Economics Department Working Paper Series   Economics

2021

Global Value Chains and Unequal Exchange: Market Power and Monopoly Power

Deepankar Basu
Department of Economics, UMass Amherst

Ramaa Vasudevan
Department of Economics, Colorado State University

Global Value Chains and Unequal Exchange: Market Power and Monopoly Power

Deepankar Basu[1] and Ramaa Vasudevan[2]

[1]Department of Economics, University of Massachusetts, Amherst.
[2]Department of Economics, Colorado State University.

July 7, 2021

Abstract

We revisit the hypotheses of unequal exchange and deteriorating terms of trade in the specific context of import-intensive, export-led strategies of developing countries which rely on integration into GVCs for access to markets in developed countries using a stylized two-country two-commodity Classical- Marxian trade model. Two sources of asymmetry can be distinguished: market power arising from the competition between suppliers that depresses the prices at which the final good is supplied; and monopoly power arising from the lead firms control and ownership of intangible assets including brand and design. The model explores some implications of these two sources of asymmetry.

Keywords: Unequal Exchange, Global Value Chains, Classical Trade Model

JEL Classification Codes: F02, F23, O19

1 Introduction

The framework of global value chain (GVC) and global production network (GPN) analysis has been used to analyze the recent cross-border expansion

and dispersion of production led by the initiatives of large corporations [Dicken (2011), Henderson et al, (2002), Gereffi et al (2001), Gereffi and Korzeniewicz (1994)]. This framework challenged the conventional measures of export performance and international competitiveness, turning the spotlight on the growing importance of value added-trade and the import-intensiveness of exports. A GVC of a final product, which is either consumed or invested, is defined as the value added of all activities that are directly and indirectly needed to produce it [Timmer et al (2014), pp. 100]. The fact that it is a value *chain* comes from the fact that the production process is fragmented and carried out in different firms. The fact that it is a *global* value chain refers to the fact that these firms are distributed across many countries (and also typically across many industries) over the globe.

About 70 percent of global trade is associated with GVCs, with services, raw materials, intermediate goods, parts and components increasingly being imported and incorporated into final consumer products that are then traded in international markets [OECD (2020)]. While there has been a slight decline after the 2008-09 crisis, and the outbreak of the COVID-19 pandemic has also had a disruptive impact on the functioning of GVCs, they remain pervasive in shaping trade and the global division of labor. As corporations restructured their operations, through outsourcing and offshoring, different stages of the production process were relocated to different parts of the world. This development also led to a changing pattern of specialization, with developing countries, particularly in Asia and Latin America, becoming the new loci for the fabrication and assembly of a range of final goods.

GVC's are instrumental in forging a global divison labor under the control of lead corporations that accentuate inequality and concentrate revenues and wealth while offering a limited scope for upgradation [Selwyn and Leyden (2021)]. Further, the increasing share of manufactures in the export basket of developing countries has also been associated with a decline in the manufacture-to-manufacture terms of trade for developing countries against developed countries since the mid-eighties [Sarkar and Singer (1993), Chakraborty (2012)].

This suggests that the issues of unequal exchange, deteriorating terms of trade and dependency highlighted by [Prebisch (1950), Singer (1950), Singer (1975), Emmanuel (1972)] in the context when developing countries specialized in the export of primary commodities and imported manufactured products from developing countries remain relevant even with the diversification of developing country exports towards manufactured goods as they were integrated into GVCs. In this context, it becomes pertinent to ask the following question: what is the scope for escaping from the trap of adverse terms of trade in the context of the fragmentation of production within such vertically coordinated, hierarchical structures of trade and production that exploit low-wage workers in developing countries? The skewed distribution of value-added towards the lead firm in the core which capture bulk of the value -added while suppliers in the periphery confront difficulties in upgrading since the gains in productivity were swamped by deteriorating prices, constitute a global process of uneven development [Smichowski et al (2021)].[1]

---

[1][Smichowski et al (2021)] delineate three distinct developmental patterns associated with GVC integration: the first cluster corresponding to the reproduction of the core

We revisit the hypotheses of unequal exchange and deteriorating terms of trade in the specific context of import-intensive, export-led strategies of developing countries which rely on integration into GVCs for access to markets in developed countries. [Milberg and Winkler (2013)] had underscored the relevance of the classical dynamic trade model in understanding how trade affects distribution, profitability and accumulation when conducted within the institutional structure of GVCs. However, the asymmetric power exercised by lead firms within the institutional framework of GVCs is at odds with the doctrine of comparative advantage [Selwyn and Leyden (2021)] . Offshoring of production within value chains, instead reaffirms the relevance of absolute advantage and low unit wage costs (rather than comparative advantage) in determining the pattern of trade [Baldone et al (2007), Milberg and Winkler (2013)]. In that spirit, we present a Classical-Marxian model of trade with two countries and two goods to investigate the implication of trade relations for unequal exchange in a context where developing countries import intermediates and capital goods as the basis for the production, and export the final consumer good within the institutional structure of GVCs.

GVCs structures are complex and involve many developing countries and multiple cross-border transactions, including trade in services, parts and components of final goods which are then exported for final assembly elsewhere. The stylized model presented here, however, strips down the structure of GVCs to a simplified two-country two-good framework as a first pass at clarifying the basic pattern of unequal exchange embedded in

comprising developed countries, a second corresponding to the pattern of unequal growth, including developing countries in Asia, to a third corresponding to what they call the social upgrading mirage. The focus of this paper is the relation between the first two clusters

4

trade within GVCs structures in the specific case of manufacture of import-intensive final consumption-goods. We capture the asymmetries of GVC arrangements by positing that the production of intermediate inputs (which happens in the North) is capital and skill intensive and the production of the final consumer good (which happens in the South) is low-skill labour intensive. Our model shows that Southern firms are at a disadvantageous position due to both the market power of Northern firms and also due to the monopoly power of Northern firms arising from the ownership of intangible capital. Hence, issues of unequal exchange and terms of trade deterioration remain relevant even in GVC arrangements.

The rest of the paper is organized as follows. Section 2 presents an overview of the asymmetry within the GVC institutional structure of the relation between the lead firm in the North and the producer firms in the South. We distinguish market power arising from the competition between suppliers in Southern economies with surplus labour that depresses the prices at which the final good is supplied; and monopoly power arising from the lead firms' control and ownership of intangible assets including brand and design. Section 3 presents the basic model of two-country, two-commodity trade. In section 4 and 5 we explore two alternative closures of the model that correspond, respectively, to market power of Northern firms (due to surplus labour in the South) and monopoly power of Northern firms (due to ownership of intangible capital). The final section concludes with thoughts about future research.

2 Market power and monopoly power within GVCs

Trade within GVCs is determined by the strategies of the lead firms engaged in cross-border production. The coordination and control of increasingly complex GVCs has been facilitated by the revolution in information and communication technology - what has been termed the second unbundling [Baldwin (2016)] - on the one hand and on the other by the adoption of trade liberalization policies, and the paradigm of export-led development strategies by developing countries. This structure allows the analysis of GVCs from two contrasting vantage points: that of governance, i.e. the organization and coordination of GVCs by the lead-firm in the North, and that of upgrading i.e. the strategies used by countries, regions and firms in the South to climb up the value chain ladder from low value-added activities to high value added activities [Gereffi (2014)].

