cdot \hat{v}^*$.

Equilibrium in the world market requires $d\zeta_E + \sum_j d\zeta_E^j = 0$. Note the definition $\hat{\zeta}_E^j \equiv v^* d\zeta_E^j / Y^j$, multiply by $v = v^*$, divide by world GDP and define country j 's GDP share by $\sigma^j \equiv Y^j / (Y + \sum_j Y^j)$. Of course, GDP shares add up to unity, $\sigma + \sum_j \sigma^j = 1$. Using (17) and the foreign equivalent, the condition for world market clearing $\sigma \hat{\zeta}_E + \sum_j \sigma^j \hat{\zeta}_E^j = 0$ pins down the impact on the common price,

$$\hat{v}^* = \frac{\sigma \varepsilon_{ZA_T}}{\varepsilon_{Zv}^*} \cdot \hat{A}_T - \frac{\sigma \varepsilon_{ZL}}{\varepsilon_{Zv}^*} \cdot \hat{L}_T - \frac{\sigma \varepsilon_{ZA}}{\varepsilon_{Zv}^*} \cdot \hat{A} + \frac{\sigma \varepsilon_{Z\beta}}{\varepsilon_{Zv}^*} \cdot \hat{\beta} - \frac{\sigma \varepsilon_{Zv}}{\varepsilon_{Zv}^*} \cdot \hat{\tau}, \quad (20)$$

where $\varepsilon_{Zv}^* \equiv \sigma \varepsilon_{Zv} + \sum_j \sigma^j \varepsilon_{Zv}^j$ is the GDP weighted average of individual country elasticities. The small open economy case analyzed above results if the number of countries n gets very large. This is most easily seen in the symmetric case where $\varepsilon_{Zv}^* = \sigma n \varepsilon_{Zv}$, leading to $\hat{v}^* = \frac{1}{n} \frac{\varepsilon_{ZA_T}}{\varepsilon_{Zv}} \hat{A}_T$, for example. As $n \rightarrow \infty$, an isolated shock in the domestic economy has only a negligible impact on the world-market price.

In general, changes in endowments or financing conditions induce direct (first-order) effects on domestic excess demand and indirect (second-order) effects on excess demand of all countries via the induced change in the common price $\hat{v}^*$. By (18), an increase in the world price boosts foreign welfare by relaxing finance constraints in the entrepreneurial sector while the terms-of-trade effect depends on the country's trade position. Apart from the traditional determinants of trade patterns, we can state:

Proposition 5 (*Comparative Advantage*) *In the reforming country, better investor protection (lower agency costs β) and a higher equity ratio of firms (higher A) create a comparative advantage in entrepreneurial sectors. Taking account of changes in terms of trade and the effect on financing constraints, foreign export nations unambiguously loose while welfare in foreign import nations changes ambiguously.*

3.4 Protection and Welfare

Since goods are homogeneous, our protection scenario makes sense only if countries are asymmetric and the home country is importing goods of the entrepreneurial sector. Clearly, protection restricts domestic demand and thereby reduces the world-market price where the strength of the impact depends on the share σ of the country in world GDP. In an open economy, tighter protection has no impact on the world price but only raises the domestic demand price, $\hat{v} = \hat{\tau}$, leading to the results noted earlier. Protection in a large country reduces the world-market price as in (20), but clearly by less than one. The end result is $\hat{v}^* < 0 < \hat{v}$ where the domestic demand price rises by $\hat{v} = (1 - \sigma\varepsilon_{Zv}/\varepsilon_{Zv}^*) \cdot \hat{\tau} > 0$. Hence, price changes relax financing constraints in the home economy but tighten them in foreign countries where a lower price erodes earnings and pledgeable income of constrained firms. If foreign countries are exporting entrepreneurial-sector output, they loose both on account of a negative terms-of-trade effect and a welfare loss from tightening financing conditions. In contrast, the terms-of-trade effect is favorable for importing countries.

