Corporate Finance and Comparative Advantage*

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Abstract

Since innovative firms are often financially constrained, access to external funds is important for the expansion of innovative industries. This paper reports four important results. First, a larger equity ratio of firms and tough governance standards relax finance constraints and create a comparative advantage in innovative industries. Second, factor price equalization requires symmetry in both the production and the financial intermediation technology. Third, less protection in the constrained sector can raise welfare by relaxing finance constraints at small terms of trade effects. Fourth, less protection of the financially dependent industry in a financially well developed country may raise world welfare.

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1 Introduction

Finance constrained firms tend to be young, mainly constrained by limited access to external finance, and innovative. They lack tangible rather than intangible assets and do not surface at random across industries but mainly in fast growing sectors with a significant amount of firm entry and exit. The latter suggests that comparative advantage in innovative industries is not only a matter of factor endowments but also hinges on a number of fundamentals relating to corporate finance and legal institutions (see Kletzer and Bardhan, 1987; and Baldwin, 1989).[1] The evidence clearly points to the importance of financing constraints rooted in the special characteristics of innovative entrepreneurial firms: they have potentially attractive investment opportunities and are more reliant on external funds than other firms; they have a high proportion of intangibles such as knowledge and reputation and have more specialized equipment with little collateral value; and there is a greater degree of asymmetric information between insiders and outsiders.[2] We thus argue that financing frictions are an important factor to influence the process of creative destruction which characterizes the expansion of innovative industries.

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),

[1] There is a large body of empirical work establishing the aforementioned stylized facts about financially constrained firms. That young entrepreneurial firms are more innovative than others is a stylized fact (see Prusa and Schmitz, 1992). Kortum and Lerner (2000) illustrate the role of venture capital for R&D expenditures. Hall (2002) points to the high costs of capital of young, small, and innovative firms. Aghion, Bond, Klemm and Marinescu (2004) suggest that these costs result from the lack of tangible assets of such firms and their 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 firms and helps to expand new firms after successful start-up investment.

[2] Beck, Demirguc-Kunt and Maksimovic (2005) report that small firms are more likely to be credit constrained than larger ones while Hall and Lerner (2009) emphasize that more innovative firms face tighter financing constraints. For a large sample of U.K. firms, Guariglia (2008) finds that financial constraints are particularly important for small and young firms and argues that these firms "are more prone to facing asymmetric information problems" (ibid., p. 1805).

standard trade theory explains a country's international trade by the 'classical' fundamentals of factor endowments and productivity differences across sectors.[3] However, there is agreement that the traditional fundamental variables are related systematically to net exports but explain only a small fraction of the sectoral trade pattern (see Baldwin, 1971; and Trefler, 1993, 1995, for eminent examples; and Feenstra, 2004, for a survey of related work). Obvious candidates to explain net trade flows beyond factor endowments and technology are market imperfections and institutional characteristics. Recent theoretical (Melitz, 2003; Bernard, Redding, and Schott, 2007; Melitz and Ottaviano, 2008) and empirical research (Das, Tybout, and Roberts, 2007; Eaton, Eslava, Kugler, and Tybout, 2008; Helpman, Melitz, and Rubinstein, 2008) emphasizes the role of fixed costs and the extensive margin of trade via firm entry and exit. However, unlike in the literature on corporate finance, the coverage of these costs essentially depends on endowment (mostly with assets embodied in labor) and is not endogenous to the model.

The literature on the role of financial frictions in trade is still quite 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 other goods. Evidence in favor of that view has been provided by Beck (2002, 2003), Svaleryd and Vlachos (2005), and Manova (2008a). One conclusion from this research is that countries with better developed financial institutions have a comparative advantage in industries which rely more intensively on external finance, and financial market liberalization increases exports disproportionately more in financially vulnerable sectors where firms require more outside finance and have fewer assets serving as collateral (see Rajan and Zingales, 1998, for a seminal classification of sectors in terms of financial dependence). The results in Svaleryd and Vlachos (2005) even indicate that differences in financial systems may be

[3]Dixit and Norman (1980) or Helpman and Krugman (1985) illustrate that the fundamental insights from classical and neo-classical trade theory – based on infinitesimally small and perfectly competitive firms – are still valid if firms entertain market power.

more important for specialization patterns than differences in human capital.[4]

Part of the work on finance constraints in open economies focuses on trade and international capital flows. For instance, Matsuyama (2004) explores how financing frictions determine capital flows in a one-good world economy. Matsuyama (2005) studies trade and capital flows in a Ricardian model with a continuum of goods where hiring of workers is constrained by a firm's pledgeable income to pay wages. The 'borrowing constraint' thus relates to hiring rather than investment. Antras and Caballero (2009) develop a $2 \times 2 \times 2$ model where one sector is financially constrained and the other is not. A key result is that trade and capital movements are complements in financially less developed countries. Ju and Wei (2008) develop a $2 \times 2 \times 2$ trade model with mobile capital where sectors differ by the extent of financial frictions and firms within sectors are homogeneous. They emphasize that, in addition to factor endowments and technology, the quality of institutions determines the patterns of trade and capital flows. This literature mainly embeds financial constraints in models with otherwise classical or neoclassical – Heckscher-Ohlin or Ricardian – reasons for trade.

Some recent theoretical work abstracts from classical endowment- and productivity-related motives for trade and focuses on the role of financial constraints on the entry of heterogeneous firms in new trade models. For instance, Manova (2008b) embeds financial constraints in a one-sector model of heterogeneous firms and illustrates how finance constraints not only affect the pattern but even the volume of trade through firm selection.[5] A novel insight from that work is that productivity of firms in a market is endogenously

[4] Related to the associated 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.

[5] Related to Manova (2008b), Chor, Foley, and Manova (2008) introduce credit constraints in the model of export-platform FDI of Helpman, Melitz, and Yeaple (2004) with heterogeneous firms. In particular, they model credit constraints to arise from the imperfect protection of lenders against default risk. Host country financial development leads to more competition for subsidiaries of foreign-owned firms in that market. The latter leads to a larger fraction of foreign affiliate exports to third countries relative to their total sales and, hence, a more extensive use of these subsidiaries as export platforms. They find evidence in support of this hypothesis in a panel data-set of U.S. foreign affiliates for the years 1989-1998.

determined by financial constraints and their impact on firm selection.

It is this paper's task to develop a theoretical model which integrates heterogeneous firms in a model of endowment- and technology-related motives for trade in the presence of endogenous financial constraints and corporate governance.[6] Specifically, we explore how two new fundamental variables relating to corporate finance affect a country's comparative advantage through their impact on firm selection.[7] We argue that (i) a country's institutional quality as reflected in agency costs due to moral hazard and (ii) own equity as a measure of financial robustness importantly affect the financing of firms and thereby determine the expansion of innovative industries. We also explore the role of factor endowments in a finance constrained economy. In our two sector model, we think of *innovative* goods to be intensive in entrepreneurial labor inputs. As in Aghion and Tirole (1994), young and innovative companies heavily rely on the managerial and technological inputs of their creators.[8] These insiders are not replaceable without serious disruption of the firm.[9] To assure incentives and prevent opportunistic behavior, entrepreneurs must keep a substantial share of the profit, giving rise to agency costs. The latter limit the debt

[6] Unlike in Manova (2008b) or Chor, Foley, and Manova (2008), embedding heterogeneous firms in a Ricardian model allows us to exploit the virtues of Jonesian algebra in determining comparative static effects. However, as in these papers, one channel of the consequences of credit constraints is their impact on the support of the productivity distribution of active firms.