The so-called smile curve (see Figure 1) offers a stylized representation of the distribution of value-added across the GVC [Meng et al, (2020)]. The pre-production stages of R&D design and logistics and the post-production stages of marketing and after-sales services which are concentrated in the lead firm, typically in developed countries, have a higher share of value-added than the production stages that are located in developing countries. The smile curve would become deeper and steeper, as depicted in Figure 1 in the movement from the dashed to the solid curve, because of two processes [Durand and Milberg (2020)].

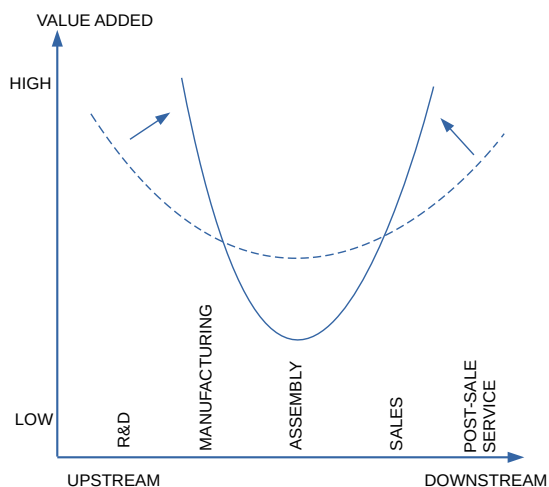The first process derives from the endogenous asymmetry of market

Figure 1: The Smile Curve.

structures within GVCs [Milberg and Winkler (2013)]. This asymmetry
emerges as a result of the polarization between the market power of dom-
inant lead firms and lower-tier supplier firms specializing in assembly and
fabrication that are subject to intense competition. The market power of
the lead firm, is reflected in the capacity to squeeze the supplier firms,
and competition manifests in a race to the bottom as suppliers compete by
squeezing labor costs. Labour costs can be squeezed by supplier firms in
the periphery (or semi-periphery) of the global capitalist economy because
of the presence of large reserves of surplus labour in these economies.

The fragmentation of production also segments the workforce, pitting
workers in the South against each other and against workers in the North,
weakening the bargaining power of workers. The decomposition of the
value-added across GVCs, in the [Timmer et al (2014)] study, found that
the overall share of capital in value-added rose by more than 6 percent

between 1995-2008, while that of medium and low-skilled workers fell by around 4 percent, the latter consistent with the presence of large reserves of low and medium-skilled labour in developing economies. [Chen et al (2018)] document a decline in the labor share in GVCs from 56 percent in 2000 to about 51 percent in 2014. The share of low-skilled workers fell more sharply outside the group of high-income countries (by 6.3 percent compared to 4.9 percent in the former) in this period. The decline in the share of wages reflects the impact of segmentation and intensified competition among suppliers in weakening the position of workers, globally, and especially in labour surplus economies.

The second process relates to monopoly power arising from the concentration of ownership and control over intellectual, intangible capital with the lead firm [Durand and Milberg (2020)]. This intangible capital includes designs and technology patents, software, market intelligence, brand-name, etc. These intangible assets are connected to the high-value-added, pre and post-production stages of the GVC. The information and communication flows that enable the integration of GVCs also imply that intangible capital plays a key role in the coordination and control of the GVC. The concentration of intangible assets in lead firms in developed countries is also associated with a specialization in high-skilled labor activities in these countries [Timmer et al (2014)]. [Chen et al (2018)] decompose the value added within GVCs taking into account the share accruing to intangible capital. Their study finds that the share of intangible capital (measured as a residual) accounted for much of the decline in labor share between 2000-2014, and at around 30 percent in 2014 dwarfed the share of tangi-

ble capital (which was around 18 percent). Further, there is a shift in the share of income away from the production stage, with the upstream stages (including marketing and distribution), where intangible assets are concentrated, accounting for about three-quarters of the value-added across the different stages of the chain in 2014 [Chen et al (2018)].

The concentration of ownership of intangible capital is thus associated with monopoly rents accruing to the lead firms controlling the GVCs. Intangible capital like patents and brand names are different from traditional capital assets in that they involve large magnitudes of often firm-specific fixed costs [Timmer et al (2014)]. These large fixed costs give rise to non-competitive product markets and the ability to charge mark-ups over cost. The monopoly arising from fixed costs is reinforced by regimes of intellectual property rights, enforced by governments.

Stricter intellectual property rights and proprietary control over standards, technologies and brands, innovational advantages of control over the chain and natural monopoly associated with economies of scale and network externalities associated with GVCs are the sources of increasing monopoly rents accruing to lead firms [Durand and Milberg (2020)] Thus, while the horizontal competition among suppliers exerts a downward pressure on the smile curve squeezing the share of value-added at the middle production stages in developing countries; there is also a concomitant process of sharpening the slope of at the two ends of the smile curve that is associated with control over intangible assets [Durand and Milberg (2020)]. This is reflected in the process of value erosion as the sectoral shares of domestic value-added in developing country exports declines with integration GVCs

[Caraballo and Jiang (2016)]. The GVC represents a concentration of control in the hands of corporate lead-firms in the North as against the small, dispersed producers in the South.

Given the limited scope for capturing value at the final-assembly/production stages of the GVC, integrating into GVCs controlled by global corporations in order to access markets in North creates new dependencies for developing countries specializing in low-wage manufacturing. [Heintz (2006)] presents a model of unequal exchange that investigates the unequal distribution of benefits (value-added) between the lead firm and the lower-tier supplier firms in developing countries based on the decomposition of the price of the final good between lead firm and subcontractors.The distribution of the gains from increased productivity of the supplier firms depends on whether these gains are captured in the form of higher monopoly rents for the brand-name lead-firm or in the form of lower prices for the final good. An increase in demand from the affluent consumer markets in the north, however, would lead to income convergence if this demand is sufficiently income elastic. An important implication is the delinking of production in the south from its domestic market as exports and consumption in the north drives demand [Heintz (2006)].

The source of unequal exchange in [Heintz (2006)] arises on one hand from branding and other associated forms of monopoly and on the other from competitive sourcing from suppliers. It relates to the two-fold dynamic outlined above that make the GVC smile curve deeper and steeper. The dynamic is embedded in the two forms of power asymmetry: (a) the market power of the lead firm sourcing from competing suppliers in developing

10

countries, and (b) the monopoly power associated with the ownership of intangible capital in the global economy.

The model presented in this paper also approaches the relation between lead firms in the North and producer firms in the South within GVCs from the lens of unequal exchange. The focus is on North-South trade relations and we put forward a more traditional classical-Marxian trade model to address the implications for terms of trade and distribution.