Proposition 6 (*Protection and Foreign Welfare*) *If the home country runs a trade deficit in the entrepreneurial sector and introduces an import barrier, the world-market price declines. Foreign export nations of entrepreneurial sector output loose both on account of worsening terms of trade and tighter financing constraints. Foreign import countries loose due to tighter financing constraints but gain from better terms of trade, rendering the overall effect on their welfare ambiguous.*

We now show the possibility that protection could even increase world welfare, if finance constraints were very different across countries. To show this possibility, we restrict the analysis to the two-country case (with a star denoting the foreign country) and consider the following scenario: the home country is financially underdeveloped (high β and firms have little own assets A) while the foreign country is not constrained so that $\mu > 0$ and $\mu^* = 0$. Everything else equal, the home country will run a trade deficit in the constrained sector as a result of financial underdevelopment, and the foreign country

a surplus. Suppose that there is another difference between countries such as in labor endowments which ‘almost’ compensates for the effect of finance constraints on the trade pattern. Hence, the asymmetric world equilibrium involves large differences in financial development but relatively small trade imbalances in the entrepreneurial sector. When trade barriers are absent at the outset, $v = v^*$ with free trade. We show that introducing a small import barrier in the home country can raise world welfare. Protection raises the domestic price and, by restricting demand in the home country, at the same time reduces the world-market price, $\hat{v} = \hat{v}^* + \hat{\tau} > 0 > \hat{v}^*$, see (20). Domestic welfare changes as in (18) in response to the price increase while foreign welfare declines due to a negative terms-of-trade effect. Adding up and noting $\mu^* = 0$, world welfare changes by

$$\begin{aligned} \hat{U} + \hat{U}^* &= \mu \cdot \frac{\gamma_s (\alpha_N - \alpha_E) x_0 / \bar{x} + \gamma (1 - \alpha_N) \alpha_E \delta}{\lambda_\alpha} \cdot \hat{v} \\ &: - (\gamma - \gamma_s) \frac{\alpha_N - \alpha_E}{\lambda_\alpha} \cdot \hat{v} - (\gamma^* - \gamma_s^*) \frac{\alpha_N^* - \alpha_E^*}{\lambda_\alpha^*} \cdot \hat{v}^*. \end{aligned} \quad (21)$$

Protection yields welfare gains because a higher price relaxes financing constraints of domestic firms as in the first line of (21). The second line captures welfare-reducing terms-of-trade effects. Since the home country is a net importer of entrepreneurial goods ($\gamma > \gamma_s$), the higher domestic price reduces welfare. Since the foreign country is a net exporter ($\gamma^* < \gamma_s^*$), the lower foreign price also reduces welfare. Since trade imbalances are assumed to be arbitrarily small, the terms-of-trade effects are close to zero. This leaves a positive welfare gain from relaxing financing constraints in the financially backward home country, resulting in higher world welfare, at least for small levels of protection.

Proposition 7 (*Protection and World Welfare*) *If firms are finance-constrained in one country but not in the other, and if trade imbalances are small, world welfare may rise with a small degree of protection in the constrained country.*

The only distortion in this scenario are the finance constraints on investment of entrepreneurial firms at home while foreign firms have easy access to external funds thanks to well developed institutions. Obviously, a policy which facilitates external financing in the

home country must raise welfare if there are no countervailing welfare losses elsewhere. Trade protection in the absence of negative terms-of-trade effects is one such policy. Of course, there might be other policies such as institutional and financial market reform which are targeted more directly at the root of the problem. However, trade policy can have important consequences on pledgeable income and the tightness of financing constraints. For this reason, as long as some financial frictions are present, trade policy can yield gains or losses that are entirely different from traditional channels for welfare effects.