[7] Our treatment of financial constraints to be endogenous is inspired by insights from Do and Levchenko (2007), who present evidence that financial development depends on trade patterns and argue that it is endogenous and in part determined by the demand for external financing which might be influenced by trade patterns shifting towards financially dependent sectors. Therefore, we model the tightness of credit constraints and the size of the intermediation margin banks charge to be endogenous and to depend on deep parameters reflecting institutional quality and firm characteristics.

[8] Early empirical work in trade pointed to the role of skilled workers in a sector for a country's net exports in that sector (see Baldwin, 1971). Recent work emphasizes entrepreneurial or managerial talent (see Grossman and Helpman, 2004; Marin and Verdier, 2003, 2008) and the innovative capacity of young firms (see Prusa and Schmitz, 1991; De Vet and Scott, 1992; for early examples).

[9] Quite similarly, Antras (2005) assumes that dismissal of a manager in a fully owned subsidiary leads to an output loss. The control rights associated with ownership reduce this output loss, compared to the loss from misbehavior in an independent outsourcing relationship.

capacity and the ability to raise outside funds. Not all firms in need of external funding are actually served. Moral hazard thus introduces a market imperfection in that firms may be denied credit and may not be able to enter the market, despite of their investment yielding a positive net present value.

The novel treatment of corporate finance in a Ricardian model of international trade with heterogeneous firms leads to a modification of the core trade theorems such as the Stolper-Samuelson and the Rybczynski theorems. In our model, these theorems as well as comparative advantage and welfare depend on structural parameters of corporate finance: agency costs of investment and the equity ratio of entrepreneurial heterogeneous firms. In particular, these fundamental parameters induce changes of the allocation of assets (capital) across sectors[10] of the extensive margin of heterogeneous firms in the financially constrained sector and, hence, average productivity of firms in the market. For instance, an increase in the equity ratio as a measure of financial robustness relaxes the financing constraint and allows a margin of innovative firms with positive net present value to continue which otherwise would have been denied credit and driven out of the market. Similarly, as in the law and finance literature (La Porta et al. 1997, 2000, and 2006), we argue that tough corporate governance standards and legal rights of external investors limit the scope for managerial discretion and moral hazard. In reducing agency costs, they relax firms' finance constraints, increase the support region of active firms with heterogeneous productivity, and change the pattern of trade. The fundamental finance parameters generate novel propositions in trade theory with regard to firm selection, factor price equalization, and welfare, and they lead to modified core theorems in international economics while maintaining their insights with regard to the consequences of technology and endowments on factor prices, production, and trade patterns.

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. Section

[10] For instance, in Antras 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.

4 explores the impact of fundamental corporate finance parameters on goods trade. The paper concludes with a summary of the key findings.

2 A Model of Trade and Finance

2.1 Basic Assumptions

Consider a world economy with two countries, two goods and two factors. Goods are distinguished by their innovative content. The innovative good is produced by finance constrained firms which are characterized by (i) potentially large market opportunities due to the innovative nature of their business model, (ii) little own assets relative to investment opportunities, and (iii) a key irreplaceable role of the innovating entrepreneur. The standard good, in contrast, is produced by more mature firms which have largely exhausted investment opportunities, have accumulated substantial own assets, and use a mature technology posing no particular management problems. The potential for managerial misbehavior is small, allowing external investors to commit a large amount of capital. We take the distinction to the extreme and assume that moral hazard is absent and firms are not finance constrained. The traditional industry is assumed 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 innovators who either start a firm (share E) or work in the traditional sector (share $1 - E$). A firm is managed by one entrepreneur. Occupational choice is limited only to agents with entrepreneurial skills, while L is a sector specific endowment. Employment in the traditional sector is, thus, $L+1-E$, while entrepreneurial labor allocated to the innovative sector is E, equal to the number of firms started. The economy's total capital endowment is unevenly distributed and amounts to $A_T = A_L L + A$ in total. 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 own equity per firm. Alternatively, we can consider the role of capital distribution for a given total asset endowment.

The entrepreneurial, innovative sector requires one unit of labor (entrepeneur) and a fixed amount of investment I per firm, or IE in total. The required investment is assumed to exceed the entrepreneur's own equity, $I > A$, and cannot take place without external financing. The returns are uncertain in two ways. First, investment succeeds with a high or low probability, depending on the entrepreneur's managerial effort. Second, if it is 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 of the firm 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 and spends all income on consumption. If investment fails, output is zero, banks do not get repaid, and entrepreneurs have zero income.

Firm decisions in the innovative sector involve discrete choices only, starting with an entry decision in stage (i) where the entrepreneur irrevocably gives up an alternative wage income w. Stage (ii) corresponds to a discrete continuation decision. If the firm is stopped, the entrepreneur is still left with her assets A which she invests in the deposit market at the going market rate of interest r to augment end of period consumption. In stage (iii), the entrepreneur injects all her assets into the firm to reduce the need for external financing, and makes a discrete effort choice. If at this stage the firm fails, the entrepreneur is left with zero income because all her wealth is lost in the process of bankruptcy. Agents are assumed risk-neutral and are price takers with respect to w, r, and v in a competitive market environment.

2.2 Finance Constrained Investment

External Financing: When productivity x becomes known after entry and is sufficiently high, the entrepreneur injects her wealth as inside equity to start the company. Alternatively, she accepts employment in the traditional sector and invests in the deposit market. The deposit interest factor is $R = 1 + r$, giving the entrepreneur's opportunity cost AR. Since required investment exceeds own equity, a bank must finance externally the remaining part $D = I - A$, with cost R per unit of lending. Given a loan rate i, the bank collects repayment $(1 + i) D$ only if the firm is successful, and nothing if it fails. The firm's total surplus is split according to

$$\begin{aligned} \pi^e &= p(xv - (1+i)D) - AR, \\ \pi^b &= p(1+i)D - DR, \quad D = I - A, \\ \pi &= pxv - IR. \end{aligned} \tag{1}$$

In the simple two state model, outside equity and outside debt are equivalent. Keeping this in mind, we phrase the model in terms of external debt. With competitive banks, the break even condition $\pi^b = 0$ in bank lending implies $(1 + i) p = R$. The loan 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 without moral hazard, shirking is costlessly avoided and firms can thus raise any amount of external funds without a financing constraint. Given competitive lending, a firm should continue if investment I yields a positive surplus:

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

Credit Analysis: To go ahead with the venture, an entrepreneur must ask for a credit. With perfect competition, banks break even and the firm gets the entire surplus. Having obtained credit, the entrepreneur chooses effort. Anticipating high effort, banks offer a competitive loan rate $(1 + i) p = R$ 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

$$IC^e: \quad p\beta^e \geqslant p_L\beta^e + b \quad \Leftrightarrow \quad \beta^e \geqslant \beta \equiv b/\left(p - p_L\right). \tag{2}$$