Unequal exchange has been analyzed from a Marxian analytical perspective by [Emmanuel (1972)] in a context of free capital mobility as an outcome of lower wages and a higher level of exploitation in the developing countries. As a result, trade involves the exchange of goods produced with a higher content of labor in the South for goods produced with relatively lower content of labor produced in the North. Within the structuralist tradition, [Singer (1950)] and [Prebisch (1950)], ascribe the deteriorating terms of trade faced by countries in the South to the lower elasticity of demand for the primary goods exported by these countries and more downwardly flexible wages. As a result, productivity gains in the South is reflected in deteriorating terms of trade. [Bacha (1978)] brings these two approaches together as alternative closures in a general equilibrium model focussing on the relative employment in the South as the strategic variable.

Before presenting our model we should note the wide range of North-South models of uneven trade in the structuralist tradition [Dutt, Darity and Davis (2005)]. These models involve different specifications and closures for the North and the South. These could be based on:

1. different rates of profit and rates of exploitation,

2. different import and export elasticities of exports and imports of the North and South,

3. different macro-economic closures (e.g. classical closure for the South and Keynesian closure for the North).

However, the traditional pattern of trade analyzed in this literature, with the South specializing in primary commodity exports, and the North in the export of manufactures has been replaced by a pattern where the South produces and exports final goods through GVCs, while importing intermediate goods from the North. It is this new situation that we analyze in this paper.

3 Basic Model

We present a stylized classical-Marxian model of trade investigating some of the implications of the emergence of GVCs, and the outsourcing of segments of the production process that are coordinated and controlled by corporate headquarters in the North, to locations in the South.

The limited purpose of our model is to explain some of the distributional implications of GVC trade and the monopoly and market power exercised by the lead Northern firms. A key characteristic of trade mediated within GVCs is that production locations in the South use technology, intermediate and capital goods and design specifications from the lead firm in the North to produce or assemble final goods that are then exported to the North. We

ignore other sectors and inter-sectoral linkages in the countries, focusing only on the sectors directly engaged in GVC trade. We also abstract from considerations of demand elasticities and investment demand to focus on the structural relation between trade and production within the GVC structure.

The model is a two-country, two-class, two-good circulating capital model in the classical-Marxian tradition. There are two countries, the North and South respectively, and two commodities – an intermediate good and a final consumption good (denoted by subscripts 1 and 2 respectively). The North specializes in the production of the intermediate good used for production of both goods, while the South specializes in the production of the consumption good, which is produced using the intermediate good imported from the North. Trade corresponds to a production process that is dispersed across the North and South. The model is set up to investigate the implications of this pattern of trade. However, the demand for consumption goods produced by GVC supplier in the South arises from both the North and the South, and production is not exclusively for export to the north.

Since each country specializes in the production of one good, the subscript 1 refers to the North and the subscript 2 refers to the the South. The price system is given by:

$$p_1 = (1 + r_1)(w_1 l_1 + p_1 k_1) \tag{1}$$

$$p_2 = (1 + r_2)(w_2 l_2 + p_1 k_2) \tag{2}$$

where r_i, is the rate of profit, w_i the nominal wage rate, l_i the amount of labor used to produce one unit of good i (the inverse of labor productivity),

k_i the physical units of good 1 used to produce 1 unit of good i, and p_i is price of the i-th good. Let $p = p_1/p_2$ denote the terms of trade between the two countries, and $\omega_i = w_i/p_2$ denote the real wage rate in country i in terms of the consumption good (produced exclusively by the South). Using the terms of trade and the real wage rates in the two countries, the price system can be written as

$$p = (1 + r_1)(\omega_1 l_1 + pk_1), \tag{3}$$

$$1 = (1 + r_2)(\omega_2 l_2 + pk_2). \tag{4}$$

We assume that workers spend their entire wage income on the consumption good, i.e. good 2. On the other hand, the entire profits of the capitalists are invested. We do not formulate a separate investment demand function. The profits of capitalists, R_i in each country are given by

$$R_1 = r_1(\omega_1 l_2 + pk_1)x_1, \tag{5}$$

$$R_2 = r_2(\omega_2 l_2 + pk_2)x_2, \tag{6}$$

where x_i is the real output of good i. The profits are used to purchase additional intermediate goods $r_i pk_i x_i$ and hire workers $r_i \omega_i l_i x_i$, both expressed in units of the consumption good.

The value of South's imports of good 1 is given by $p_1(1 + r_2)k_2 x_2$, where $p_1 k_2 x_2$ is the South's demand for replacing the used up intermediate inputs, and $r_2 p_1 k_2 x_2$ is the South's demand to meet the needs for expansion (coming

14

from investment of profits in the South). In a similar way, the value of the South's exports of good 2 is given by $(1 + r_1)w_1 l_1 x_1$, where $w_1 l_1 x_1$ is the North's demand for consumption goods that is needed to carry on production at the existing level, and $r_1 w_1 l_1 x_1$ is the North's demand for consumption goods to take account of expansion (due to reinvestment of profits). Assuming that trade is balanced, we have

$$(1 + r_1)\omega_1 l_1 x_1 = p_1(1 + r_2)k_2 x_2. \tag{7}$$

Let $x = x_2/x_1$ be the ratio of the output in the South (good 2) to the output in the North (good 1). Then, dividing the trade balance condition through by p_2 gives us

$$x = \frac{\omega_1 l_1 (1 + r_1)}{pk_2 (1 + r_2)}. \tag{8}$$

Summarizing the discussion so far, we see that the basic model has four endogenous variables, the terms of trade, p, the profit rate in the North and South, r_1, r_2, and the relative output ratio, x, but only three equations:

$$1 = (1 + r_2)(\omega_2 l_2 + pk_2), \tag{9}$$

$$p = (1 + r_1)(\omega_1 l_1 + pk_1), \tag{10}$$

$$x = \frac{\omega_1 l_1 (1 + r_1)}{pk_2 (1 + r_2)}. \tag{11}$$

Hence, we need one more equation to close the model. In this paper, we will explore two closures of the model. In a first closure we assume that the terms of trade is fixed by market power of Northern firms in the world market at some level $\bar{p}$. In this case, the profit rates in the two countries

will be unequal in general (due to barriers to mobility of capital from the South to the North, the existence of large fixed costs for the firms in the North, etc.). The North uses its dominant market position to set the terms of trade and ensure that Northern firms earn a higher rate of profit on their capital than Southern firms.

In the second closure, firms in the North derive power from their ownership and control of intangible capital and this enables them to extract what we terms a monopoly rent. To analyze this closure, we can understand the Northern firms' monopoly premium or quasi-rent as a rate of return over and above the rate of profit that Southern firms earn. This monopoly rent can be conceptualized as a reflection of the power Northern firms' derive from the ownership of intangibles. Unlike capital advanced to hire labor or purchase intermediate inputs, intangible capital does not increase productive capacity. It includes the brand identity, goodwill, design and market access of the lead firm in the North. From the perspective of distribution, what is important is that the ability to extract this monopoly rent effectively ensures a higher rate of return on the capital invested by Northern firms compared to those in the South.