4 Conclusions

This paper provides a two-sector general equilibrium model with financial frictions and international trade. Firms in a standard sector are financially unconstrained and use capital intensively. Companies in the entrepreneurial sector are heterogeneous with regard to earnings and crucially depend on managerial labor inputs of the founder. Entrepreneurs have little own assets and must rely on external credit. To prevent managerial misbehavior, they must keep a sufficiently large profit stake which limits pledgeable income and debt capacity. In consequence, some marginal firms with positive net value are denied external funding for investments. In equilibrium, limited access to credit retards entry and profitable investment which limits the expansion of the entrepreneurial sector. The model endogenously determines the allocation of financial assets across sectors, sectoral labor allocation following from occupational choice of potential entrepreneurs, financial constraints of entrepreneurial firms, average productivity in the entrepreneurial sector due to exit and entry, sectoral production, and trade.

The fundamentals of corporate finance affect core theorems in international trade such as the Stolper-Samuelson and Rybczinsky theorem and the law of comparative advantage through their impact on the extensive margin of production in the financially constrained entrepreneurial sector. Beyond classical results, the paper explores how trade and comparative advantage endogenously depend on financial and institutional development across

countries and on the distribution of financial assets within an economy. Not only the level, but also the distribution of capital matters. Protection and financial frictions interact in important ways to determine national and world welfare. Institutional reform such as accounting and reporting standards for increased corporate transparency makes entrepreneurs more accountable to outside investors, raising a firm's pledgeable profit and debt capacity, thereby facilitating entrepreneurial investment with strictly positive net value. A redistribution of capital towards potential entrepreneurs results in a greater equity ratio per firm which similarly relaxes financing constraints. Since constrained investment yields strictly positive net value, such policies boost welfare by initiating an expansion of the entrepreneurial sector. Policies that could improve the institutional environment and help firms to accumulate more own equity are called for but might be difficult to implement and could take a long time to yield significant effects. At least in a transitory period, protection of the financially constrained entrepreneurial sector may similarly raise a country's welfare since a higher domestic price boosts earnings and debt capacity and thereby facilitates investment with positive net value. Depending on the interaction between terms-of-trade effects and financial frictions, protection in the most constrained importing country could even raise world welfare.

Appendix

Factor Prices: How shocks change factor prices depends on cost shares. By (13), cost shares in the numeraire sector are $\alpha_N = Rk_N$ and $1 - \alpha_N = wl_N$. Unit demands in (11) imply cost shares of $\alpha_E = Rk_E/v = RI/(vp\bar{x})$ for capital and $1 - \alpha_E = wl_E/v = \bar{\pi}/(vp\bar{x})$ for 'entrepreneurial labor'. The second equality substitutes (11) and uses the occupational choice condition $w = (1 - G_0)\bar{\pi}$ which states that expected profit must compensate for the foregone wage. Adding up cost shares yields $vp\bar{x} = IR + \bar{\pi}$ as in (5). Hence, the average value of output per firm in the entrepreneurial industry consists of the cost of capital plus the expected profit that rewards entrepreneurial labor services.

Log-differentials indicate relative changes such as $\hat{v} \equiv dv/v$. The continuation decision in (3) affects productivity via the threshold x_0 , $vp x_0 (\hat{x}_0 + \hat{v}) = DR\hat{R} - AR\hat{A} + \beta p\hat{\beta}$. Divide by output value, use the cost share α_E defined above, denote the debt asset ratio by $\delta \equiv D/I$ and, correspondingly, the equity ratio by $1 - \delta = A/I$,

$$\frac{x_0}{\bar{x}} \cdot \hat{x}_0 = \delta \alpha_E \cdot \hat{R} - \frac{x_0}{\bar{x}} \cdot \hat{v} - (1 - \delta) \alpha_E \cdot \hat{A} + \frac{\beta}{v\bar{x}} \cdot \hat{\beta}. \quad (\text{A.1})$$

A higher deposit rate R makes credit rationing more severe and drives the weakest firms out of business, i.e., a higher threshold productivity is required to obtain credit. A higher price boosts revenues and pledgeable income which relaxes the credit constraint, allows weaker firms to continue and, hence, reduces firm turnover (churning). Higher own equity A as a measure of financial strength reduces the need for external funding and allows for a lower threshold. Note that $\beta/(v\bar{x})$ expresses agency cost as a share of output value.