To guarantee high effort, the insider must receive at least $\beta^e = xv - (1+i)\,D \geqslant \beta$. Pledgeable income is the maximum incentive compatible repayment $xv - \beta$ that can credibly be promised to the bank. The incentive constraint limits repayment and, thereby, bank lending to $(1+i)\,D \leqslant vx - \beta$. 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 as repayment to the bank, $(1+i)\,D = vx - \beta$, it may not be enough to allow the bank to break even. Hence, there is a lowest productivity draw where pledgeable income just suffices to pay back. Combining with the bank's break-even condition, the finance (incentive) constraint yields the cut-off productivity

$$x_0 = \frac{p\beta + (I - A)\,R}{pv} > x_0^{FB}. \tag{3}$$

Only projects with a higher return $x \geqslant x_0$ are continued, less profitable ventures are denied credit and are closed down again. If the inequality would not hold, the firm would not be finance constrained, and the continuation decision would be first best. The problem would be uninteresting. Hence, we assume

$$p\beta > AR > 0, \tag{A}$$

which says that the minimum incentive compatible compensation of the entrepreneur, in expected value, exceeds the opportunity cost of her own equity. For all productivity draws $x > x_0$, the firm is given credit and allowed to continue. Due to (A), the threshold productivity x_0 yields a strictly positive surplus[11]

$$\pi_0 = pvx_0 - IR = p\beta - AR > 0. \tag{4}$$

[11] In addition to (A) and (4), we assume the project to yield negative net present value at x_0 when shirk-

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_0, the innovator would still make a profit but is denied credit. Hence, the weakest firms with lowest productivity are credit constrained. Only firms with higher productivity receive credit since they have enough pledgeable income. With bank profits remaining zero, the managerial incentive constraint becomes slack.

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 $g(x)$. From all productivity draws, a fraction $G(x_0)$ will be stopped, either by the bank or because the entrepreneur is unwilling to continue. From now on, we use the short-hand $G_0 \equiv G(x_0)$ and $g_0 \equiv g(x_0)$. For all $x > x_0$, profits are strictly positive, $\pi(x) = vpx - IR$, and trivially increasing in x. Expected profit, conditional on getting financed, is

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

With probability G_0, entry results in so low a productivity that the firm is denied credit and is shut down. The entrepreneur has already forgone a wage income but is still able to earn AR by investing her assets in the deposit market rather than injecting them into the firm. With probability $1 - G_0$, productivity is high enough to warrant continuation. The firm invests own equity and gets a loan.

Entry must be decided one stage earlier before the actual productivity of the firm is known. The expected net present value must be large enough to justify entry, i.e. to give up alternative wage earnings w,

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

Since $\pi(x) = pvx - IR$ is the surplus over the endowment value AR, expected end of period wealth from setting up the firm is $\bar{\pi}_e + AR$. Employment in the standard sector

ing, $p_L vx_0 - IR + b < 0$. Expanding this gives $[p_L(vx_0 - (1+i_L)D) + b - AR] + [p_L(1+i_L) - R]D < 0$, meaning that either the entrepreneur is better off not continuing and consuming AR, or the bank must deny credit because it cannot break even.

yields $w + AR$. Investors start a new venture in the innovative sector as long as $\bar{\pi}_e \geqslant w$. Free entry eliminates rents, making the inequality binding.

2.3 Standard Sector

Firms in the standard sector use a linear homogeneous technology combining capital and labor. To compare with innovative firms, suppose a firm is defined by one unit of capital so that aggregate investment reflects an extensive margin only and is equal to the number of firms. Suppose cash-flow is ϕ per unit of capital. Assuming the same investment risk, the expected profit of a firm is $\pi_N = p\phi - R$. It may be split among owners and banks in the same way as in (1). Taking the extreme case that there are no agency costs and finance constraints in the standard sector, the Modigliani Miller theorem renders the distinction between internal and external funds irrelevant. Investment is, thus, at the first best level. Free entry implies $p\phi = R$. Define the cash-flow per unit of capital by $\phi \equiv p^{-\alpha} f_0 1^{\alpha} \tilde{l}^{1-\alpha} - w\tilde{l}$ which is available only if the initial investment was successful. Multiplying the zero profit condition by K and defining aggregate employment by $L = \tilde{l}pK$ thus yields $f_0 K^{\alpha} L^{1-\alpha} = wL + RK$.

Given linear homogeneity and absence of agency costs, production is analyzed in the standard way. Denote capital and labor per unit of output by k and l. Cost minimization $u(w, R) = \min wl + Rk$ subject to $f_0 k^{\alpha} l^{1-\alpha} \geqslant 1$ yields unit factor demands $k = f_0^{-1} \left(\frac{\alpha}{1-\alpha} \frac{w}{R}\right)^{1-\alpha}$ and $l = f_0^{-1} \left(\frac{\alpha}{1-\alpha} \frac{w}{R}\right)^{-\alpha}$. 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

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

where lower indices N, E denote demand for standard and innovative goods by agent j. The standard good (consumption c_{jN}) is the *numeraire*, hence v is the relative price of the innovative good. Without loss of generality, we specify Cobb Douglas preferences,

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

implying constant expenditure shares, $v c_{jE} = \gamma y_j$ 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

Labor endowment consists of a mass one of entrepreneurial agents and L workers. Of all potential entrepreneurs, a part $1-E$ opts for employment in the standard sector. The other part starts a firm in the innovative industry. A fraction G_0 is closed again since the productivity draw is too low. When the firm continues, it invests capital I and, together with managerial effort, produces output x. By the law of large numbers, aggregate output X_E is the number of entrants E, times the fraction $1-G_0$ continued, times the average productivity $\bar{x}$ of expansion stage firms, times the fraction p surviving to the production stage. The total value of production is

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

Banks intermediate between savers and investors. All investment is financed out of the initial capital endowment A_T. An agent who prefers employment, invests her full asset wealth in the deposit market, giving a supply $(1-E)A$. The other part E starts a firm in the innovative sector. A fraction G_0 is closed again since productivity is too low, leaving wealth A to invest in the deposit market. The others continue and invest equity A in their own firm, together with external funds, to finance investment. Equilibrium requires market clearing for loanable funds, $A_L L + A(1-E) + AG_0 E = (I-A)(1-G_0)E + k_N X_N$, which 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. Labor market clearing is $L_T = E + l_N X_N$.[12] Defining unit labor demand l_E gives the factor market conditions,

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

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

$$Y = w \cdot L_T + R \cdot A_T. \tag{12}$$

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

$$v = wl_E + Rk_E, \quad 1 = wl_N + Rk_N. \tag{13}$$

[12] A part L always works in the standard sector and is immobile. A mass 1 of entrepreneurial agents is mobile and can work in either sector. A part E starts a firm in the innovative sector and thereby reduces labor supply in the standard sector. Sectoral employment $l_N X_N = L+1-E$ and $l_E X_E = E$ thus reflects free entry and occupational choice of entrepreneurial agents.