The North can thus exercise its control either by deploying its market power to control the terms of trade or by using its monopoly power to extract monopoly rents. By presenting the two closures separately we can distinguish two distinct sources of power that the North exercises: market power through control over terms of trade (which is made possible by the existence of large reserves of surplus labour in the South) and monopoly power (which is made possible by the ownership of intangible capital). In

16

both closures, we do not allow for mobility of labour across countries and real wage rates differ across the two countries.

We start by laying out our assumptions about technology, costs and prices.

Assumption 1. The technology of production in the North and South differ because they carry out different parts of the production process, i.e. the North produces the intermediate inputs and the South produces the final good. To characterize such a context, we assume that

(a) the real wage rate is higher in the North than in the South, i.e. $\omega_1 > \omega_2$;

(b) the input-intensity of production is higher in the north, i.e. $k_1 > k_2$;

(c) the organic composition of capital is higher in the north, i.e.

$$\frac{\omega_1 l_1}{k_1} < \frac{\omega_2 l_2}{k_2};$$

(d) the terms of trade, p, consistent with a zero profit rate in the South is higher than the terms of trade consistent with a zero profit rate in the North, i.e.

$$\frac{1 - \omega_2 l_2}{k_2} > \frac{\omega_1 l_1}{1 - k_1}.$$

The first assumption, that the wages in the North are higher than wages in the South, is natural. After all, the lead firm in the North deploys the GVC framework to outsource the production of the final good 2 to the South in order to take advantage of lower wage costs. Note that the

choice of technique problem pertains solely to the lead firm outsourcing part of the production process within GVC contractual arrangements which tie the supplier firms in the south into producing the final good using imported intermediates.

The second and third assumptions relate to the technology of production. Superior technology is used by the lead firm in the North, which translates into a higher input-intensity of production, i.e. $k_1 > k_2$. The use of superior technology also implies that the share of wage cost in total cost of production is lower in the North than in the South. This is because the superior technology, which is used in the North, is more capital-intensive. A lower share of wage cost in the North, than in the South, means that,

$$\frac{w_1 l_1}{w_1 l_1 + p_1 k_1} < \frac{w_2 l_2}{w_2 l_2 + p_1 k_2},$$

which then leads to the expression in Assumption 1 (c). Thus the pattern of specialization where the low-wage South produces the labor-intensive final good results in the unit wage cost to unit intermediate costs, or alternatively, the share of labor costs in unit costs in the South being higher relative to the North.

The final assumption relates to the terms of trade and we will explain this in section 4.3 and use it in the discussion in section 5.

4   Market Power of North

This closure reflects the control that the corporate headquarters in the North have in setting the terms within value chains. Hence, market power of Northern firms can set the terms of trade at a level of their choosing: $\bar{p}$. The production/ assembly of the final good can be moved to another location if the terms are not favorable in any given country, compelling the Southern firms to accept the terms of trade imposed by the Northern firm or be pushed out of the market. Note that the extreme competition between supplier firms is made possible by the existence of large reserves of surplus labour in Southern economies. Thus, for given level of wage rates, the rate of profit in the South will adjust to maintain the competitive price for good 2 and access the market in North through the value chain. We capture the market power of the Northern firm directly by its ability to set the terms of trade,

$$p = \bar{p}. \tag{12}$$

The model with the market power closure has four endogenous variables, p, r_1, r_2, x and four equations, (9), (10), (11), and (12). Using this model, we would like to investigate two sets of questions. First, since the terms of trade is set by Northern firms, we are left with three endogenous variables that change with parameters of the model, x, r_1 and r_2. We are interested in understanding how changes in the different parameters affect these endogenous variables. The second question we would like to investigate relates to the terms of trade fixed by Northern firms. Are there bounds within which

19

the terms of trade that will be chosen by Northern firms will lie? Is it in the interest of Northern firms to attain a value of the terms of trade that is neither too low nor too high?

4.1 Output Ratio

A little algebraic manipulation shows that the output ratio is given by

$$x = \frac{\omega_1 l_1 (\omega_2 l_2 + \bar{p} k_2)}{k_2 (\omega_1 l_1 + \bar{p} k_1)} = \frac{(\omega_2 l_2 / k_2) + \bar{p}}{1 + (\bar{p} k_1 / \omega_1 l_1)}$$

which shows that $\partial x / \partial \omega_i > 0$, $\partial x / \partial l_i > 0$, and $\partial x / \partial k_i < 0$.

An increase in wages, in both the North and the South, leads to an increase in the relative output (and hence employment) in the South. Rising wages increases the demand for the output of the South. However, given the fixed price $\bar{p}$, the increase in wages would squeeze the profits of the Southern capitalist. The output ratio x also increases with a rise in the labor input needed for one unit of output in either country. An increase in labor productivity, would therefore decrease output in the South relative to the North, reflecting a decline in labor employment and a corresponding decline in the demand for the consumption good.

Interestingly, the impact of the Northern firms' market power has an ambiguous effect on relative output:

$$\partial x / \partial \bar{p} \gtrless 0 \ \text{ if } \ (\omega_1 l_1 / k_1) \gtrless (\omega_2 l_2 / k_2)$$

This implies that the South will lose in terms of relative output from an

increase in $\bar{p}$ when $(\omega_1 l_1/k_1) < (\omega_2 l_2/k_2)$, i.e. when the ratio of spending on wages to that on the intermediate good is higher in the South than in the North. But the in Assumption 1 (c) ensures that this condition holds. Thus, the pattern of specialization that emerges within the GVC framework leads to a disadvantageous position for Southern firms in terms of volume of output. As the market power of Northern firms increase and they raise the terms of trade, Southern firms will lose because output will fall. The intuition for this result is straightforward. When the terms of trade rise, the wage good becomes less expensive in relative terms. Hence, trade can be balanced by a lower import by the North of the Southern output (final goods). This implies a lower level of the output ratio, x.

4.2 Profit Rates

From (9), we know that

$$r_2 = \frac{1}{\omega_2 l_2 + \bar{p} k_2} - 1.$$

Hence, $\partial r_2/\partial \omega_2 < 0$, $\partial r_2/\partial l_2 < 0$, $\partial r_2/\partial k_2 < 0$, and $\partial r_2/\partial \bar{p} < 0$. Note that the real wage rate, labour productivity and the intermediate input-coefficient in the North has no effect on the rate of profit in the South. The main channel through which trade impacts the rate of profit in the South is through the terms of trade. If Northern firms raise the terms of trade, $\bar{p}$, then the rate of profit in the South falls. If the southern producer responds to deteriorating terms of trade by squeezing wages, then relative output would be adversely affected.

Similarly, from (10), we know that

$$r_1 = \frac{\bar{p}}{\omega_1 l_1 + \bar{p} k_1} - 1.$$

Hence, $\partial r_1 / \partial \omega_1 < 0$, $\partial r_1 / \partial l_1 < 0$, $\partial r_1 / \partial k_1 < 0$, and $\partial r_1 / \partial \bar{p} > 0$.[2] Just as in the case of the South, the real wage rate, labour productivity and intermediate-input coefficient of the South has no effect on the rate of profit in the North. The terms of trade has the expected effect: If Northern firms raise the terms of trade, $\bar{p}$, then the rate of profit in the North rises.

