Stolper-Samuelson After Kalecki: 
International Trade and Income Distribution 
with Oligopolistic Mark-Ups and Partial Pass-Through

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Abstract

The central innovation in this paper is to construct a model of international trade in which firms are oligopolistic producers of nationally differentiated goods, and therefore engage in partial pass-through behavior (and adjust their mark-ups) in response to changes in tariffs or foreign prices, in a model that otherwise resembles a standard Heckscher-Ohlin model (except for its treatment of capital and profits). The model constructed here allows for international differences in technology à la Ricardo, but follows Heckscher and Ohlin in emphasizing differences in factor proportions in analyzing the distributional impact of trade on non-produced primary inputs (e.g., land and labor, or more- and less-skilled labor). Following Kalecki, profits are modeled as oligopolistic rents determined by mark-ups on unit factor costs for the primary inputs. Drawing upon the extensive literature on “partial pass-through” of changes in exchange rates and tariffs, mark-ups are modeled as flexible in response to changes in home country unit factor costs relative to tariff-adjusted prices of foreign varieties. Specifically, trade liberalization raises mark-ups in the export industry and lowers them in the import-competing industry.

As a result of such adjustments in mark-ups, trade liberalization benefits firms (increases profits) in export industries and hurts firms (reduces profits) in import-competing industries. Although factor price equalization does not hold in this model, a variant of the Stolper-Samuelson theorem holds for the non-produced inputs. Trade liberalization benefits the primary (non-capital) factor used intensively in the export industry relative to the primary factor used intensively in the import-competing industry, but these Stolper-Samuelson effects are attenuated by the adjustments of mark-ups that occur in the presence of partial pass-through of tariff reductions. If the pass-through of the tariff reductions is very partial, and if the goods differ widely in their primary factory intensities, then it is possible that the Stolper-Samuelson “magnification effect” may not hold (i.e., the gains or losses to a factor may depend on the factor owners’ consumption of the two goods).

The paper also presents a simple model of vertical trade in intermediate goods. This model shows that a fall in the world price of (less-skilled) labor-intensive intermediate goods redistributes income against (less-skilled) labor and in favor of the other factor (either more-skilled labor or natural resources), and—provided that the price of foreign-produced final goods does not fall enough to compensate—increases mark-ups (and the profit share) for producers of final goods. These results hold in a small open economy, regardless of whether the country is a net exporter or importer of either intermediate or final goods. This analysis sheds light on why (contrary to standard Stolper-Samuelson reasoning) the same social interests appear to be gaining and losing (i.e., skilled labor, natural resources, and capital are gaining while less-skilled labor is losing) from “globalization” in most countries today, regardless of the countries’ factor abundance or the factor composition of their trade.

**JEL Classifications:** F10, B50, D33
1. Introduction

Almost since its inception, the neoclassical trade model of Heckscher (1919) and Ohlin (1933) has been subject to sharp criticisms from various perspectives. Long ago, Williams (1929) denounced the static nature of neoclassical models of comparative advantage, arguing that they place too much emphasis on efficiency gains in the use of existing resources, while ignoring the much greater impact of trade in transforming a country’s productive capacities.1 Numerous critics have questioned the strong assumptions—such as constant returns to scale, identical technology, identical homothetic preferences, and perfect competition—that are necessary to prove most Heckscher-Ohlin (H-O) theorems. The so-called “new trade theory” was based on a desire to introduce increasing returns to scale cum imperfect competition into international economics (e.g.,), as well as to add the dynamic elements that H-O had ignored.2 Post-Keynesians have criticized all barter models of trade for ignoring the interactions between trade and finance and because they do not allow for unemployment or trade imbalances.3

In spite of these and other criticisms, nothing has yet replaced one key component of the H-O approach—the theorem of Stolper and Samuelson (1941)—as the core analytical framework of international economists for modeling the distributional effects of trade. The general version of the Stolper-Samuelson (S-S) theorem states that free trade benefits the factor used relatively intensively in export production and harms the factor used relatively intensively in import-competing production, while protectionism has the opposite effects. The recognition that free

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1 More recently, this line of criticism has been bolstered by the “neo-Schumpeterian” perspective, which argues that technological innovation, rather than factor proportions, explains most of the industrialized countries’ trade in manufactures. See, e.g., Dosi et al. (1990) and Milberg (1991). Similar criticisms were made by Robinson (1979), Kaldor (1985), and Pasinetti (1981).

2 See, for example, Krugman (1990), Grossman and Helpman (1991), and Grossman (1992).

3 See, for example, Milberg (1994), Blecker (2003, 2005), and Davidson (2007).
trade produces losers as well as winners has emerged as an important qualification to the
traditional case for trade liberalization policies, and has had a profound impact on our
understanding of the political economy of trade policy. Yet, the many intellectual challenges to
the H-O approach raise an obvious question: to what extent does the S-S theorem remain valid,
even if other parts of the H-O model are rejected?

In the first place, it is important to note that the “weak” or “general” version of S-S stated
above does not require several of the standard H-O assumptions. For example, the weak S-S
theorem does not require identical technology, identical homothetic preferences, or the absence
of factor-intensity reversals. Without these assumptions, H-O may not give correct predictions
about the direction of trade, but we can still identify the winners and losers from trade according
to which factors are used intensively in export versus import-competing industries—regardless
of whether those factors are the abundant and scarce factors, respectively, or not. Similarly, the
existence of dynamic effects of trade does preclude a S-S type of analysis of how a given pattern
of trade at a given point in time affects the distribution of income in that situation. Furthermore,
S-S does not require neoclassical factor substitution; the theorem also holds with fixed
coefficients (although it does require constant returns to scale, competitive factor markets, and
free mobility of factors between industries).