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

Turning to the trade balance, observe that commodity demand follows from (8-9) and depends on individual income. A worker with wealth A_L earns $w + A_L R$. An innovator closing down early and investing in the deposit market earns AR while failure after investment leaves zero. Successful entrepreneurs get $\pi(x) + AR$, depending on realized productivity. Since demand is linear in income, agent heterogeneity doesn't 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

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

In the absence of international capital flows, a trade surplus in innovative goods must be offset by a deficit in traditional commodities.

3 Industrial Structure

To establish how corporate governance shapes comparative advantage in innovative industries, we start with a small open economy taking world goods prices as given. We first study how an increase in the world price v of innovative goods affects factor prices. We thus reestablish a modified Stolper Samuelson theorem in an economy with finance constrained firms. Second, we consider an increase in the economy's total capital endowment A_T, keeping constant the inside equity A of firms. 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 and factor prices. The classical analysis is completed by computing changes in aggregate income resulting from factor endowment shocks and deriving the impact on aggregate demand. We then get the impact on excess demand and the trade pattern.

The paper aims to explore the influence of corporate finance on trade patterns. We thus consider an increase in inside equity A which determines the financial strength and robustness of innovative firms, keeping constant the aggregate 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! Finally, we turn to the role of legal institutions. The law and finance literature has emphasized the importance of tight investor protection, commercial law to make firms more transparent to outside investors etc. These regulations determine the quality of governance which limits managerial autonomy and discretion, makes managers more accountable to outside stakeholders, and thereby reduce agency costs and facilitate external financing. We interpret better governance as a reduction of parameter β which relates to private benefits of shirking.

3.1 Unit Demands

Unit factor demands importantly depend on cost shares which reflect the factor intensity assumptions. We have argued in the introductory section that the finance constrained innovative sector is intensive in (entrepreneurial) labor and the traditional sector is capital intensive. By (13), cost shares in the traditional 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' in the innovative sector. 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. To check consistency, add up the cost shares and get $vp\bar{x} = IR + \bar{\pi}$ as in (5). Hence, the average value of output per firm in the innovative industry consists of the cost of capital plus the average expected profit required to reward entrepreneurial labor services.

To analyze comparative statics, we take log-differentials with hats indicating relative changes such as $\hat{x}_0 \equiv dx_0/x_0$. The continuation decision in (3) determines the threshold

x_0, giving $vpx_0\left(\hat{x}_0+\hat{v}\right) = DR\hat{R} - AR\hat{A} + \beta p\hat{\beta}$ in differential form. 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 $1-\delta = A/I$,

$$\frac{x_0}{\bar{x}} \cdot \hat{x}_0 = \delta\alpha_E \cdot \hat{R} - \frac{x_0}{\bar{x}} \cdot \hat{v} - (1-\delta)\,\alpha_E \cdot \hat{A} + \frac{\beta}{v\bar{x}} \cdot \hat{\beta}. \tag{15}$$

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 and allows weaker firms to continue. Higher own equity A as a measure of financial strength reduces the need for external funding and allows for a lower threshold. Note that $\beta/\left(v\bar{x}\right)$ expresses the agency cost as a share of the output value of the average firm.

A higher threshold productivity raises average productivity of active firms by

$$\hat{\bar{x}} = \frac{\bar{x}-x_0}{\bar{x}} \frac{x_0 g_0}{1-G_0} \cdot \hat{x}_0. \tag{16}$$

Unit factor demands in the entrepreneurial sector exclusively depend on the threshold value x_0 which is driven by the impact on the finance constraint in (15),[13]

$$\hat{k}_E = -\frac{\bar{x}-x_0}{\bar{x}} \frac{x_0 g_0}{1-G_0} \cdot \hat{x}_0, \quad \hat{l}_E = \frac{x_0}{\bar{x}} \frac{x_0 g_0}{1-G_0} \cdot \hat{x}_0. \tag{17}$$

Factor prices affect unit demands only via their impact on the threshold value,

$$\hat{l}_E = \frac{x_0 g_0}{1-G_0}\left[\delta\alpha_E\hat{R} - (1-\delta)\,\alpha_E\hat{A} - \frac{x_0}{\bar{x}}\hat{v} + \frac{\beta}{v\bar{x}}\hat{\beta}\right], \quad \hat{k}_E = -\frac{\bar{x}-x_0}{x_0} \cdot \hat{l}_E. \tag{18}$$

In the traditional sector, unit demands adjust according to (7),

$$\hat{k}_N = -\hat{R}, \quad \hat{l}_N = -\hat{w} = \frac{\alpha_N}{1-\alpha_N} \cdot \hat{R}. \tag{19}$$

[13] Writing $\hat{k}_E = -\hat{\bar{x}}$ and $\hat{l}_E = -\hat{\bar{x}} + \frac{x_0 g_0}{1-G_0}\hat{x}_0$ shows that higher productivity reduces both unit demands. A higher cut-off value also means that a start-up entrepreneur continues less often which raises the labor use per unit of output. In contrast, capital is invested only after continuation is decided. Hence, there is no separate effect on unit capital demand beyond its impact on average productivity.

3.2 Factor Prices

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 (19) and get $\alpha_N\hat{k}_N+(1-\alpha_N)\,\hat{l}_N=0$. The same does not hold for the entrepreneurial sector because factor demand is finance constrained. Use (17) and the definitions of π_0 and cost shares to get

$$\alpha_E\hat{k}_E+(1-\alpha_E)\,\hat{l}_E=\mu\cdot\frac{x_0}{\bar{x}}\hat{x}_0, \quad \mu\equiv\frac{\pi_0}{vp}\frac{g_0}{1-G_0}. \tag{20}$$

This term would be zero in a first best world with $\pi_0^{FB}=0$, see (FB). In a credit constrained economy, the marginal firm makes an excess return $\pi_0>0$, indicating that entry is too small. The parameter μ may be seen as a measure of the capital market friction due to moral hazard 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 a higher capital cost R on the output price. Using the previous two equations together with (15) yields

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

Given that the traditional sector is capital intensive and the innovative sector intensive in (entrepreneurial) labor, the determinant $\lambda_\alpha=\alpha_N-\alpha_E-(1-\alpha_N)\,\mu\delta\alpha_E$ must be positive. In the first best case with $\mu=0$, the standard condition would be $\alpha_N>\alpha_E$. With binding finance constraints, the condition becomes more stringent: $\lambda_\alpha>0$ requires $(\alpha_N-\alpha_E)\,/\,[(1-\alpha_N)\,\alpha_E]>\mu\delta\geqslant 0$. The tighter financing frictions are, the more capital intensive the traditional sector must be to guarantee $\lambda_\alpha>0$. We assume the deviation from the first best to be not too large. Inverting the system yields the solution

$$\hat{R}=-\varepsilon_{Rv}\cdot\hat{v}+\varepsilon_{R\beta}\cdot\hat{\beta}-\varepsilon_{RA}\cdot\hat{A}, \quad \hat{w}=-\frac{\alpha_N}{1-\alpha_N}\cdot\hat{R}, \tag{21}$$

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

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

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

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

The statement on financial strength stems from the scenario that the total capital endowment is kept constant, i.e. asset wealth of workers is simultaneously reduced when potential entrepreneurs are endowed with more assets, $\hat{A} > 0 > \hat{A}_L$. Hence, in essence, the statement about the financial strength is a statement about the *distribution of wealth* in the economy. The importance of this distributional result is new in trade theory. Assuming that it is the more wealthy people who start a firm, $A > A_L$, a more unequal wealth distribution boosts interest and reduces wages, thus reinforcing inequality.