4.3 Terms of Trade

Given that Northern firms have the market power to set the terms of trade, p, between the intermediate and final good, it is natural to ask whether there are bounds that Northern firms would want the terms of trade to lie within? In fact, there are two considerations that suggest that it is in the interest of Northern firms to neither choose a high nor a low terms of trade, but rather to ensure that it lies within a given interval. On the one hand, the terms of trade cannot be pushed up beyond a value that makes the rate of profit in the South zero. If the terms of trade is pushed higher than this level, then Southern firms will no longer participate in the GVC arrangement. This participation constraint gives us the upper bound for the terms of trade, p'. On the other hand, the terms of trade cannot be pushed down below the level that will make the rate of profit in the North lower than in the South. Being the dominant player in the GVC arrangement,

_____

[2]Note that $\partial r_1 / \partial \bar{p} > 0$ because $0 < k_1 < 1$.

Northern firms would never participate if their rate of profit fell below the profit rate of the junior partner, the Southern firm. This consideration provides the lower bound for the terms of trade, $\tilde{p}$.

Result 1. Let $\bar{p}$ be the terms of trade chosen by Northern firms. Given Assumption 1 (d), we will have $\tilde{p} \leq \bar{p} \leq p'$, where

$$p' = \frac{1 - \omega_2 l_2}{k_2}$$

and

$$\tilde{p} = \frac{k_1 - \omega_2 l_2}{2k_2} + \sqrt{\left(\frac{k_1 - \omega_2 l_2}{2k_2}\right)^2 + \frac{\omega_1 l_1}{k_2}}.$$

The proof of this result is given in the appendix. To understand the intuition behind the condition that ensures the inequality, note that $\tilde{p}$ corresponds to the positive terms of trade when $r_2 = r_1$ (for details, see the appendix). We can now make sense of, and understand the role of, Assumption 1 (d). From (9), we can see that $\frac{1 - \omega_2 l_2}{k_2}$ corresponds to the terms of trade when $r_2 = 0$. From (10), we can see that $\frac{\omega_1 l_1}{1 - k_1}$ corresponds to the terms of trade when $r_1 = 0$. Assumption 1 (d) states that the former is higher than the latter, i.e. the terms of trade corresponding to a zero profit rate in the South is higher than the terms of trade associated with a zero profit rate in the North. This assumption makes sense because the rate of profit in the North should be an increasing function of the terms of trade, which is just another way of saying that it is in the interest of Northern firms to have a relatively higher terms of trade, $p = p_1/p_2$, because Northern firms sell good 1. Hence, the magnitude of the terms of trade which would force Northern firms to quit the GVC arrangement - when $r_1 = 0$ -

would be lower than the magnitude of the terms of trade that would allow them to participate, while at the same time forcing Southern firms to quit - when $r_2 = 0$.

Result 1 shows that $\tilde{p} < p'$, and that Northern firms will choose to set the terms of trade, $\bar{p}$, at a magnitude that lies in the closed interval $[\tilde{p}, p']$. If they push the terms of trade higher than p', then firms from the South will no longer participate in the GVC arrangement (because their rate of profit would become negative). On the other hand, firms in the North would not allow the terms of trade to fall below $\tilde{p}$ because that would make their rate of profit lower than what prevails in the South. The exact magnitude of the terms of trade will be determined, within this interval, by the relative bargaining power of the two regions and more specifically by the market power exercised by the North, but there are clear bounds to the movement of terms of trade.

5 Monopoly Power from Intangible Capital Ownership

Production organized through GVCs by lead firms give rise to a specific international division of labour. Lead firms in the North specialize in high-skilled and capital-intensive parts of the production process and firms in the South are forced to specialize in low-skill intensive parts of the production. Part of the high-skilled and capital-intensive production process is geared towards the production of intangible capital, like brands, designs (which

can then be patented), and marketing networks. Since intangible capital involve large fixed costs, they give rise to monopoly market structures. The ownership and control of intangible capital therefore entails extraction of rent - which we capture in a second closure of the basic model. In this second closure of our model, the North does not exercise direct control over the price of the final good exported from the South, as we had posited in the first closure. Rather, the North exercises power through its dominant position in the value chain by capturing additional revenues/rents from the South, so that the returns earned by Northern firms (which includes profit and rent) is always higher than the returns earned by firms in the South.

The Southern countries depend on the North for access to this intangible capital. This access does not by itself expand productive capacity but it allows the South to use the brands, designs and marketing capacity of the North to initiate production of final goods through contractual relations with the Northern firms. These contractual relations allow the South to sell the final good assembled and produced by it (using the intangible capital and intermediate inputs from the North) in both the global (North) and domestic (South) market. In effect, therefore, the GVC has forged a global division of labor where the production of final goods for the global market has been relocated to the South, but is dependent on key intermediate inputs and access to intangible capital owned and controlled by the North.

We incorporate this revenue extraction, by postulating that the North is able to extract returns above the rate of profit earned by the Southern firm, or the general rate of profit. This positive premium is represented by α, a parameter that represents a form of monopoly rent extracted from

the South by North. Thus the price charged for the intermediate input produced by the North is given by

$$p_1 = (w_1 l_1 + p_1 k_1) + r(w_1 l_1 + p_1 k_1) + \alpha(w_1 l_1 + p_1 k_1),$$

where the first component is the recovery of cost, the second is the profit earned, and the third is a quasi-rent earned because of ownership of intangible capital. Final goods produced in the South are exported to the North and directly sold in the South, and the price of the final good is determined as before,

$$p_2 = (w_2 l_2 + p_1 k_2) + r(w_2 l_2 + p_1 k_2),$$

where the first term is the recovery of cost and the second term is the profit income. It is important to note that the rate of return of firms in the South is r and the rate of return of the lead firm in the North is $r + \alpha$. Hence, as long as $\alpha > 0$, the lead firm is able to earn a higher rate of return than the junior partner in the GVC arrangement.

5.1 Case 1: Rent is Not Invested

The first case we analayze is one where rents accruing to the North are not reinvested but instead used for unproductive expenditure (say non-tradable services). In this case the trade balance condition given in (7) would remain unchanged. So in this case, we have three endogenous variables, r, p, x, and

the following three equations to capture the model:

$$1 = (1 + r)(\omega_2 l_2 + pk_2), \tag{13}$$

$$p = (1 + r + \alpha)(\omega_1 l_1 + pk_1), \tag{14}$$

$$x = \frac{\omega_1 l_1}{pk_2}. \tag{15}$$

Result 2. If $0 < \alpha < 1/k_1$, the solution of the above system for positive terms of trade, p, is given by,

$$p = \frac{(k_1 + \alpha\omega_1 l_1 k_2) - \omega_2 l_2(1 - \alpha k_1)}{2k_2 (1 - \alpha k_1)}$$

$$+ \sqrt{\left\{\frac{(k_1 + \alpha\omega_1 l_1 k_2) - \omega_2 l_2(1 - \alpha k_1)}{2k_2 (1 - \alpha k_1)}\right\}^2 + \frac{(1 + \alpha\omega_2 l_2)\omega_1 l_1}{k_2(1 - \alpha k_1)}}.$$

The proof follows easily by using the two price equations, (13) and (14), to eliminate the rate of profit, r, convert then into a quadratic equation in p, and then solving for the positive real root of the quadratic. It is important to note that this solution is valid only under the assumption on α, i.e. the monopoly power (arising out of ownership of intangible capital) must be bounded above by $1/k_1$ for a meaningful solution to the terms of trade to be ensured. Too much monopoly power will mean there is no GVC trade.