What is perhaps most problematic, however, is that S-S cannot and should not be applied
to the returns to capital, when capital is measured as the value of aggregated stocks of hetero-
geneous, produced capital goods. Inspired by Sraffa (1960) and other neo-Ricardian critics of
neoclassical capital theory, several economists in the 1970s showed that the conventional
treatment of capital and profits in the Heckscher-Ohlin-Samuelson (HOS) model was

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4 In contrast, the “strong” version of S-S, which makes the following assumptions, predicts specifically that owners
of the abundant factor gain from free trade while owners of the scarce factor lose. See Chacholiades (1978) for a
thorough exposition of the different versions of S-S.
fundamentally flawed. With regard to S-S, since the rate of return to capital is not a monotonic inverse function of the aggregate value of stocks of heterogeneous capital goods, it is impossible to make any general prediction about the effect on profits of an increase in the relative price of “capital-intensive” goods (defined as goods with a high value of capital per worker). Hence, it does not make sense theoretically to treat capital as a primary factor of production, analogous to land or labor, in applying the S-S theorem. Nevertheless, no one has ever invalidated the applicability of S-S to primary or non-produced factor inputs, such as labor and natural resources, and Steedman and Metcalf (1977) and Steedman (2005) specifically proved the applicability of S-S to such factors regardless of the presence of produced intermediate goods.

This paper is based on the belief that it is important not to “throw out the [S-S] baby with the [H-O] bathwater.” The S-S insight that changes in a country’s relative prices due to trade affect the distribution of income between the owners of factors of production that are utilized with different intensities in different industries remains a powerful insight, but only if it is confined to the primary (non-produced) factor inputs (i.e., labor and natural resources), not capital. In this paper, capital will be treated as owned by firms that receive economic profits or “oligopolistic rents,” in contrast with the traditional approach in which the returns to capital are conceived as rental prices for “endowments” of scarce capital equipment paid by perfectly competitive firms earning zero economic profits. Following Kalecki (1954), we shall assume that profits are determined by the mark-ups of oligopolistic firms; in the present context, mark-ups will be modeled as charged on the unit costs of all primary (non-produced) factors of production.

Then, we draw upon the new theories of trade with oligopoly to model how profit mark-ups adjust in response to changes in tariff rates or foreign prices, while continuing to treat the

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5 Many of the key papers from this literature as applied to trade theory are collected in Steedman (1979a). More detailed references including some neoclassical responses are discussed in section 2, below.
wages or rents of the other (primary) factors of production (labor and natural resources) in a traditional S-S fashion. This literature has shown that oligopolistic firms may only partially “pass-through” changes in tariffs or exchange rates into prices of domestic (or exported) products; when this occurs, firms also adjust their profit mark-ups as part of a “pricing to market” strategy. Although this implication has received much support in a large empirical literature, there have been remarkably few efforts to re-integrate the lessons from the literature on partial pass-through and flexible mark-ups with the core models of international trade. Although most studies have focused on the partial pass-through of exchange rate changes, Feenstra (1989) showed that, under common and plausible assumptions, oligopolistic firms should adjust their prices (and mark-up rates) symmetrically in response to changes in either exchange rates or tariffs—and found empirical evidence in support of this equivalency.

As will be demonstrated below, the S-S theorem has to be modified when the assumption of perfect competition in product markets is replaced by oligopolistic competition with partial pass-through of tariff changes. We will show that S-S “magnification effects” on factor prices are attenuated or weakened by the adjustments of profit mark-ups in industries with partial pass-through of tariff changes, and therefore some of the standard predictions about which factors experience absolute gains or losses need to be modified. We also obtain new results for the effects of trade on the profits of firms, which more resemble the predictions of the specific

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6 Helpman and Krugman (1985) are a partial exception, but they did not focus on the case of oligopoly with partial pass-through and continued to treat capital as a scarce factor receiving rental payments.

7 I am indebted to Bob Feinberg for this reference.

8 This result was anticipated by Melvin and Warne (1973), who showed that S-S does not hold in the case of pure monopoly. However, their brief discussion of S-S is limited to noting that it cannot be proved in the presence of monopoly. They did not analyze the implications of partial pass-through behavior in oligopolistic industries, and they did not consider treating the returns to capital as consisting in the profits of oligopolistic firms rather than the rental price of capital. I am indebted to Bruce Elmslie for this reference.
factors model rather than an H-O model with mobile factors. Finally, we also suggest an extension of the modeling framework developed here to address the distributional impact of the outsourcing of intermediate inputs.

Before proceeding further, a few caveats are in order. The focus here is entirely on the distributional effects of trade; the quantity side of the implicit trade model is not developed here. This paper does not attempt to construct a complete “heterodox” model of international trade. Many elements that would be important in such an effort are not considered here, such as interactions between trade and finance, endogenous variations in employment, and a bargaining approach to wage determination. In spite of its limited objectives, this paper is written in the belief that the combination of Kaleckian mark-up pricing for determining profits and a S-S approach for determining prices of primary factors of production is a fruitful beginning for an effort to develop such a more comprehensive model.

The rest of this paper is organized as follows. Section 2 reviews the trade theories, empirical tests, and oligopoly models that motivate this paper. Section 3 presents the core Ricardo-Heckscher-Kalecki model of trade with two primary factor inputs and oligopolistic profits determined by mark-up pricing. Section 4 discusses the implications for how changes in foreign prices and tariff rates affect both firms’ profits and the prices of the primary factors of production. Section 5 then briefly extends the model to consider outsourcing of intermediate goods and the implications of “globalization” of production. Section 6 concludes by discussing the implications for the political economy of trade policy and globalization, as well as the limitations of the present analysis and directions for future research.

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9 The specific factors model is attributed to Haberler (1933) and Viner (1937); for modern expositions, see Jones (1971) and Neary (1978).
2. Literature Survey

In this section we survey three literatures that support the approach taken in this paper: critiques of the standard treatment of capital and profits in H-O trade models, empirical tests of H-O and S-S that emphasize non-capital inputs, and studies of oligopolistic mark-up pricing in open economies.

2.1 Capital and Profits in Trade Theory

The traditional approach of treating capital as a primary factor of production in H-O trade models came under attack from economists in the Cambridge (UK) school of capital theory in the 1970s. As proved by various scholars from the British Cambridge (and later acknowledged by the leading lights of the American Cambridge), the presumption of a monotonic inverse relationship between the quantity of capital and its rate of return is not generally valid when the quantity of capital is measured by the value of an aggregated stock of heterogeneous, produced capital goods (the prices of which incorporate profits at an equalized rate). Applying this critique to trade theory, Metcalfe and Steedman (1973) and Mainwaring (1976) demonstrated that key components of the H-O model (including both the price and quantity versions of the H-O theorem and factor-price equalization) do not generally hold when the two factors of production are labor and the value of aggregated, heterogeneous capital goods.