How exactly does financial robustness change factor prices? When new firms in the innovative 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 if their balance sheet improves. Having more own equity, they require a smaller loan so that pledgeable income is enough to repay credit. Along with a lower productivity of the marginal firm, average productivity $\bar{x}$ declines as well. Capital demand per unit of output, $k_E = I/\left(p\bar{x}\right)$, rises. The marginal firm uses the same investment but produces much less output than other firms so that capital demand per unit of output rises when more firms at the low productivity margin are financed. When a firm has more equity and credit rationing is relaxed, an entrepreneur is allowed to continue more often and, thus, produces 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 equal to the output price v in zero profit equilibrium can only remain constant when interest falls and wages rise.

When agency costs β increase due to weaker governance standards and more severe moral hazard, it becomes more costly to compensate entrepreneurs for their managerial effort. Pledgeable income shrinks and debt capacity declines. Banks can no longer expect credible repayment from some marginal firms and will deny credit. Therefore, start-ups are terminated more often, the productivity x_0 of the marginal firm increases which, in turn, yields higher average productivity. Therefore, capital demand per unit of output falls and unit labor demand rises. Given a constant output price, unit cost is fixed in zero profit equilibrium, requiring a rise in interest and a decline in the wage rate. Equation (21) also shows that the impact of weak institutions on factor prices can be compensated by firms being financially more robust, i.e. if $\hat{A} = (\varepsilon_{R\beta}/\varepsilon_{RA})\,\hat{\beta}$. The same statement applies to other results below on sectoral supply and comparative advantage.

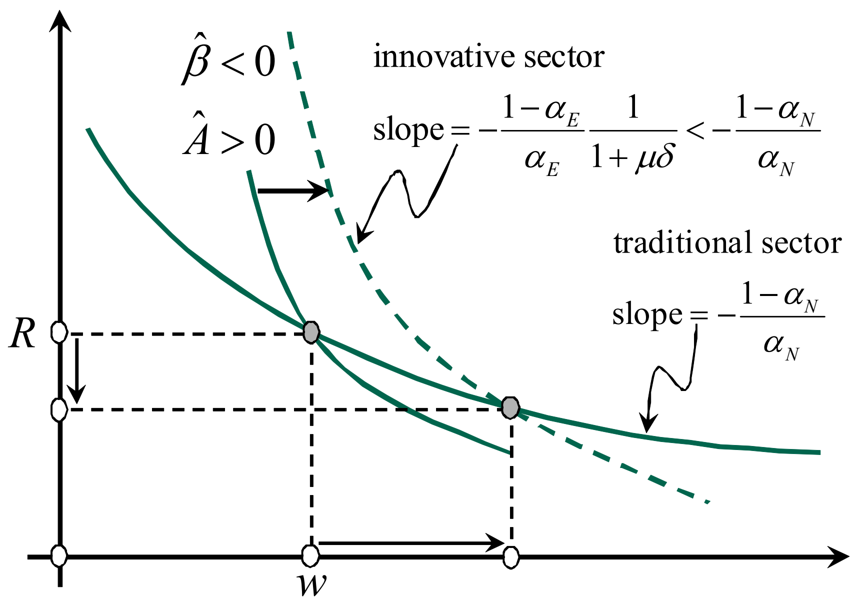

Fig. 1: Financial Robustness, Agency Costs and the Stolper Samuelson Theorem

Figure 1 illustrates the modified Stolper Samuelson theorem. The two curves are the sectoral zero profit conditions. The comparative statics is determined by the system following (20). For a given output price, entrepreneurial firms make a larger profit when they are financially stronger and need less outside funding ($\hat{A} > 0$). To lure away entrepreneurs from employment in the standard sector, innovative firms compete up the wage until profits are zero. The unit cost curve shifts to the right. When labor gets more scarce and expensive, the traditional sector must shrink. Being capital intensive, it releases relatively more capital than labor. Interest must fall until traditional sector firms can break even. A lower interest, however, boosts profits of innovative firms, allowing them to compensate entrepreneurs for an even higher wage. The process continues until, in the new intersection in Figure 1, firms in both sectors are on their cost curves and simultaneously break even at a lower interest and higher wage. Lower agency costs or a higher price for innovative goods induces a similar adjustment.

3.3 Sectoral Outputs

The Rybczynski theorem of classical trade theory explains a country's sectoral structure in terms of 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 firms in the innovative industry constant. Log-differentiating the factor market conditions in (11) yields

$$\begin{aligned} \hat{A}_T - \hat{k} &= s_A \hat{X}_E + (1 - s_A)\, \hat{X}_N, \quad \hat{k} = s_A \hat{k}_E + (1 - s_A)\, \hat{k}_N, \quad s_A = k_E X_E / A_T, \quad (22) \\ \hat{L}_T - \hat{l} &= s_L \hat{X}_E + (1 - s_L)\, \hat{X}_N, \quad \hat{l} = s_L \hat{l}_E + (1 - s_L)\, \hat{l}_N, \quad s_L = l_E X_E / L_T. \end{aligned}$$

In a first step, we hold product prices as well as own equity A and agency costs β of innovative firms constant which implies that factor prices remain constant as well. Hence, unit factor demands remain invariant, $\hat{k}_j = \hat{l}_j = 0$. The determinant of the system, $s_A - s_L$, is negative and $\lambda_s = s_L - s_A > 0$, if the innovative sector is labor intensive and, thus, absorbs a larger share of the labor endowment. Inverting the system yields

$$\begin{aligned} \hat{X}_E &= \frac{1}{\lambda_s}\left[(1-s_A)\left(\hat{L}_T-\hat{l}\right)-(1-s_L)\left(\hat{A}_T-\hat{k}\right)\right], \\ \hat{X}_N &= \frac{1}{\lambda_s}\left[s_L\left(\hat{A}_T-\hat{k}\right)-s_A\left(\hat{L}_T-\hat{l}\right)\right]. \end{aligned} \tag{23}$$

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

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

Next, we turn to the impact of changes in output prices and the structural parameters determining the financing of innovative firms (financial strength and governance of firms). Unit factor demand in the entrepreneurial sector depends on $\hat{x}_0$ only, see (17). We thus need to evaluate the change in the threshold productivity in (15). Substituting the change in the interest rate given in (21) yields

$$\frac{x_0}{\bar{x}}\hat{x}_0 = -\left(\varepsilon_{Rv}\delta\alpha_E + \frac{x_0}{\bar{x}}\right)\cdot\hat{v} + \left(\varepsilon_{R\beta}\delta\alpha_E + \frac{\beta}{v\bar{x}}\right)\cdot\hat{\beta} - \left(\varepsilon_{RA}\delta + 1 - \delta\right)\alpha_E\cdot\hat{A}. \tag{24}$$

The effect of a higher price is to allow some marginal firms to continue which would otherwise have been finance constrained. Increased financial strength has the same effect. Observe that a lower threshold value also erodes the average productivity $\bar{x}$ in the innovative sector. The marginal and financially weakest firms are the least productive. When more of them continue, because a higher price or more own equity boosts their debt capacity, average productivity declines.[14] However, one must be reminded that even marginal firms generate a positive net present value to society when entry is finance constrained. The decline in average productivity is, thus, not to be seen as damaging. Quite to the contrary, since entry is finance constrained, more entry is an improvement. Finally, higher agency costs tighten the financing constraint and lead to a higher threshold productivity needed for continuation.