Thus, $\partial p/\partial \alpha > 0$.[3] Along expected lines, an increase in the ability of the North to extract quasi-rents exerts an upward pressure on the terms of trade, p. Further $\partial p/\partial \omega_1 > 0$, $\partial p/\partial l_1 > 0$ and $\partial p/\partial k_1 > 0$. Thus, an increase in the real wage rate, a fall in labour productivity and an increase

---

[3]To see this easily note that in the expression for p, α occurs on the numerator with positive and in the denominator with negative signs.

in the intermediate input coefficient in the North all put an upward pressure on the terms of trade. Interestingly, the analogous changes in the South have ambiguous effects on the terms of trade, i.e. we cannot ascertain the signs of $\partial p/\partial \omega_2$, $\partial p/\partial l_2$ and $\partial p/\partial k_2 < 0$ without further assumptions.

The extraction of monopoly quasi-rents by Northern firms creates a distinct output disadvantage for the firms in the South. To see this, note that $\partial p/\partial \alpha > 0$ and under the assumption that rents are not reinvested, the trade balance condition is $x = \omega_1 l_1/pk_2$. Hence, an increase in α will reduce the relative output of the South, i.e.

$$\partial x/\partial \alpha < 0. \tag{16}$$

This means that an increase in the ability to extract monopoly quasi-rents by firms in the North decreases the output of the South relative to the North. Rents divert demand away from the consumption good produced by the South so that trade balance is re-established where the relative output of the South is lower than before the increase in monopoly rents by the lead firm in the North.

5.2   Case 2: Rent is Invested

Now let us consider the case where the entire rents are reinvested. When the rents are also invested, then the price equations, (13) and (14), remain unchanged. The trade balance condition changes due to the addition of the rent. This can be rearranged to give us the following expression for relative output,

$$x = \frac{(1 + r + \alpha)\omega_1 l_1}{(1 + r)pk_2} = \frac{(\omega_2 l_2 + pk_2)\omega_1 l_1}{(\omega_1 l_1 + pk_1)k_2},$$

so that

$$\partial x / \partial \alpha = \frac{\omega_1 l_1}{k_2} \left[\frac{(\omega_1 l_1 + pk_1)k_2 \partial p / \partial \alpha - (\omega_2 l_2 + pk_2)k1 \partial p / \partial / \alpha}{(\omega_1 l_1 + pk_1)^2} \right].$$

In this case

$$\partial x / \partial \alpha \gtreqless 0 \ \text{ if } \ \frac{\omega_1 l_1}{k_1} \gtreqless \frac{\omega_2 l_2}{k_2}$$

An increase in α would lower relative output of the South if the ratio of the wage cost to the requirement of the intermediate input per unit of output in South is higher than in the North, i.e. if the organic composition of capital is higher in the North than in the South. This is precisely the condition underlying the pattern of specialization within the GVC framework as captured by Assumption 1 (c). Note that, in the first closure of our model, this pattern of specialization also has the effect of squeezing relative output in the South when the terms of trade increases.

The rate of profit, r, and α, the parameter capturing monopoly quasi-rents, are negatively related to each other. Since

$$1 + r = \frac{1}{\omega_2 l_2 + pk_2}$$

and $\partial p / \partial \alpha > 0$, we see that $\partial r / \partial \alpha < 0$. To see this more explicitly, note that $1 + r$ can be derived from the two price equations as:

29

$$1 + r = -\frac{\alpha}{2} - \frac{\omega_2 l_2 + k_1}{2(k_2 \omega_1 l_1 - \omega_2 l_2 k_1)}$$

$$+ \sqrt{\left\{\frac{-\alpha}{2} - \frac{\omega_2 l_2 + k_1}{2(k_2 \omega_1 l_1 - \omega_2 l_2 k_1)}\right\}^2 + \frac{1 - \alpha k_1}{(k_2 \omega_1 l_1 - \omega_2 l_2 k_1)}}.$$

Thus, $\partial r / \partial \alpha < 0$ [4] Hence, when Northern firms increase the extraction of monopoly quasi-rents, by increasing α, the general rate of profit falls. While they gain in terms of rent extraction, they lose in terms of profits earned. However, the lower general rate of profit also implies a redistribution from capitalists in the South to capitalists in the North through rent extraction. Hence, an increase in α unambiguously hurts the material interests of Southern firms participation in GVC arrangements.

There is however, an upper bound to α set by the condition that $r = 0$. Denoting this value of α as α', we have,

$$\frac{1 - \omega_2}{k_2} = \frac{(1 + \alpha')\omega_1 l_1}{1 - (1 + \alpha')k_1},$$

which shows that

$$\alpha' = \frac{(1 - k_1)(1 - \omega_2 l_2)}{\omega_1 l_1 k_2 + k_1 (1 - \omega_2 l_2)}. \tag{17}$$

If α is raised beyond this level, the rate of profit earned by firms in the South will become negative. Southern firms will not participate in GVC arrangements in such a situation. Hence, the monopoly parameter α cannot be raised above this maximum level, α'.

---

[4]This can be easily inferred from the negative sign associated with each α in the expression for $1 + r$.

It is easy to check that $\alpha' < 1/k_1$, the condition that underlies the derivation of the positive terms of trade in the closure with monopoly power deriving from intangibles (see Result 2). To see this, note that because the wage share has to be less than unity, we have $\omega_2 l_2 < 1$.[5] Since $k_1 > 0$, we have,

$$k_1 (1 + \alpha') = \frac{k_1 (1 - \omega_2 l_2)}{\omega_1 l_1 k_2 + k_1 (1 - \omega_2 l_2)} = 1 - \frac{\omega_1 l_1 k_2}{\omega_1 l_1 k_2 + k_1 (1 - \omega_2 l_2)} < 1 + k_1.$$

so that

$$1 + \alpha' < 1 + \frac{1}{k_1}.$$

It is also interesting to note that

$$\alpha' > 0 \ \text{ if and only if } \ \frac{1 - \omega_2 l_2}{k_2} > \frac{\omega_1 l_1}{1 - k_1},$$

which is the assumption about terms of trade captured in Assumption 1 (d) and underlies Result 1 on the bounds of terms of trade in the case of the exercise of market power. Thus, as long as Assumption 1 (d) holds and the monopoly power derived from the ownership of intangible capital is bounded above (by $1/k_1$), Northern firms will exercise that monopoly power to ensure $0 < \alpha < \alpha' < 1/k_1$. This will provide incentives for Southern firms to participate in the GVC arrangement (because r, the rate of profit they earn, will be positive) and also maintain a higher rate of profit for the lead firm in the North (because $\alpha > 0$).