In a neoclassical response, Kemp (1973) and Ethier (1979) showed that the H-O theorems about the direction of trade and factor-price equalization (FPE) can still be valid with hetero-

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10 This result was conceded by Samuelson (1966), although he and other neoclassicals continued to dispute the usefulness of the Cambridge (UK) approach. See Harcourt (1972) for a survey of the “Cambridge-Cambridge” debate about capital theory.

11 For a more detailed discussion of neo-Ricardian critiques of trade models, see Blecker (2005).
geneous capital goods, provided that these theorems are re-stated assuming exogenously given prices (i.e., the value of capital has to be measured at unchanging world prices). However, by holding prices constant, the theorems cannot predict the direction of trade based on a comparison of autarky prices, and merely describe the free trade equilibrium itself. Moreover, as conceded by Leamer (1984, pp. 43-44), this approach cannot rescue the S-S theorem because this theorem is explicitly concerned with the effects of changing goods prices.

Although most modern expositions of the 2×2×2 HOS model use capital and labor as the two factors of production, Samuelson (1949) originally used two non-produced factors of production, land and labor, in his proof of FPE. Steedman and Metcalfe (1977) showed that the Cambridge (UK) critique of neoclassical capital theory is much less destructive of HOS predictions when the two primary factors are land and labor, even if heterogeneous intermediate goods (with a positive rate of profit on the value of their stocks) are taken into account. Under other HOS assumptions (e.g., constant returns to scale and identical technology), and assuming equal (but positive) rates of profit in both countries, the quantity version of HOS still holds: each country exports the good that is relatively intensive in its physically more abundant factor (land or labor), in spite of multiple equilibria and other anomalies. Under these assumptions, FPE (in rents and wages) still holds, and S-S holds in its weak form (free trade hurts whichever primary factor, land or labor, is used intensively in the import-competing sector).

More recently, Steedman (2005) considered an HOS-type model in which there are two primary (non-produced) inputs (land and labor), and the two produced goods are both used as

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12 However, the price version of HOS breaks down in this model, because the relationship between the factor-price ratio and factor intensities (land-labor ratios) is not monotonic. Steedman and Metcalfe’s (1977) analysis implies that HOS predictions about non-produced factors of production (e.g., land and labor) are valid only if profit rates differ by relatively small amounts across countries. Empirically, although profit rates are not exactly equalized around the world, they very much less than other factor returns, such as real wages, which differ by larger orders of magnitudes. For example, U.S. wages are roughly 10 times Mexican wages and 20 times Chinese wages (Leamer, 2000); rates of return to capital do not normally differ so much.
intermediate inputs. He assumes zero profits (“interest”) on stocks of the produced goods, so the paradoxes found in the earlier capital-theoretic critique do not arise. For the primary factors, the presence of intermediate goods does not alter the standard S-S results: an increase in the relative price of a good raises the real returns to the factor used intensively in that good, lowers the real returns to the other factor, and induces substitution of the latter factor for the former. In contrast, for the produced inputs, no definite results can be established about how their use as intermediate goods responds to changes in their prices. Although Steedman focuses on the latter result, what is more important for our purposes is his demonstration that the presence of intermediate goods does not invalidate the standard S-S results for the primary, non-produced factor inputs.

The same economists who launched the capital-theoretic critique of the traditional HOS model also developed an alternative set of neo-Ricardian trade models in the late 1970s and 1980s. These models focused on international differences in technology as the underlying determinant of trade, but also allowed for capital-theoretic paradoxes that could “distort” the pattern of trade and make the free trade specialization sub-optimal (see Steedman 1979a, 1979b). However, most of these models assumed a fixed real wage bundle, which effectively precludes a S-S type analysis of the distributional impact of trade. Workers who receive a fixed real wage can neither gain nor lose from trade, while capitalists generally gain (because of the

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13 A neoclassical counter-critique called the neo-Ricardian welfare results into question. Smith (1979) argued that Steedman and Metcalfe’s welfare comparisons across steady-state equilibria (i.e., free trade versus autarky) were inappropriate, because if one compares the intertemporal consumption paths with free trade and autarky one finds that the free-trade paths are never inferior (in the sense that the present value of future consumption is at least as great along the free-trade paths as on the autarky path). As in static models, there are losers from free trade (in the intertemporal context, certain generations are worse off), but the free trade path is a potential Pareto improvement and suitable compensation could possibly ensure that no generation is worse off. However, the possibility of compensatory mechanisms in intertemporal models is even less credible than in static models, and Smith’s argument does not rescue the validity of aggregating heterogeneous capital goods in the static models that are used to analyze the distributional effects of trade on owners of current factor inputs.

14 Mainwaring (1991) is a partial exception. Although he assumes fixed real wages in his core models, he also considers the consequences of a labor constraint in the “Centre” and a natural resource constraint in the “Periphery.” He does not consider any models with two constraints (labor and/or resources) in the same country.
presumption that only profit-maximizing specializations are chosen).

None of the neo-Ricardian trade models ever emerged as a consensus alternative to the standard H-O approach. There were many reasons for this “failure to launch,” including ideological resistance as well as the fact that they were soon eclipsed by the new mainstream models of Krugman (1979) and others. The interests of heterodox trade economists also shifted in the direction of more dynamic and evolutionary models focused on technological change. On the whole, the neo-Ricardian models appear to have served more of a critical function than as a positive alternative. Nevertheless, those models established two key points of relevance for this paper: (1) the traditional treatment of capital and profits in H-O models is untenable, as long as capital consists of heterogeneous produced inputs that have to be measured in price terms; and (2) the traditional treatment of non-produced factor inputs, such as land and labor (or, by extension, different types of labor), is nevertheless valid, at least with regard to the S-S theorem.