A higher threshold raises average productivity of active firms by

$$\hat{\bar{x}} = \frac{\bar{x} - x_0}{\bar{x}} \frac{x_0 g_0}{1 - G_0} \cdot \hat{x}_0. \quad (\text{A.2})$$

Unit factor demands depend on the threshold x_0 which is driven by the finance constraint in (A.1). Consider capital demand per unit of output, $k_E = I/(p\bar{x})$. If x_0 rises, indicating tighter financing constraints, average productivity $\bar{x}$ rises, meaning that a unit of capital generates more output or, conversely, capital used per unit of output falls:

$$\hat{k}_E = -\frac{\bar{x} - x_0}{\bar{x}} \frac{x_0 g_0}{1 - G_0} \cdot \hat{x}_0, \quad \hat{l}_E = \frac{x_0}{\bar{x}} \frac{x_0 g_0}{1 - G_0} \cdot \hat{x}_0. \quad (\text{A.3})$$

Unit labor demand $l_E \equiv 1/[(1 - G_0)\bar{x}p]$, in contrast, rises with tighter financing constraints since $(1 - G_0)\bar{x} = \int_{x_0}^{\infty} x dG(x)$ falls. A new entrant produces output less frequently if financial constraints reduce the continuation probability. Hence, one unit of output requires more entrants so that unit labor demand rises with tighter credit constraints. Substituting the determinants of credit rationing in (A.1) yields

$$\hat{l}_E = \frac{x_0 g_0}{1 - G_0} \left[\delta \alpha_E \hat{R} - (1 - \delta) \alpha_E \hat{A} - \frac{x_0}{\bar{x}} \hat{v} + \frac{\beta}{v\bar{x}} \hat{\beta} \right], \quad \hat{k}_E = -\frac{\bar{x} - x_0}{x_0} \cdot \hat{l}_E. \quad (\text{A.4})$$

In the traditional sector, unit demands respond in standard ways to factor prices, see (7),

$$\hat{k}_N = -\hat{R}, \quad \hat{l}_N = -\hat{w} = \frac{\alpha_N}{1 - \alpha_N} \cdot \hat{R}. \quad (\text{A.5})$$

Free entry equates unit costs with output prices. Log-differentiating (13) yields

$$\begin{aligned}\hat{v} &= \alpha_E \left(\hat{R} + \hat{k}_E \right) + (1 - \alpha_E) \left(\hat{w} + \hat{l}_E \right), \\ 0 &= \alpha_N \left(\hat{R} + \hat{k}_N \right) + (1 - \alpha_N) \left(\hat{w} + \hat{l}_N \right).\end{aligned}$$

Use (A.5) and get $\alpha_N \hat{k}_N + (1 - \alpha_N) \hat{l}_N = 0$. A small variation in factor demands has no impact on profits when these quantities are optimally chosen. Only the direct, mechanical effects of factor prices determine the change in unit costs which must be zero in the numeraire sector. The same does not hold for the entrepreneurial sector because factor demand is finance-constrained. To see this, differentiate the zero-profit condition $w = \bar{\pi}_e$, yielding $(1 - G_0)(p\bar{x}dv - IdR) - dw = \pi_0 g_0 dx_0$. Price changes affect the zero-profit condition not only by their direct mechanical effect but also by affecting the financing threshold! Since the marginal firm is constrained, it earns an excess return $\pi_0 > 0$. A relaxation of the credit constraint, allowing an entrant to invest in the marginal, but profitable project, strictly raises expected profit by π_0 . Expressing in relative changes, multiplying by l_E/v and using the definitions of unit demand and cost shares yields

$$\alpha_E \hat{R} + (1 - \alpha_E) \hat{w} = \hat{v} - \mu \cdot \frac{x_0}{\bar{x}} \hat{x}_0, \quad \mu \equiv \frac{\pi_0}{vp} \frac{g_0}{1 - G_0}. \quad (\text{A.6})$$