---

[5]Note that ω_2 is the real wage rate, and $1/l_2$ is the labour productivity. Hence, $\omega_2 l_2$ is the wage share.

6 Conclusion

A stylized model of unequal exchange within the GVC framework has been presented in this paper to clarify certain features of dependency that are embedded in the structure of GVC trade. Lead firms in the North initiate GVC production by shifting low-skilled, low-productivity parts of the production process to low-wage economies in the global South. In our model, we capture this by positing a pattern of specialization where the South produces final goods consumed by workers in the North and the South, using intermediate goods imported from the North. Under certain plausible conditions, this pattern of specialization results in a structure where increasing labor productivity in both the North and the South could depresses relative output and employment in the South. This suggests that workers in the South may not benefit from increasing labor productivity and technological upgradation.

The asymmetric power structure of the GVC further erodes the scope for expansion of relative output in the South. Since high capital-intensive and high skill-intensive parts of the production process are specialized by lead firms in the North, while low capital-intensive and low skill-intensive parts are outsourced to the firms in the South, the ratio of wage costs to the cost of intermediate goods (or the labor intensity of production) in the North is lower than that in the South. Under this condition both the exercise of market power by capitalist firms in the North to squeeze the terms of trade faced by capitalist firms in the South; and the exercise of monopoly power through its control of intangible assets to extract rents would result in a squeeze of the output of the South relative to that in the North. Hence,

it seems that both capitalist firms and workers in Southern countries face inherent disadvantages when the latter participates in GVCs.

Further, while the model of unequal exchange is meant to focus on North-South asymmetry within the GVC framework, it also highlights the contradiction between capitalists and workers as a whole. On the one hand, in order to preserve or increase profits in the face of a squeeze of the terms of trade, capitalists in the South would attempt to cut unit wage costs - and thereby adversely affect workers in the South. On the other hand, if a change in the balance of bargaining power enables the South to push back against the deteriorating terms of trade, then firms in the North would respond by cutting wage costs - thereby harming the interests of workers in the North. Thus, the exercise of market power by the lead firm in the North does not negate the distributional conflict between capital and labour over wage and profit shares. Even in the case of the deployment of monopoly power by the North (arising from ownership of intangible capital), the trade-off between the rate of profit and rents suggests that the distributional conflict would continue to play a role in both the North and the South.

The lead firms in the North promote GVCs as a way of reducing costs by re-locating production to lower wage regions. The premise of GVC integration for the South is access to wider global markets. Export promotion enables the producers in the South to escape the limits of domestic market and constraints of low domestic wages and employment. Thus, conventional policy implications of GVC promotion generally focus on moving up the value added ladder and to developing supply linkages domestically (i.e.

reducing the import content of production).

However, the structure of GVC's tends to push producers in the South to lower value-added segments of the GVC. The model in this paper highlights the role of power asymmetries in this process. This includes market power arising from the capacity of lead firms to force suppliers in the South to compete among themselves by cutting unit wage costs, and monopoly power based on the ownership and control of critical intangible assets. These power asymmetries, which are pervasive in the contemporary global economy, suggest a cautious approach for countries in the South while deciding to jump on the GVC bandwagon.

A final point can be made to signal a fruitful direction for future research. In this paper, we have assumed that the good produced by the South is a final good, which is consumed by workers in both the North and the South. This assumption tethers the expansion of output in the South to its domestic market and to domestic employment. If in contrast, the product of the South was solely targeted at the market in the North, so that the South's output is not consumed domestically, production in the South would get delinked from its home market and depend on the growth of output and employment in the North as underscored by [Heintz (2006)]. The present model has also not taken into account capitalist spending on the consumer good produced in the South. Incorporating capitalist consumption in a situation where the South specializes in exporting a luxury good that targets the affluent capitalists of the North, would attenuate the structural dependence of relative output in the South on domestic employment, since it would no longer be consumed by domestic workers. To the

extent that the market for the South's output is oriented disproportionately to exports, and to capitalist consumption in the north, relative output in the South would also be disassociated from the domestic market for mass consumer goods and therefore employment in the South.

This suggests that in order to harness integration within GVCs towards increasing output and employment in the South, the focus, paradoxically, has to turn towards developing the domestic market, through wage employment, rather than narrowly pursuing the export market in the North. The spillovers associated from GVCs would depend on the extent to which it is integrated with the domestic market and not just domestic suppliers. This might seem counter-intuitive, since GVCs have become pervasive as a vehicle for export-oriented production. If instead they served as means of coordination of production across borders - not solely to service markets in the North but more broadly in both the North and the South - they would offer more scope for the growth of relative output and employment in South. This however, means turning the premise of GVC integration and export-oriented production on its head. These implications are worth exploring in future research that incorporates inter-sectoral linkages within the North and the South (including with non-tradable sectors), and further specifies capitalist consumption and investment demand to address the demand side more explicitly.

References

[Bacha (1978)] Bacha, E. (1978) An interpretation of unequal exchange from Prebisch-Singer to Emmanuel. Journal of Development Economics. 1978 5(4):319-330)

[Baldone et al (2007)] Baldone, s., Sdogati, F. and Tajoli, L. (2007), On Some Effects of International Fragmentation of Production on Comparative Advantages, Trade Flows and the Income of Countries, The World Economy, 30 (11): 1726-1769

[Baldwin (2016)] Baldwin, R., (2016) The Great Convergence: Information Technology and the new globalization Cambridge, MA: Harvard University Press.

[Caraballo and Jiang (2016)] Caraballo J.G & X. J iang (2016) Value-Added Erosion in Global Value Chains: An Empirical Assessment, Journal of Economic Issues, 50(1): 288-296

[Chakraborty (2012)] Chakraborty S. (2012) Is Export Expansion of Manufactured Goods an Escape Route from Terms of Trade Deterioration of Developing Countries? Journal of South Asian Development. 7(2):81-108

[Chen et al (2018)] Chen, W., Los, B., & Timmer, M. P. (2018). Factor incomes in global value chains: The role of intangibles (Working Paper No. w25242). National Bureau of Economic Research.

[Darity and Davis (2005)] Darity, W. and Davis, L.S. (2005). Growth, Trade and Uneven Development., Cambridge Journal of Economics 2(1): 141-170.

[Dicken (2011)] Dicken, P. (2011) Global Shift: Mapping the Changing Contours of the World Economy, 6th edn, New York: Guilford.

[Durand and Milberg (2020)] Durand, C. and Milberg W. (2020) Intellectual monopoly in global value chains, Review of International Political Economy, 27:2, 404-429.

[Dutt] Dutt, A.K. (1989)Uneven development in alternative models of North-South trade. Eastern Economic Journal 15(2) 91-10.

[Emmanuel (1972)] Emmanuel, A., (1972), Unequal Exchange: a study of the imperialism of trade, New York and London: Monthly Review Press.