2.2 New Empirical Findings in the Heckscher-Ohlin Framework

Over the past few decades, mainstream trade economists have made significant progress in empirical tests of the H-O model. It will be argued here that this research suggests a shift away from a focus on capital-labor proportions and toward more of an emphasis on a multiplicity of primary, non-produced factor inputs. Starting with the famous “paradox” of Leontief (1953), the H-O model has generally been found to have poor predictive power in regard to capital-labor proportions. Most empirical research since that time does not find robust evidence that “capital-abundant” countries tend to export “capital-intensive” goods.\textsuperscript{15} Numerous studies from the 1960s

\textsuperscript{15} An apparent exception is a fairly new line of research epitomized by the recent paper of Batista and Potin (2007). They allow for violations of certain standard H-O assumptions, such as identical technology and incomplete specialization, and make “quality” adjustments to conventional measures of capital and labor. The authors focus on showing that capital-abundant countries tend to produce relatively more capital-intensive goods; since their focus is more
through the 1980s found that, on the contrary, trade patterns were better explained by multi-factor models that take into account other inputs such as natural resources and skilled labor (or “human capital”) as well as differences in technological capabilities.\footnote{Vanek (1963) was the first to emphasize natural resources as a third factor of production in explaining U.S. trade. In a later elaboration, Wright (1990) argued that capital and natural resources are complementary inputs in U.S. production, and hence the capital-intensity of U.S. trade is explained by the abundance or scarcity of natural resources in the U.S. relative to other nations at various points in history. Keesing (1966), Baldwin (1971), and Stern and Maskus (1981), among others, emphasized skilled labor or human capital as a third factor, in addition to “physical” capital and ordinary or “unskilled” labor. These studies found that U.S. exports were intensive in skilled labor/human capital, thus explaining Leontief’s results by his failure to distinguish different types of labor.}

Subsequently, Leamer (1980, 1984) argued that, in a world of multiple factors, goods, and countries, it was wrong to test H-O by measuring the factor composition of a country’s 
\textit{traded goods}. Following the earlier suggestions of Vanek (1968), Leamer developed what he called the Heckscher-Ohlin-Vanek (HOV) model, in which a country is abundant (scarce) in a given factor of production if the country’s share of the world supply of that factor is greater (less) than the country’s share of total world consumption. In the HOV model, the correct testable implication is that a country should be a net exporter (importer) of the \textit{services} of a given factor if and only if it is abundant (scarce) in that factor, in this sense.

Empirical work by Bowen, Leamer, and Sveikauskas (1987) and Trefler (1995), using data for large numbers of countries and factors,\footnote{Bowen, Leamer, and Sveikauskas used seven types of labor and three types of land, in addition to capital, and included 27 countries. Trefler included 33 countries; his factors are discussed below.} found very weak support for HOV predictions under conventional assumptions. There were no strong correlations between countries’ abundance or scarcity in the factors of production (in the HOV sense) and their net exports of factor services. However, Trefler (1995) showed that, by allowing for international differences in tastes and technology as well as in factor endowments, a more complete HOV model could explain a high percentage of the variation in countries’ net exports of factor services. The

on development than trade, the authors do not estimate the factor content of trade. Given the way capital-abundant countries and capital-intensive goods are defined, this aspect of the results appears to be largely tautological.
resulting model could perhaps also be described as “HOR” (Heckscher-Ohlin-Ricardo), because of the allowance for technological differences. More importantly for present purposes, given that Trefler included six types of labor and two types of natural resources, his results imply that the predictive power of factor proportions derives mainly from the inclusion of other factors of production besides capital (and also requires controlling for technological differences).\textsuperscript{18}

Turning to the distributional side, the S-S theorem is now more often applied to the effects of trade on wage inequality between different segments of the labor force, rather than to the overall distribution of income between capital and labor.\textsuperscript{19} Empirical evidence for S-S effects in explaining wage inequality is, however, mixed. A number of studies have tested whether changes in the “skill premium” (i.e., the relative wage of more educated professional, technical, and supervisory workers compared with less educated production workers) in the U.S. economy can be explained by decreases in the relative prices of less-skill-intensive goods (which are U.S. imports). After early studies by Lawrence and Slaughter (1993) and Krugman and Lawrence (1994) cast doubt on the existence of such a correlation, later research by Wood (1994), Thompson (1997), Sachs and Shatz (1998), and Leamer (1998, 2000) found various kinds of evidence for S-S effects on the U.S. skilled wage premium.\textsuperscript{20}

Berman, Bound, and Griliches (1994) and Bernard and Jensen (1997) found that most of

\textsuperscript{18} Trefler’s emphasis on differences in preferences was rejected in later studies, such as Harrigan (1997). Earlier empirical studies that focused on international differences in technology as an explanation for deviations from H-O predictions included Dosi et al. (1990) and Elmslie and Milberg (1992).

\textsuperscript{19} The other part of the H-O analysis of distributional effects of trade is, of course, FPE. Trefler (1993) found that deviations from FPE are mainly explained by international differences in technology. Batista and Potin (2007) argue that complete specialization is also important, at least for countries with very high or very low capital-labor endowment ratios. However, as argued by Leamer (1998, 2000), the right theorem to apply to the effects of trade liberalization or other sources of changes in world prices (e.g., China’s entry into the global economy) is S-S, not FPE.

\textsuperscript{20} For example, Sachs and Shatz showed that there was a falling ratio of import-weighted value added prices to export-weighted value added prices in the U.S. economy (thereby correcting Lawrence and Slaughter’s use of gross output prices). Thompson used a 3-good (agriculture, manufactures, and service), 3-factor (capital, unskilled labor, skilled labor) HOS model. Employing an empirical version of the Jones (1965) algebra, he found large elasticities of wages with respect to prices of manufactured goods: −7.35 for skilled wages and +7.85 for unskilled wages.
the changes in the skilled wage premium had occurred within industries, rather than between them, contrary to what one would expect from S-S. This finding was initially interpreted as implying that skill-biased technological change, rather than trade, was the main “culprit” in explaining the rising skilled wage premium. However, Feenstra and Hanson (1996, 1997, 1999) argued that falling prices of imported intermediate goods that are intensive in less-skilled labor could explain the within-industry declines in the relative wages of less-skilled workers. Although these studies have made advances in understanding how trade affects the wage premium for more skilled workers, this literature has largely sidestepped the issue of how trade affects the overall distribution of income between capital and labor income more broadly.