If entry and continuation were unconstrained, $\pi_0^{FB} = 0$, the standard results would apply. In a credit constrained economy, however, continuation investment by the marginal firm earns an excess return $\pi_0 > 0$, indicating that too many projects are abandoned. The parameter μ may be seen as a measure of capital market frictions which is small if either π_0 (deviation from the first best) or the density of firms near the threshold level is small. Since x_0 rises with R , this term acts to magnify the effect of capital cost R on the price. Equation (A.1) shows how prices and other parameters relating to corporate finance affect the threshold. Using this together with the previous two equations yields

$$\begin{bmatrix} \alpha_N & 1 - \alpha_N \\ (1 + \mu\delta)\alpha_E & 1 - \alpha_E \end{bmatrix} \begin{bmatrix} \hat{R} \\ \hat{w} \end{bmatrix} = \begin{bmatrix} 0 \\ (1 + \mu\frac{x_0}{\bar{x}})\hat{v} - \frac{\beta}{v\bar{x}}\mu\hat{\beta} + (1 - \delta)\alpha_E\mu\hat{A} \end{bmatrix}.$$

Given that the traditional sector is capital intensive and the entrepreneurial sector intensive in (managerial) labor, the determinant $\lambda_\alpha = \alpha_N - \alpha_E - (1 - \alpha_N)\mu\delta\alpha_E$ is positive. In

the first-best case with $\mu = 0$, the standard condition is $\alpha_N > \alpha_E$. With credit rationing, the condition $\lambda_\alpha > 0$ becomes more stringent. The tighter are financing frictions, the more capital intensive the traditional sector must be. We assume the deviation from the first best to be small. Inverting the system yields

$$\hat{R} = -\varepsilon_{Rv} \cdot \hat{v} + \varepsilon_{R\beta} \cdot \hat{\beta} - \varepsilon_{RA} \cdot \hat{A}, \quad \hat{w} = -\frac{\alpha_N}{1 - \alpha_N} \cdot \hat{R}, \quad (\text{A.7})$$

where elasticities are [as a convention, all parameters are defined positive]

$$\varepsilon_{Rv} \equiv \frac{1 - \alpha_N}{\lambda_\alpha} \left(1 + \mu \frac{x_0}{\bar{x}}\right), \quad \varepsilon_{R\beta} \equiv \frac{1 - \alpha_N}{\lambda_\alpha} \frac{\beta}{v\bar{x}} \mu, \quad \varepsilon_{RA} \equiv \frac{1 - \alpha_N}{\lambda_\alpha} (1 - \delta) \alpha_E \mu.$$

The magnification effect (Jones 1965), $\hat{w} > \hat{v} > 0 > \hat{R}$, holds if $\hat{w}/\hat{v} = \frac{\alpha_N}{\lambda_\alpha} \left(1 + \mu \frac{x_0}{\bar{x}}\right) > 1$ which, upon substituting λ_α , is equivalent to $\mu \frac{x_0}{\bar{x}} \alpha_N > 0 > -[1 + (1 - \alpha_N) \mu \delta] \alpha_E$ and is naturally fulfilled.