[Gereffi (2014)] Gereffi, G. (2014) Global value chains in a post-Washington Consensus world." Review of International Political Economy 21(1): 9-37.

[Gereffi et al (2001)] Gereffi, G., Humphrey, J., Kaplinsky, R. and Sturgeon, T.J. (2001) Introduction: Globalisation, Value Chains and Development, IDS Bulletin 32,3.

[Gereffi and Korzeniewicz (1994)] Gereffi, G. and Korzeniewicz, M. (eds) (1994) Commodity Chains and Global Capital- ism, Westport, CT: Praeger.

[Heintz (2006)] Heintz, J. 2006. Low-wage manufacturing and global commodity chains: a model in the unequal exchange tradition. Cambridge Journal of Economics 30(4): 507-520.

[Henderson et al, (2002)] Henderson, J., Dicken, P., Hess, M., Coe, N. and Yeung, H. (2002) Global Production Networks and the Analysis of Economic Development, Review of International Political Economy, 9(3): 426-64.

[Meng et al, (2020)] Meng, B., Ye, M., and Wei, S-J. (2020). Measuring Smile Curves in Global Value Chains, Oxford Bulletin of Economics and Statistics, 82(5): 988-1016.

[Milberg and Winkler (2013)] Milberg, W. and Winkler D., (2013) Outsourcing Economics: Global Value Chains in Capitalist Development. Cambridge, UK : Cambridge University Press.

[OECD (2020)] OECD (2020) Trade Policy Implications of Global Value Chains.

[Prebisch (1950)] Prebisch, R. (1950) The economic development of Latin America and its principal problems, United Nations Economic Commission for Latin America, 7(1)

[Singer (1950)] Singer, H.W. (1950), The distribution of gains between investing and borrowing countries, American Economic Review, 40(2): 473-85.

[Singer (1975)] Singer. H.W., (1975) The distribution of gains revisited, in: H. Singer, The Strategy of lnternational development: Essays in the

economics of backwardness White Plains, NY: International Arts and Sciences Press.

[Sarkar and Singer (1993)] Sarkar, P. and H.W. Singer (1993) Manufactured Exports of Developing Countries and their Terms of Trade since 1965, World Development, 19 (4): 333-40.

[Selwyn and Leyden (2021)] Selwyn B, Leyden D. (2021) Oligopoly-driven development: The Word Bank's Trading for Development in the Age of Global Value Chains in perspective. Competition and Change. doi:10.1177/1024529421995351.

[Smichowski et al (2021)] Smichowski, B.C., Durand, C. and S. Knauss (2021) Participation in global value chains and varieties of development patterns, Cambridge Journal of Economics, 45 (2); 271–294.

[Timmer et al (2014)] Timmer, M. P., A. A. Erumban, B. L., R. Stehrer, and Gaaitzen J. de Vries. 2014. "Slicing Up Global Value Chains." Journal of Economic Perspectives, 28 (2): 99-118.

A   Proof of Result 1

Proof. The upper bound for the terms of trade chosen by Northern firms, $\bar{p}$, comes from the necessity to make sure that the rate of profit in the South is positive - otherwise Southern firms will not participate in the GVC. Using (9), we see that $r_2 = 0$ if and only if $p = (1 - \omega_2 l_2)/k_2$. Since $\partial r_2/\partial \bar{p} < 0$, this gives us the upper bound, $p' = (1 - \omega_2 l_2)/k_2$. The terms of trade will always be lower than this magnitude, i.e. $\bar{p} \leq p'$.

The lower bound for $\bar{p}$ arises from the need to ensure that $r_1 > r_2$ - otherwise the dominant position of Northern firms in the GVC arrangement will be in jeopardy. Using (9) and (10), we see that the sufficient condition for $r_1 > r_2$ is given by

$$k_2 p^2 + (\omega_2 l_2 - k_1)p - \omega_1 l_1 > 0.$$

Now, consider the quadratic equation in p given by $k_2 p^2 + (\omega_2 l_2 - k_1)p - \omega_1 l_1 = 0$. Since the discriminant of this quadratic equation is positive, the equation has two real roots. It is also easy to see that one root is positive and the other negative. Since the terms of trade cannot be negative, the positive root is the only meaningful one and is given by

$$p = \frac{k_1 - \omega_2 l_2}{2k_2} + \sqrt{\left(\frac{k_1 - \omega_2 l_2}{2k_2}\right)^2 + \frac{\omega_1 l_1}{k_2}}.$$

For values of p larger than this root, the quadratic function will be positive (because the coefficient of p^2 is positive, i.e. $k_2 > 0$). Hence, we get the lower bound as

$$\tilde{p} = \frac{k_1 - \omega_2 l_2}{2k_2} + \sqrt{\left(\frac{k_1 - \omega_2 l_2}{2k_2}\right)^2 + \frac{\omega_1 l_1}{k_2}}.$$

The terms of trade chosen by Northern firms will always be larger than this magnitude, i.e. $\tilde{p} \leq \bar{p}$.

The final step of the proof comes from showing that $\tilde{p} < p'$, and this strict inequality is ensured by Assumption 1 (d): $(1 - \omega_2 l_2)/k_2 > \omega_1 l_1/(1 - k_1)$.

To see this, note that if

$$\frac{1 - \omega_2 l_2}{k_2} > \frac{\omega_1 l_1}{1 - k_1}$$

then, assuming $0 < k_1 < 1$ and $0 < k_2$, we have,

$$\left(\frac{1 - \omega_2 l_2}{k_2}\right)\left(\frac{1 - k_1}{k_2}\right) > \left(\frac{\omega_1 l_1}{k_2}\right)$$

so that

$$\left(\frac{1 - \omega_2 l_2}{k_2}\right)\left[\frac{1 - \omega_2 l_2}{k_2} - \frac{k_1 - \omega_2 l_2}{k_2}\right] > \left(\frac{\omega_1 l_1}{k_2}\right).$$

Hence

$$\left(\frac{1 - \omega_2 l_2}{k_2}\right)^2 + \left(\frac{k_1 - \omega_2 l_2}{2k_2}\right)^2$$
$$-2\left(\frac{1 - \omega_2 l_2}{k_2}\right)\left(\frac{k_1 - \omega_2 l_2}{2k_2}\right) > \left(\frac{k_1 - \omega_2 l_2}{2k_2}\right)^2 + \left(\frac{\omega_1 l_1}{2k_2}\right).$$

Hence,

$$\left(\frac{1 - \omega_2 l_2}{k_2}\right) - \left(\frac{k_1 - \omega_2 l_2}{2k_2}\right) > \sqrt{\left(\frac{k_1 - \omega_2 l_2}{2k_2}\right)^2 + \frac{\omega_1 l_1}{k_2}},$$

so that

$$p' = \left(\frac{1 - \omega_2 l_2}{k_2}\right) > \left(\frac{k_1 - \omega_2 l_2}{2k_2}\right) + \sqrt{\left(\frac{k_1 - \omega_2 l_2}{2k_2}\right)^2 + \frac{\omega_1 l_1}{k_2}} = \tilde{p}.$$

$\square$