2.3 Mark-Up Pricing and Partial Pass-Through

In seeking an alternative way to model profits, we draw our principal inspiration from the seminal work of Kalecki (1954), who first developed the idea that mark-up pricing by oligopolistic firms could be used as the basis for determining the profit share of national income. Mark-up pricing has been assumed in many open economy macro models (see, e.g., Dornbusch, 1980), and was introduced into models of “North-South” trade by Taylor (1981, 1983), Dutt (1988, 1990), and Blecker (1996). While many of these models treated mark-up rates as

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21 Some economists (e.g., Wood, 1994; Leamer, 2000) have noted that labor-saving technological innovations may be partly induced by international competitive pressures, thus questioning the effort to separate “trade” and “technology” as distinct causes of distributional shifts.

22 This result assumes, of course, that industries are defined broadly enough that a number of vertically linked production activities are included in the same “industry” (for example, including both automotive parts and final automobile assembly in “motor vehicles”). Some of the changes that appear to occur “within” such broad industries would be seen as occurring “between” industries if the industries were more finely disaggregated.

23 Exceptions include Thompson (1997), Leamer (1998, 2000), and Feenstra and Hanson (1996, 1997), all of whom used three-factor models including capital. Feenstra and Hanson are especially noteworthy for modeling international capital mobility and outsourcing. However, all of them treat capital in the standard way as a scarce factor earning a return equal to its scarcity rent, with zero economic profits of perfectly competitive firms.

24 This methodology has been adopted in a large literature on neo-Kaleckian macro models (sometimes also referred to as “structuralist” or “post-Keynesian” models). See, for example, Taylor (1983, 2004) and Lavoie (1992).
exogenously given, flexible mark-ups (and, implicitly, partial pass-through) in response to exchange rate changes were introduced into open economy macro models by Krugman and Taylor (1978) and Blecker (1989a, 1999). Arestis and Milberg (1993-94) showed how partial pass-through in response to exchange rate changes arises naturally in Kalecki’s original model of mark-ups as well as in Eichner’s (1976) theory of oligopolistic pricing. However, most of these models did not focus on the traditional S-S issue of how trade policies (either protectionist or liberalizing) affect income distribution.

One branch of the new trade theory with imperfect competition implies that, if a home country increases a tariff, a profit-maximizing foreign monopolist or oligopolist will reduce its own-currency price, thereby implying partial pass-through of the tariff change into the price of home country imports (e.g., Brander and Spencer, 1984). In addition, numerous empirical studies have found partial pass-through of exchange rate changes into either export prices, import prices, or domestic prices in a variety of settings, although (as one would expect) the results are sensitive to industry structure and the types of goods traded.25 Feenstra (1989) demonstrated (both theoretically and empirically) that changes in tariff and exchange rates have symmetrical effects on import prices (based on a model of oligopoly in the foreign export industry).

Although the focus in this literature has been on the partial pass-through phenomenon per se, these models also imply that profit mark-ups are likely to vary in systematic and predictable ways in response to either tariff or exchange rate changes in industries that exhibit partial pass-

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25 For example, Woo (1984), Mann (1986), and Dornbusch (1987) analyzed why U.S. import prices did not change by the full amount that would be expected from the appreciation and subsequent depreciation of the dollar in the 1980s. Ohno (1989), Marston (1990), and Parsley (1993) found evidence for partial pass-through of yen appreciation into Japanese export prices. Feinberg (1986, 1989, 1996) estimated the pass-through of changes in exchange rates and import prices into domestic prices, which he found was partial in many cases, especially (as one would expect) in industries that were more concentrated and produced more differentiated products.
through behavior.\textsuperscript{26} For example, if the United States either imposes a tariff or depreciates the dollar, we would expect foreign exporting firms who “price to market” to reduce their own-currency export prices relative to their own-currency unit costs, thereby lowering their mark-ups, while competing U.S. producers would be expected to raise domestic prices relative to their dollar-denominated costs, thereby raising their mark-ups. If either the dollar depreciates or a foreign country lowers its tariff, U.S. export firms would be expected to increase their prices relative to their costs (both measured in dollars), thereby raising their mark-ups. Thus, the partial pass-through literature implies simple and intuitive rules for how profit mark-ups of domestic producers are likely to adjust in response to changes in tariff rates or foreign prices.

Before proceeding to our model, one additional caveat is in order. The literature on labor rents implies that a portion of the oligopolistic profits in concentrated industries may be captured by workers if they have strong bargaining power, for example as a result of union organizing or efficiency wage effects.\textsuperscript{27} There have been some efforts to apply this type of analysis to the effects of international trade on income distribution (e.g., Ortega and Rodríguez, 2005; Bivens, 2006). That type of analysis is not incorporated here, but could be included in future extensions of this work. In this paper, markets for primary inputs (labor and/or natural resources) are treated as perfectly competitive in order to sharpen the contrast between our results and those of the conventional S-S analysis. The model in the following sections differs from the conventional model only in the treatment of returns to capital, not wages of labor or rents of natural resources.

\textsuperscript{26} This behavior would not be observed, for example, in industries in which domestic and imported goods are very close substitutes, or for imported goods for which there is no domestic production.

\textsuperscript{27} See, for example, Krueger and Summers (1988), and Katz and Summers (1989a, 1989b).
3. The Core Ricardo-Heckscher-Kalecki Model

This model is named for the economists who contributed the three fundamental ideas that it synthesizes: technological differences (Ricardo), factor costs (Heckscher), and oligopolistic mark-ups (Kalecki).\(^{28}\) We use a 2-good, 2-factor HOS-type framework applied to a single, small country for simplicity, as well as to facilitate comparisons with “core” conventional trade models; extensions to multiple countries and factors in an HOV framework are left for future research.