Sectoral Outputs: A country's sectoral structure depends on relative factor endowments A_T and L_T . With an increase in total asset endowment we mean the endowment of workers only, keeping the equity ratio A of entrepreneurial firms constant. Log-differentiating the factor market conditions in (11) yields

$$\begin{aligned} \hat{A}_T - \hat{k} &= s_A \hat{X}_E + (1 - s_A) \hat{X}_N, \quad \hat{k} = s_A \hat{k}_E + (1 - s_A) \hat{k}_N, \quad s_A = \frac{k_E X_E}{A_T}, \\ \hat{L}_T - \hat{l} &= s_L \hat{X}_E + (1 - s_L) \hat{X}_N, \quad \hat{l} = s_L \hat{l}_E + (1 - s_L) \hat{l}_N, \quad s_L = \frac{l_E X_E}{L_T}. \end{aligned} \quad (\text{A.8})$$

In a first step, we hold product prices, own equity A and agency costs β constant which keeps factor prices and unit factor demands constant, $\hat{k}_j = \hat{l}_j = 0$. The determinant of the system, $s_A - s_L$, is negative and $\lambda_s = s_L - s_A > 0$, if the entrepreneurial sector is labor intensive. Inverting the system yields sectoral output effects:

$$\begin{aligned} \hat{X}_E &= \frac{1}{\lambda_s} \left[(1 - s_A) (\hat{L}_T - \hat{l}) - (1 - s_L) (\hat{A}_T - \hat{k}) \right], \\ \hat{X}_N &= \frac{1}{\lambda_s} \left[s_L (\hat{A}_T - \hat{k}) - s_A (\hat{L}_T - \hat{l}) \right]. \end{aligned} \quad (\text{A.9})$$

The magnification effect results in $\hat{X}_E = \frac{1 - s_A}{s_L - s_A} \hat{L}_T > \hat{L}_T$ and $\hat{X}_N = \frac{s_L}{s_L - s_A} \hat{A}_T > \hat{A}_T$.

Consider next the impact of changes in output prices and structural parameters relating to the financing of entrepreneurial firms. Unit factor demand in the entrepreneurial sector depends on $\hat{x}_0$ only, see (A.3). We thus need to evaluate the change in the threshold productivity in (A.1). Substituting the change in the interest rate given in (A.7) yields

$$\frac{x_0}{\bar{x}} \hat{x}_0 = - \left(\varepsilon_{Rv} \delta \alpha_E + \frac{x_0}{\bar{x}} \right) \cdot \hat{v} + \left(\varepsilon_{R\beta} \delta \alpha_E + \frac{\beta}{v \bar{x}} \right) \cdot \hat{\beta} - (\varepsilon_{RA} \delta + 1 - \delta) \alpha_E \cdot \hat{A}. \quad (\text{A.10})$$

The marginal and financially weakest firms which previously had no access to credit, are the least productive. When more of them continue, because a higher output price or better corporate finance ($\hat{A} > 0 > \hat{\beta}$) boosts their debt capacity, average productivity declines. Recall, however, that even marginal firms generate a positive net-present value to society when investment is credit rationed. Declining average productivity is, thus, not to be seen as damaging. Quite to the contrary, more continuation, i.e., less firm turnover and exit, is an improvement since constrained investment yields an excess return.

Unit factor demands depend on factor prices via their impact on the threshold productivity while unit demands in the traditional sector adjust in a standard cost minimizing way. Evaluating the change in unit demands in (A.8) by first substituting (A.4)-(A.5), collecting terms and finally replacing $\hat{R}$ with (A.7) yields,

$$\hat{k} = \varepsilon_{kv} \cdot \hat{v} + \varepsilon_{kA} \cdot \hat{A} - \varepsilon_{k\beta} \cdot \hat{\beta}, \quad \hat{l} = -\varepsilon_{lv} \cdot \hat{v} - \varepsilon_{lA} \cdot \hat{A} + \varepsilon_{l\beta} \cdot \hat{\beta}, \quad (\text{A.11})$$