[14] This is consistent with the empirical finding of Lerner (2002) that venture capital backed investments are less productive and generate less value added in boom periods when the industry expands.

Unit factor demands in the innovative sector depend on the change in factor prices via their impact on the threshold productivity while unit demands in the traditional sector reflect factor prices as in standard cost minimization. Armed with these results, we evaluate the change in unit factor demands in (22) by first substituting (18-19), collecting terms and finally replacing $\hat{R}$ with (21). After some computations,

$$\hat{k} = \varepsilon_{kv} \cdot \hat{v} + \varepsilon_{kA} \cdot \hat{A} - \varepsilon_{k\beta} \cdot \hat{\beta}, \quad \hat{l} = -\varepsilon_{lv} \cdot \hat{v} - \varepsilon_{lA} \cdot \hat{A} + \varepsilon_{l\beta} \cdot \hat{\beta}, \tag{25}$$

where the elasticity parameters are again defined with positive values,

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

According to proposition 1, a higher price of innovative goods reduces interest and boosts the wage rate since the innovative sector is assumed to be labor intensive. Both work to augment unit capital demand and reduce unit labor demand. Higher own equity of innovative firms tilts the factor price frontier in the same way, yielding the same change in unit factor demands while higher agency costs induce the opposite adjustment. Combining (23) and (25), we can derive the impact on sectoral output,

$$\begin{aligned}
\lambda_s \hat{X}_E &= (1 - s_A)\, \hat{L}_T - (1 - s_L)\, \hat{A}_T + \left[(1 - s_A)\, \varepsilon_{lv} + (1 - s_L)\, \varepsilon_{kv}\right] \cdot \hat{v} \\
&: \; + \left[(1 - s_A)\, \varepsilon_{lA} + (1 - s_L)\, \varepsilon_{kA}\right] \cdot \hat{A} - \left[(1 - s_A)\, \varepsilon_{l\beta} + (1 - s_L)\, \varepsilon_{k\beta}\right] \cdot \hat{\beta}, \qquad (26) \\
\lambda_s \hat{X}_N &= s_L \hat{A}_T - s_A \hat{L}_T - \left[s_L \varepsilon_{kv} + s_A \varepsilon_{lv}\right] \cdot \hat{v} \\
&: \; - \left[s_L \varepsilon_{kA} + s_A \varepsilon_{lA}\right] \cdot \hat{A} + \left[s_L \varepsilon_{k\beta} + s_A \varepsilon_{l\beta}\right] \cdot \hat{\beta}.
\end{aligned}$$

Note that all coefficients are defined positive, i.e. $\lambda_s > 0$. Apart from the Rybczynski effects in Proposition 2, we have

Proposition 3 ***(Supply Changes)*** *The innovative sector expands when the price rises, firms become financially more robust, and corporate governance improves.*

Aggregate supply importantly depends on the number of entrants E and the number 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 leaves factor prices and unit demands unchanged. Therefore, a larger labor endowment leads to an expansion of the innovative industry which exclusively occurs on 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 innovative sector? By the Stolper Samuelson theorem, interest declines while the wage rate increases. Both adjustments relax the financing constraint as in (15), allow more marginal firms to continue and, thereby, reduce average productivity. By (17), a lower cut-off productivity 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 in the innovative sector while the number of entrants becomes ambiguous. Hence, the expansion is shifted from the extensive (number of entrants) to the intensive margin (increased continuation rate).

3.4 Demand Side

Consumer demand for innovative goods 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 $\hat{Y} = \omega \left(\hat{R} + \hat{A}_T\right) + (1 - \omega) \left(\hat{w} + \hat{L}_T\right)$. Substituting the factor price changes in (21) yields

$$\hat{Y} = \omega \cdot \hat{A}_T + (1 - \omega) \cdot \hat{L}_T - \theta \cdot \hat{R}, \quad \theta \equiv \frac{\alpha_N - \omega}{1 - \alpha_N} > 0. \tag{27}$$

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 and note

$RA_T = \alpha_E v X_E + \alpha_N X_N$. Divide by Y, denote sectoral GDP shares by $\gamma_s \equiv vX_E/Y$ 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 than in the economy at large. The average share, in turn, exceeds the share of capital income in the innovative industry which is populated by young entrepreneurial companies with most of the return being a reward for managerial labor inputs (wage opportunity cost of entrepreneurship). 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 equilibrium interest rate from (21) yields

$$\hat{Y} = \omega \cdot \hat{A}_T + (1 - \omega) \cdot \hat{L}_T + \theta \varepsilon_{Rv} \cdot \hat{v} - \theta \varepsilon_{R\beta} \cdot \hat{\beta} + \theta \varepsilon_{RA} \cdot \hat{A}. \tag{28}$$

A higher world price for innovative goods raises aggregate income. Part of it reflects the fact that a higher price boosts pledgeable income and helps the expansion of finance constrained entrepreneurial firms in the innovative sector. The elasticity ε_{Rv} defined in (21) is magnified by the parameter μ which parameterizes the tightness of the financing constraint. This parameter would be zero in a first best world without financing frictions where continuation occurs until profit of the marginal firm is driven down to zero. For the same reasons, the equity ratio of firms and agency costs are relevant only in a finance constrained economy with $\mu > 0$. In the first best, the interest elasticities in (21) would be zero, making corporate finance irrelevant for aggregate income.

Given that young entrepreneurial growth companies in innovative industries tend to be finance constrained, a larger equity ratio of firms (higher A for given A_T) which characterizes financially more robust firms with stronger balance sheets, raises aggregate income. The reason is that a larger equity ratio facilitates external funding of investments with strictly positive net present value ($\pi_0 > 0$ at the margin). With lower equity, a larger credit is needed. These marginal firms would be denied credit since pledgeable income would not suffice to repay the larger required loan. Finally, 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 misbehavior and opportunism and, thereby, raise the agency costs of investment β in innovative industries which intensively rely on entrepreneurial inputs. Larger agency costs reduce pledgeable income and, thereby, the debt capacity of these firms which limits the leveraged expansion of the innovative sector.

Aggregate income and relative prices determine demand for innovative goods,

$$\hat{C}_E = \hat{Y} - \hat{v} = \omega \cdot \hat{A}_T + (1-\omega) \cdot \hat{L}_T - (1-\theta\varepsilon_{Rv}) \cdot \hat{v} - \theta\varepsilon_{R\beta} \cdot \hat{\beta} + \theta\varepsilon_{RA} \cdot \hat{A}, \qquad (29)$$

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 $\alpha_N > \omega > \alpha_E$. We argue for $1 > \theta\varepsilon_{Rv}$ which is fulfilled if finance constraints are not too tight and μ is close to zero. In this case, a higher output price restrains demand. Note that, even with a degenerate demand reaction, excess demand for innovative goods would still decline with a higher own price as long as the supply change dominates.