The two goods, 1 and 2, are produced using two primary factors of production, i.e., non-produced inputs. One of these factors will be called \(L\) for labor, which may be interpreted as (less-skilled) labor or production workers. The other factor will be designated as \(N\), which—depending on the application of the analysis—can be interpreted as either land/natural resources or skilled labor (also known as human capital or professional and technical workers). Hereafter, whenever we refer to “factors” we mean only \(L\) and \(N\), not capital. For the reasons discussed earlier, we deliberately do not treat capital as a primary factor. Capital enters the analysis as the productive assets owned by oligopolistic firms, which obtain profits by charging a mark-up over the unit costs of hiring the two primary factors, \(L\) and \(N\).\(^{29}\) In this section, we do not consider intermediate inputs explicitly; they will be considered in a later section.

Using the dual cost functions that have become the standard workhorses of international trade models (see, e.g., Wong, 1995; Feenstra, 2004), but assuming oligopolistic competition

---

\(^{28}\) Here I refer to the conventional “textbook” version of Ricardo’s trade model. As discussed by Maneschi (1983, 1992), the original trade theory of Ricardo (1821) included natural resource scarcity (which generates decreasing marginal productivity in agricultural production), positive profits, and capital accumulation.

\(^{29}\) Of course, the firms own stocks of capital goods (plant and equipment), which are necessary for production, but we assume that there is sufficient excess capacity that capital equipment is not a binding constraint on production. Alternatively, we may assume that additional capital goods can be produced when necessary and hence capital inputs are not a constraint on production of final goods.
with positive economic profits, the prices of the two goods can be expressed as follows:

\[
\begin{align*}
\text{(1)} & \quad p_1 = (1 + \phi_1)[wa_{L1} + qa_{N1}] = (1 + \phi_1)c_1(w, q) \\
\text{(2)} & \quad p_2 = (1 + \phi_2)[wa_{L2} + qa_{N2}] = (1 + \phi_2)c_2(w, q)
\end{align*}
\]

where \(a_{ij}\) is the quantity of input \(i\) required per unit of output \(j\), \(w\) and \(q\) are the prices of the factors \(L\) and \(N\), respectively,\(^{30}\) \(c_j(w, q)\) is the unit factor cost function (i.e., average costs excluding mark-ups) for each good \(j\), and \(\phi_j \geq 0\) is the mark-up rate on good \(j\). The input-output coefficients \(a_{ij}\) can be taken as fixed, or they can be assumed to be optimal coefficients determined by cost-minimizing firms with neoclassical production functions of the form:

\[
\text{(3)} \quad y_j = f_j(L_j, N_j), \quad j = 1, 2
\]

where \(f(\cdot)\) is assumed to have all the usual “well-behaved” properties (e.g., constant returns to scale, diminishing marginal productivity, and satisfaction of all second-order conditions).\(^{31}\) In this case, the unit factor cost functions \(c_j(w, q)\) are the optimal, minimized cost functions which are dual to the production functions (3). To enhance comparability with mainstream trade models, we will assume that the input-output coefficients \(a_{ij}\) are flexible and are derived (via cost minimization) from production functions of the form (3), but all of the main, qualitative results of this paper would still hold if there were fixed coefficients.\(^{32}\)

Assuming oligopolistic competition with barriers to entry in both industries in each country, there is no presumption that the positive mark-ups are competed away by new entrants.

---

\(^{30}\) Thus, \(w\) is the wage rate for ordinary or less-skilled labor, while \(q\) is either the rental rate on land (natural resources) or the salary of more skilled labor (professional/technical workers or human capital).

\(^{31}\) Although it is not otherwise implied by standard definitions of “well-behaved” production functions, we will also assume that there are no factor-intensity reversals between the two industries, which essentially requires that their elasticities of substitution must not be too different. This assumption is made to focus on the effects of incorporating mark-ups into the H-O model, rather than more familiar “anomalies.” Note that assuming fixed coefficients is sufficient, although not necessary, to rule out factor-intensity reversals.

\(^{32}\) When the \(a_{ij}\) are derived by cost-minimization, they are functions of the factor prices, \(a_{ij} = a_{ij}(w, q)\), but we will suppress the factor prices to avoid notational clutter. Since the derivation of these optimal input-output coefficients is not novel, there is no need to detain ourselves by showing it here.
or that profit rates are equalized across industries. By allowing for technological differences, there is no presumption that the production functions or input-output coefficients are identical across countries. We also do not assume identical homothetic preferences. In fact, no assumption about preferences is required for the present analysis. We assume that, although finished goods markets are oligopolistic, factor markets are perfectly competitive, and hence factor prices are flexible and there is “full employment” (or rather, a fixed level of employment) for both primary factors, $L$ and $N$.

### 3.1 Autarky Equilibrium and Comparative Advantages

Although our primary focus will be on how trade affects income distribution, no presentation of a trade model would be complete without at least a brief characterization of the implications of the model for comparative advantages and the pattern of trade. Using (1) and (2), the relative price of good 1 can be expressed as

$$
\frac{p_1}{p_2} = \frac{(1 + \phi_1)(w_{L1} + qa_{N1})}{(1 + \phi_2)(w_{L2} + qa_{N2})} = \frac{(1 + \phi_1)((w/q)(a_{L1}/a_{N1}) + 1)}{(1 + \phi_2)((w/q)(a_{L2}/a_{N2}) + 1)} \left( \frac{a_{N1}}{a_{N2}} \right).
$$

Applying this expression to autarky prices, and considering a comparison with a foreign

---

33 Of course, financial investors may allocate their portfolios over equity in firms in different industries so as to equalize the returns on financial capital invested in both sectors of the economy. We do not explore such an extension of the model here, but we note that allowing for financial interests in (or control over) the production of different goods may be a way of reconciling the present analysis with the idea that capital mobility should lead to equalized rates of return. What is truly “mobile” between industries is financial capital and ownership, not “real” capital embodied in productive capital goods (plant and equipment). This distinction has been recognized in some recent mainstream work in the H-O framework (e.g., Batista and Potin, 2007).

34 Since it is not necessary for present purposes, we do not assume that the production functions (3) differ across countries in any particular way, e.g., by Hicks-neutral, Harrod-neutral, or Marx-biased technological differences. Such differences in technology across countries could, however, be analyzed using the present framework.