where the elasticity parameters are again defined with positive values,

$$\begin{aligned} \varepsilon_{kv} &\equiv s_A \frac{(\bar{x} - x_0) g_0}{1 - G_0} [\delta \alpha_E \varepsilon_{Rv} + x_0 / \bar{x}] + (1 - s_A) \varepsilon_{Rv}, \\ \varepsilon_{lv} &\equiv s_L \frac{x_0 g_0}{1 - G_0} [\delta \alpha_E \varepsilon_{Rv} + x_0 / \bar{x}] + (1 - s_L) \varepsilon_{Rv} \frac{\alpha_N}{1 - \alpha_N}, \\ \varepsilon_{k\beta} &\equiv s_A \frac{(\bar{x} - x_0) g_0}{1 - G_0} [\delta \alpha_E \varepsilon_{R\beta} + \beta / (v \bar{x})] + (1 - s_A) \varepsilon_{R\beta}, \\ \varepsilon_{l\beta} &\equiv s_L \frac{x_0 g_0}{1 - G_0} [\delta \alpha_E \varepsilon_{R\beta} + \beta / (v \bar{x})] + (1 - s_L) \varepsilon_{R\beta} \frac{\alpha_N}{1 - \alpha_N}, \\ \varepsilon_{kA} &\equiv s_A \frac{(\bar{x} - x_0) g_0}{1 - G_0} \alpha_E [\delta \varepsilon_{RA} + 1 - \delta] + (1 - s_A) \varepsilon_{RA}, \\ \varepsilon_{lA} &\equiv s_L \frac{x_0 g_0}{1 - G_0} \alpha_E [\delta \varepsilon_{RA} + 1 - \delta] + (1 - s_L) \varepsilon_{RA} \frac{\alpha_N}{1 - \alpha_N}. \end{aligned}$$

Since the entrepreneurial sector is assumed to be labor intensive, a higher price reduces interest and boosts the wage rate. The impact on unit factor demand works via three channels. First, a price increase directly relaxes the financing constraint in (A.1), allowing firms to invest more frequently, thereby tilting unit factor demand from entrepreneurial labor towards capital, see (A.3). Second, by the Stolper Samuelson effect, a higher output price reduces interest which further relaxes the financing constraint and makes the entrepreneurial sector use more capital per unit of output. Third, lower interest and higher wages lead the standard sector to substitute labor for more capital, reflecting cost minimization. Higher own equity and lower agency costs of entrepreneurial firms affects credit constraints and tilts the factor-price frontier in the same way, yielding the same change in unit factor demands. Combining (A.9) and (A.11), we can derive the impact on sectoral output where all coefficients are defined positive, i.e., $\lambda_s > 0$:

$$\begin{aligned}
\lambda_s \hat{X}_E &= (1 - s_A) \hat{L}_T - (1 - s_L) \hat{A}_T + [(1 - s_A) \varepsilon_{lv} + (1 - s_L) \varepsilon_{kv}] \cdot \hat{v} \\
&\quad + [(1 - s_A) \varepsilon_{lA} + (1 - s_L) \varepsilon_{kA}] \cdot \hat{A} - [(1 - s_A) \varepsilon_{l\beta} + (1 - s_L) \varepsilon_{k\beta}] \cdot \hat{\beta}, \\
\lambda_s \hat{X}_N &= s_L \hat{A}_T - s_A \hat{L}_T - [s_L \varepsilon_{kv} + s_A \varepsilon_{lv}] \cdot \hat{v} \\
&\quad - [s_L \varepsilon_{kA} + s_A \varepsilon_{lA}] \cdot \hat{A} + [s_L \varepsilon_{k\beta} + s_A \varepsilon_{l\beta}] \cdot \hat{\beta}.
\end{aligned} \tag{A.12}$$

Trade Balance: Aggregate income and relative prices determine demand,

$$\hat{C}_E = \hat{Y} - \hat{v} = \omega \cdot \hat{A}_T + (1 - \omega) \cdot \hat{L}_T - (1 - \theta \varepsilon_{Rv}) \cdot \hat{v} - \theta \varepsilon_{R\beta} \cdot \hat{\beta} + \theta \varepsilon_{RA} \cdot \hat{A}, \tag{A.13}$$

where $1 - \theta \varepsilon_{Rv} = [\omega - \alpha_E - \mu \cdot (\delta \alpha_E (1 - \alpha_N) + (\alpha_N - \omega) x_0 / \bar{x})] / \lambda_\alpha$ uses the definitions of ε_{Rv} , θ and λ_α . The factor intensity assumption implies $\alpha_N > \omega > \alpha_E$. If finance constraints are not too tight and μ is close to zero, we have $1 > \theta \varepsilon_{Rv}$. In this case, a higher output price restrains demand.