3.5 Trade Balance

Excess demand in the domestic economy, $\zeta_E \equiv C_E - X_E$, results in a trade balance deficit for innovative goods. We are interested in how the trade balance responds to changes in the novel fundamental parameters introduced by our analysis: the abundance of total assets A_T in the economy, the financial robustness of innovative firms measured by A at given A_T, and the extent of agency costs as captured by β. Measuring the change in excess demand by $\hat{\zeta}_E \equiv vd\zeta_E/Y$, we get $\hat{\zeta}_E = \gamma\hat{C}_E - \gamma_s\hat{X}_E$. Substituting (29) and (26), and using $\lambda_s = s_L - s_A$ when necessary, yields

$$\hat{\zeta}_E = \varepsilon_{ZA_T} \cdot \hat{A}_T - \varepsilon_{ZL} \cdot \hat{L}_T - \varepsilon_{Zv} \cdot \hat{v} - \varepsilon_{ZA} \cdot \hat{A} + \varepsilon_{Z\beta} \cdot \hat{\beta}, \qquad (30)$$

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 wish to depart from the frequent assumption of balanced trade and allow for asymmetric country characteristics. But we do assume that the trade imbalance is not too large so that $\gamma_s - \gamma$ is small and $\varepsilon_{ZL} > 0$ in all cases. Furthermore, in restricting attention to a neighborhood of the first best, all elasticities are positive, despite of the countervailing influence of the terms associated with θ. To see this, note the assumption (A) in section 2.2 which implies that finance constraints are binding. Hence, some firms with positive net present value are rationed. The marginal firm makes a strictly positive profit π_0, leading to $\mu > 0$. Letting the agency cost approach $\beta p \to AR$ from above, implying $\pi_0 \to 0$ and $\mu \to 0$, moves the equilibrium arbitrarily close to the first best. By the Modigliani Miller theorem, the distinction between external debt and own equity becomes irrelevant. All terms multiplying with μ drop out, leaving the classic two sector trade model. Letting private benefits and, thus, agency costs only marginally exceed the borderline case of assumption (A), we keep close to the first best. Consider now the elasticity $\varepsilon_{Z\beta}$. Since $\mu \to 0$ implies $\varepsilon_{R\beta} \to 0$, the last term vanishes. However, since $\mu \to 0$ is equivalent to $\beta \to AR/p > 0$, the elasticities $\varepsilon_{l\beta}$ and $\varepsilon_{k\beta}$ as listed in (25) remain strictly positive, implying that $\varepsilon_{Z\beta}$ remains positive as well. Given that the debt and equity ratios δ and $1-\delta$ are exogenous, ε_{lA} and ε_{kA} remain positive by the same argument which keeps ε_{ZA} positive. Hence, all elasticities in (30) are strictly positive when being close to the first best allocation.

Under these conditions, when the economy gets richer in financial assets, it starts to develop a surplus in the standard capital intensive sector while the innovative sector relying intensively on entrepreneurial inputs records an excess demand, resulting in a trade deficit. Given that demand declines in its own price ($1 > \theta\varepsilon_{Rv}$), a higher output price of innovative goods expands output and results in a trade surplus in this sector (sectoral excess demand falls). Finally, higher agency costs lead to a trade deficit in innovative goods. When entrepreneurial firms are endowed with stronger balance sheets, the entrepreneurial sector expands, resulting in a trade surplus.

3.6 Trade Barriers and Welfare

Financial development and trade protection can have important consequences for per capita welfare. To investigate the consequences of trade protection, we assume the country to be a *net importer* of innovative goods. In light of Proposition 3 and the results noted in (30), such a situation might emerge because weak institutions or financially fragile firms in the innovative sector have difficulties in raising external funds. Given the trade deficit and the weak financial state of firms, the country might introduce (non-tariff) trade barriers $\tau > 1$ to restrict imports and protect its infant industry. Domestic consumers pay v on home produced goods and τv^* for imports. No-arbitrage dictates $v = \tau v^*$.[15] Since a small open economy cannot affect the world market price v^*, import protection raises the domestic price by $\hat{v} = \hat{\tau}$. By (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 of innovative goods, $\hat{v}_c = \gamma\hat{v}$. Substituting the income gain in (28), and noting the coefficients θ, ε_{Rv}, ω and λ_α yields

$$\hat{U} = (\theta\varepsilon_{Rv} - \gamma) \cdot \hat{v} - \theta\varepsilon_{R\beta} \cdot \hat{\beta} + \theta\varepsilon_{RA} \cdot \hat{A}, \qquad (31)$$

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

[15] Foreign consumers pay v^* for the national good, and $\tau v = \tau^2 v^* > v^*$ when importing. Hence, foreigners demand only national goods. Any remaining excess supply is exported.

$\gamma - \gamma_s$. If the country is a net importer, the demand share exceeds the supply share of the innovative 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 as measured by the real value of income 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 a strictly positive net present 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 increase despite of a negative terms of trade effect!

If a country cannot implement for some reason 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 initiative facilitates access to external funds and thereby promotes the expansion of the innovative sector. Better governance helps constrained firms to realize profitable and previously unexploited investment opportunities. This is reflected in the parameter $\varepsilon_{R\beta}$ 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 4 ***(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 in innovative goods, protection relaxes finance constraints and can improve welfare despite of a negative terms of trade effect.*

4 The World Economy

4.1 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 neoclassical result is retrieved in our model when setting $\mu = 0$ in (20-21) and noting that the solution of factor prices in both countries according to (21) depends in exactly the same way on the world market price v. When finance 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 are identical, and production technology, including the distribution $g(x)$ in the innovative sector, is symmetric as well. To see this, note that the cut-off $x_0(v, R)$ in (3), the profit of the marginal firm $\pi_0(v, R)$ in (4), and the average productivity $\bar{x}(v, R)$ in (5) all depend on v and R in exactly the same way, and so does the parameter μ in (20). Hence, the solution in (21) of factor prices in both countries depends in exactly the same way on the common world market price which clarifies the symmetry conditions for factor price equalization in our model of trade and finance.

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 firm 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 (21). Figure 1 illustrates.

Proposition 5 ***(Factor Price Equalization)*** *Free trade leads to factor price equalization as long as both production and intermediation technologies are identical. Differences in financial development lead to factor price differences.*

4.2 Comparative Advantage

Autarky: Under autarky, $\zeta_E = \hat{\zeta}_E = 0$. Using this in (30) results in

$$\hat{v} = \frac{\varepsilon_{ZA_T}}{\varepsilon_{Zv}} \cdot \hat{A}_T - \frac{\varepsilon_{ZL}}{\varepsilon_{Zv}} \cdot \hat{L}_T - \frac{\varepsilon_{ZA}}{\varepsilon_{Zv}} \cdot \hat{A} + \frac{\varepsilon_{Z\beta}}{\varepsilon_{Zv}} \cdot \hat{\beta}. \tag{32}$$

If trade is balanced in the initial equilibrium ($\gamma = \gamma_s$), then $\varepsilon_{ZA_T} = \varepsilon_{ZL}$ in (30) 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 free entry, 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 innovative industry, leading to excess supply and requiring a lower relative price.[16] Lower agency costs in financing entrepreneurship ($\hat{\beta} < 0$), for example due to improved corporate governance standards or financial institutions, favor expansion of the innovative sector and also reduce the relative price. Lower agency costs relax the incentive constraint and boost pledgeable income, allowing more marginal firms to be financed which otherwise would have been credit constrained.