35 Any such analysis implicitly assumes balanced trade with full employment. A more realistic analysis allowing for imbalanced trade, capital flows, and unemployment would allow for trade to follow absolute rather than comparative advantage (see Brewer, 1985; Milberg, 1994; Davidson, 2007). Again, we assume more (neo)classical conditions in order to focus on the way in which positive mark-ups alter an otherwise conventional trade model.

36 Some caveats about the concept of “autarky” are appropriate here. Autarky does not refer to a historical state
country with a similar equation, whether the home country has the comparative advantage in
good 1 or 2 depends on three things: (i) differences in technology reflected in the input-output
coefficients \((a_{ij})\) and/or the underlying production functions \(f_j()\); (ii) differences in factor costs
reflected in factor-intensity ratios \((a_{Lj}/a_{Nj})\) and relative factor prices \((w/q)\);\(^{37}\) and (iii) differences
in industry structure reflected in mark-up rates \((\phi_j)\). While conventional Ricardian and H-O
models (respectively) privilege either (i) or (ii), there is no \textit{a priori} reason why either one should
be more important in general than the other, and as noted earlier recent empirical studies suggest
that both are important. Although one would not expect mark-up rates generally to differ as
much as either technology or factor prices, nevertheless mark-up rates may affect comparative
advantages and trade patterns for countries with similar levels of technologies and factor prices.\(^{38}\)

3.2 Factor Prices and Goods Prices

Figure 1 represents a possible equilibrium for goods prices and factor prices in the model
described by equations (1) and (2), above. How a specific equilibrium configuration of this type
is determined in an open economy will be discussed in the next section; here we simply wish to
illustrate how positive mark-ups \(\phi_j > 0\) drive a wedge between goods prices \(p_j\) and unit factor
costs \(c_j\) that is not found in the conventional S-S analysis. The solid curves labeled \(c_1\) and \(c_2\)
represent the inverse factor price relations or unit factor cost curves for each industry described

\(^{37}\) Note that we say “factor costs” and not “factor endowments,” because when technology can differ across coun-
tries, factor prices (and the cost-minimizing input-output coefficients) may depend on technological differences as
well as on factor supplies.

\(^{38}\) For example, Blecker (1989b) found evidence that high mark-up rates in the U.S. steel industry contributed
significantly to the rise of steel imports into the United States in the 1960s. At that time, most U.S. steel imports
came from other developed countries (mostly European) with similar factor endowments and technology.
by the unit factor cost functions, $c_j(w, q)$ ($j = 1, 2$). These curves are drawn as convex to the original on the assumption of positive and finite elasticities of substitution in the production functions (3); with fixed coefficients, these curves would be linear. The $c_1$ curve is drawn as steeper than $c_2$ assuming, without loss of generality, that good 1 is $L$-intensive, i.e., $(a_{L1}/a_{N1}) > (a_{L2}/a_{N2})$. The equilibrium factor prices are $(w^0, q^0)$.

![Graph showing relationships between factor prices, unit factor costs, and goods prices](image)

**Figure 1.** Relationships between factor prices, unit factor costs, and goods prices

Under the standard assumption of perfect competition and zero profits, the goods prices $(p_1, p_2)$ equal the unit factor costs $(c_1, c_2)$ and these curves can be referred to as “zero profit conditions.” However, with positive mark-ups ($\phi_j > 0$)—which for expository purposes we take as exogenously given here (adjustments in mark-ups are modeled in the next section)—the relevant prices curves are the higher dashed curves $p_1$ and $p_2$, which are described by equations

39 The slopes of the $c_1$ and $c_2$ curves are equal to $-(a_{L1}/a_{N1})$ and $-(a_{L2}/a_{N2})$, respectively.
(1) and (2). In this situation, the intersection of the price curves $p_1$ and $p_2$ has no particular significance, since the factor prices remain at $(w^0, q^0)$. With positive mark-ups $\phi_j > 0$, the combined payments to the primary factors $N$ and $L$ are lower than firms’ total revenue and the difference (i.e., the gap between the price and cost curves in Figure 1) is accounted for by firms’ profits. This begs the question of how goods prices, (primary) factor prices, and mark-up rates are simultaneously determined in an open economy, which is considered in the next section.

4. Effects of Trade on Income Distribution with Partial Pass-Through

Next, we proceed to model how the distribution of income—both between the two primary factors $L$ and $N$ and between those factors and the profits of the firms that employ them—is affected by international trade. We assume that each industry, 1 and 2, produces a final good that is an imperfect substitute for its foreign counterpart (trade in intermediate goods is considered in the following section). The prices of the foreign varieties are $p_1^*$ and $p_2^*$, which are taken as exogenously given on the small country assumption. Thus, $p_1$ and $p_2$ should be interpreted as the prices of domestically produced varieties of the same goods, expressed in a common currency for convenience.40

Suppose, without loss of generality, that the home country exports good 1 and imports good 2. Then, assuming no transportation costs for simplicity, the price of home exports in the foreign market is $p_i(1 + t_i^*)$, where $t_i^* \geq 0$ is the foreign ad valorem tariff rate, and the price of

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40 Exchange rates are not considered explicitly in this paper, but the effects of changes in exchange rates should be similar to the effects of changes in foreign prices as modeled here.
imported foreign goods in the home market is \( p_2^*(1 + t_2) \), where \( t_2 \geq 0 \) is the home tariff rate.\(^{41}\)

Since home and foreign products are imperfect substitutes, home and foreign varieties of each good do not generally sell for the same price.\(^{42}\) Instead, and to build in the idea of partial pass-through of changes in tariffs or foreign prices into domestic prices, we postulate the following relationships between home and foreign prices for each good:

\[
(5) \quad p_1 = B_1 \left( \frac{p_1^*}{T_1^*} \right)^{1-\beta_1}
\]

and

\[
(6) \quad p_2 = B_2 \left( p_2^* T_2 \right)^{1-\beta_2}
\]

where \( B_j > 0, 0 \leq \beta_j < 1 \) (\( j = 1, 2 \)), and, for notational convenience, we use the “tariff factors” equal to one plus the tariff rates, \( T_j = 1 + t_j \geq 1 \) and \( T_j^* = 1 + t_j^* \geq 1 \).\(^{43}\) In (5) and (6), the \( B_j \) terms are constants that represent the qualitative characteristics that affect whether the home or foreign variety of each good, \( j = 1, 2 \), command higher prices, while the exponents \( 1 - \beta_j \) represent the degree of pass-through of the tariffs (or foreign prices) into home prices (which depends on the degree of substitutability of the home and foreign varieties of each good in consumption and the

\(^{41}\) Alternatively, one could think of \( t_j \) and \( t_j^* \) (\( j = 1, 2 \)) as incorporating all trade barriers, including transportation costs, converted to tariff-equivalent rates.