Excess demand, $\zeta_E \equiv C_E - X_E$, corresponds to a trade balance deficit. Measuring the change in excess demand by $\hat{\zeta}_E \equiv v d\zeta_E / Y$, we get $\hat{\zeta}_E = \gamma \hat{C}_E - \gamma_s \hat{X}_E$. Substituting (A.13) and (A.12), and using $\lambda_s = s_L - s_A > 0$ when necessary,¹⁰ yields

$$\hat{\zeta}_E = \varepsilon_{ZA_T} \cdot \hat{A}_T - \varepsilon_{ZL} \cdot \hat{L}_T - \varepsilon_{Zv} \cdot \hat{v} - \varepsilon_{ZA} \cdot \hat{A} + \varepsilon_{Z\beta} \cdot \hat{\beta}, \tag{A.14}$$

¹⁰ Sectoral factor shares are $s_L = \frac{l_E X_E}{L_T} > s_A = \frac{k_E X_E}{A_T}$ if the entrepreneurial sector is labor intensive.

where coefficients are defined as

$$\begin{aligned}
\varepsilon_{Zv} &\equiv \frac{(1-s_A)\varepsilon_{lv} + (1-s_L)\varepsilon_{kv}}{\lambda_s} \gamma_s + (1-\varepsilon_{Rv}\theta)\gamma, \\
\varepsilon_{ZA_T} &\equiv \frac{\lambda_s \omega \gamma + (1-s_L)\gamma_s}{\lambda_s}, \quad \varepsilon_{ZL} \equiv \frac{(\lambda_s \omega + 1-s_L)\gamma + (\gamma_s - \gamma)(1-s_A)}{\lambda_s}, \\
\varepsilon_{ZA} &\equiv \frac{(1-s_A)\varepsilon_{lA} + (1-s_L)\varepsilon_{kA}}{\lambda_s} \gamma_s - \varepsilon_{RA}\theta\gamma, \\
\varepsilon_{Z\beta} &\equiv \frac{(1-s_A)\varepsilon_{l\beta} + (1-s_L)\varepsilon_{k\beta}}{\lambda_s} \gamma_s - \varepsilon_{R\beta}\theta\gamma.
\end{aligned}$$

We assume that the trade imbalance is not too large so that $\gamma_s - \gamma$ is small and $\varepsilon_{ZL} > 0$ in all cases. All elasticities are positive, despite of the countervailing influence of the terms associated with θ , if one keeps to a neighborhood of the first best. Assumption (A) in Section 2.2 implies credit rationing, leading to $\mu > 0$. Letting $\beta p \rightarrow AR$, implying $\pi_0 \rightarrow 0$ and $\mu \rightarrow 0$, makes the equilibrium approach the first best. All terms multiplying with μ drop out, including ε_{RA} and $\varepsilon_{R\beta}$. Consider the elasticity $\varepsilon_{Z\beta}$. Since $\mu \rightarrow 0$ implies $\varepsilon_{R\beta} \rightarrow 0$, the last term vanishes. However, since $\mu \rightarrow 0$ is equivalent to $\beta \rightarrow AR/p > 0$, the elasticities $\varepsilon_{l\beta}$ and $\varepsilon_{k\beta}$ listed in (A.11) remain positive, implying that $\varepsilon_{Z\beta}$ remains positive. By the same arguments, ε_{ZA} stays positive.

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