Many Countries: Let us focus on parameter domains with imperfect specialization so that production of both goods takes place in all countries also after some economic shock. Suppose that protection and other economic shocks are limited to the home economy. Hence, v^* is the common world market price for all other countries, 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 $v = v^*$. Whenever we discuss the consequences of the home economy

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

introducing trade protection, we assume it to be an importer of innovative goods so that $\hat{v} = \hat{v}^* + \hat{\tau}$. We consider only exogenous changes in the home country so that excess demand in other foreign countries, indexed by j, changes only in response to a world price shock, $\hat{\zeta}_E^j = -\varepsilon_{Zv}^j \cdot \hat{v}^*$. Note as well that we do not impose symmetry in the initial equilibrium but allow for trade imbalances. Hence, some of the foreign economies may be importing and others exporting innovative goods.

Equilibrium in the world market for innovative goods 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 $v = v^*$ and 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 (30) 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

$$\hat{v}^* = \frac{\sigma\varepsilon_{ZA_T}}{\varepsilon_{Zv}^*} \cdot \hat{A}_T - \frac{\sigma\varepsilon_{ZL}}{\varepsilon_{Zv}^*} \cdot \hat{L}_T - \frac{\sigma\varepsilon_{ZA}}{\varepsilon_{Zv}^*} \cdot \hat{A} + \frac{\sigma\varepsilon_{Z\beta}}{\varepsilon_{Zv}^*} \cdot \hat{\beta} - \frac{\sigma\varepsilon_{Zv}}{\varepsilon_{Zv}^*} \cdot \hat{\tau}, \tag{33}$$

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 $n \to \infty$, 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 on all countries via the induced change in the common price $\hat{v}^*$. By (31), an increase in the world price boosts foreign welfare by relaxing finance constraints in the innnovative 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 6 ***(Comparative Advantage)*** *In the reforming country, better investor protection and corporate governance standards reflected in lower agency costs (lower β) and a higher equity ratio of entrepreneurial firms (higher A) create a comparative advantage in innovative industries. Taking account of changes in terms of trade and the effect* *on financing constraints, foreign export nations unambiguously loose while the welfare change in foreign import nations is ambiguous.*

4.3 Protection and Welfare

Since goods are homogeneous, our specific protection scenario makes sense only if countries are asymmetric and the home country is importing innovative goods. Clearly, protection restricts domestic demand and, therefore, requires a reduction in the world market price where the strength of the impact depends on the share σ of the country in world GDP. In a small open economy, an increase in protection has no impact on the world market price but only raises the domestic demand price, $\hat{v} = \hat{\tau}$, giving rise to the results noted earlier. With large countries, protection in one of them reduces the world market price as in (33), 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 finance constraints in the home economy but tighten them in foreign economies where the lower output price erodes earnings and pledgeable income of constrained firms. If foreign countries are exporting innovative goods, 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 7 ***(Protection and Foreign Welfare)*** *If the home country is an importer of innovative goods and introduces an import barrier, the world market price declines. Foreign export nations loose both on account of worsening terms of trade and tighter finance constraints. Foreign import countries loose from tighter finance 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 are very different across countries. To show this possibility, we restrict our interest to a two-country version (with a star denoting the foreign country) and consider the following scenario: the home country is financially underdeveloped (high β and firms might also 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, and the foreign country a surplus. Suppose that there is another country difference such as a relatively larger labor endowment 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 for innovative goods. When trade barriers are absent at the outset, $v = v^*$ with free trade. We now 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 (33). Aggregate welfare in the home country changes as in (31) in response to the price increase while foreign welfare declines on account of a negative terms of trade effect. Adding up and noting $\mu^* = 0$, world welfare changes by

$$\begin{aligned} \hat{U} + \hat{U}^* &= \mu \cdot \frac{\gamma_s (\alpha_N - \alpha_E) x_0/\bar{x} + \gamma (1 - \alpha_N) \alpha_E \delta}{\lambda_\alpha} \cdot \hat{v} \\ &: - (\gamma - \gamma_s) \frac{\alpha_N - \alpha_E}{\lambda_\alpha} \cdot \hat{v} - (\gamma^* - \gamma_s^*) \frac{\alpha_N - \alpha_E}{\lambda_\alpha} \cdot \hat{v}^*. \end{aligned} \tag{34}$$

Protection yields welfare gains because a higher price relaxes finance constraints of domestic firms as in the first line of (34). The second line captures welfare-reducing terms of trade effects. Since the home country is a net importer of innovative 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 finance constraints in the financially backward home country, resulting in higher world welfare, at least for small levels of protection.

Proposition 8 ***(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 expansion of innovative sector firms at home while foreign firms have easy access to external funds thanks to a 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 finance constraints. For this reason, as long as some financial frictions are present, trade policy can yield gains or losses entirely different from traditional channels for welfare effects.

5 Conclusions

This paper analyzes the role of endogenous financial constraints on the extensive margin of firm activity and international trade. We consider economies with two industries, a standard and an innovative sector. Firms in the standard sector are financially unconstrained and use capital intensively. Companies in the innovative sector are heterogeneous with regard to productivity and crucially depend on the managerial input of the founder. Entrepreneurs need more capital than they own and have to rely on external financing through (perfectly competitive) banks. Since managerial effort is not verifiable, entrepreneurs and banks cannot write contracts to avoid moral hazard. To prevent managerial misbehavior, entrepreneurs must keep a sufficiently large financial stake in the firm which limits pledgeable income and debt capacity. As a result, some marginal firms with positive net present value are denied external funding in equilibrium, thereby limiting the expansion of innovative industries.

The analysis introduces two novel fundamental parameters determining financial constraints, firm entry, and international trade simultaneously in a Heckscher-Ohlin-Samuelson model with Ricardian features: an innovative firm's equity ratio, as a measure of financial robustness, and the extent of agency costs, reflecting a country's corporate governance standards and quality of financial institutions. Lower agency costs relax the financial constraint by raising a firm's pledgeable profit and debt capacity. A higher equity ratio, characterizing firms with stronger balance sheets, reduces the need for external funding so that even a smaller pledgeable profit suffices to repay debt. Both fundamentals facilitate the financing of firms with relatively low productivity but still positive net present value and thereby support the expansion of innovative industries. This illustrates how fundamental parameters of corporate finance affect core theorems in international trade such as the Stolper-Samuelson theorem, the Rybczinsky theorem, and the law of comparative advantage through their impact on the extensive margin of trade.

Moreover, we establish conditions for factor price equalization. In particular, we illustrate that factor price equalization does not only depend on *goods production technologies* but also on *financial intermediation technologies* of the banking sector. Finally, we indicate that, with pre-existing and unavoidable finance constraints, (non-tariff) protection of the constrained industry in a country which is a net importer of that sector's goods may raise this country's welfare. With many countries, protection of the most constrained net importer in that sector may even improve world welfare.

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