\(^{42}\) In e-mail correspondence during the summer of 2007, Lance Taylor raised a concern about whether this assumption is tantamount to incorporating the Armington (1969) specification of demand, which has been the subject of much controversy because of its frequent use in computable general equilibrium models (see, e.g., von Arnim and Taylor, 2007). In response, I would say that the assumption of imperfect substitutes or nationally differentiated products—without which one could not avoid imposing the “law of one price”—is the only respect in which this model resembles Armington. Armington models assume a “nested” structure of demand, in which consumers first choose between different (composite) goods, then (for each good) choose between domestic products and (composite) imports, and finally choose between different sources of imports. No such nested decision-making based on composite goods is implied by or required for the present analysis.

\(^{43}\) The meaning of equation (6) is fairly obvious, since \( p_2^* T_2 \) is the tariff-inclusive price of imports. The intuition for (5) may be more obscure, but consider that the relevant comparator for the price that domestic export firms receive is the tariff-adjusted price of the foreign variety, which in this case is “deflated” by the tariff factor \( T_1^* \) to obtain what the domestic firm would get if it sold its exports for \( p_1^* \). Note that, in the special case where the goods are perfect substitutes, we would have \( B_j = 1 \) and \( \beta_j = 0 \).
firms’ oligopolistic strategic behavior, neither of which is modeled explicitly here). Thus, \(1 - \beta_j\) is the elasticity of the price of the home variety with respect to a change in the tariff-adjusted price of the foreign variety: perfect substitutes would imply \(\beta_j = 0\) or \(1 - \beta_j = 1\) (in which case there would be full pass-through), while as the goods become less substitutable, \(\beta_j\) rises, \(1 - \beta_j\) falls, and the pass-through into prices of domestic varieties becomes more and more partial.

Equations (5) and (6) pin down the domestic prices in relation to the (given) prices of foreign varieties; we need two additional equations to determine the mark-up rates and thereby pin down the unit factor costs in (1) and (2). For the mark-up on the export good, we assume

\[
(1 + \phi_1) = \Phi_1 \left( \frac{p_1^*}{T_1^* c_1} \right)^{\alpha_1}, \quad \Phi_1 \geq 1, \ 0 \leq \alpha_1 < 1
\]

where \(\Phi_1\) is a constant reflecting other (exogenous) determinants of the home industry’s mark-up rate (e.g., concentration), and \(\alpha_1\) is the elasticity of the mark-up factor \((1 + \phi_1)\) with respect to the ratio \(p_1^*/T_1^* c_1\), which reflects home cost competitiveness (including the effect of the foreign tariff).\(^{44}\) Thus, when home goods become more competitive in export markets (because of a rise in the foreign price or a reduction in the foreign tariff), home firms raise their mark-ups.

Similarly, in the import-competing sector 2, the home country mark-up is determined by

\[
1 + \phi_2 = \Phi_2 \left( \frac{T_2 p_2^*}{c_2} \right)^{\alpha_2}, \quad \Phi_2 \geq 1, \ 0 \leq \alpha_2 < 1
\]

where \(\Phi_2\) is a constant reflecting other (exogenous) determinants of the sector’s mark-up, and \(\alpha_2\) is the elasticity of the mark-up factor with respect to the home cost competitiveness ratio, \(T_2 p_2^*/c_2\). Thus, when home goods become more cost competitive (for example, because foreign prices rise or home tariffs are raised), domestic producers of import-competing goods increase

\(^{44}\) Analogous measures of home competitiveness have been used by Blecker (1989a, 1999). This comparison of the home unit costs and foreign price, adjusted for tariffs, is also in the spirit of Feenstra (1989) and Arestis and Milberg (1993-94). Note that perfect competition (zero profits) is the special case in which \(\Phi_j = 1\) and \(\alpha_j = 0\), while a positive but rigid mark-up is the case in which \(\Phi_j > 1\) and \(\alpha_j = 0\) \((j = 1, 2)\).
their mark-ups. We assume that the elasticities of the mark-up factors with respect to the cost competitiveness of home goods \( \alpha_j (j = 1, 2) \) are constant for simplicity.\(^{45}\)

Combining equations (1)-(2) and (5)-(8), we obtain the following reduced-form solutions for unit factor costs in each industry:

\[
(9) \quad c_1(w, q) = \left[ \frac{B_1}{\Phi_1} \left( \frac{p_1^*}{T^*_1} \right)^{1-\alpha_j} \right]^{\frac{1}{1-\alpha_j}}
\]

and

\[
(10) \quad c_2(w, q) = \left[ \frac{B_2}{\Phi_2} \left( T_2 p_2^* \right)^{1-\alpha_j-\beta_j} \right]^{\frac{1}{1-\alpha_j}}
\]

We obtain reduced form solutions for the mark-up factors by using (5)-(6) and (9)-(10) in (1)-(2) and solving for \((1 + \phi_j)\), which after simplification yields

\[
(11) \quad 1 + \phi_1 = \left( \frac{\Phi_1}{B_1^{\alpha_j}} \right)^{\frac{1}{1-\alpha_j}} \left( \frac{p_1^*}{T_1^*} \right)^{\frac{\alpha_j\beta_j}{1-\alpha_j}}
\]

and

\[
(12) \quad 1 + \phi_2 = \left( \frac{\Phi_2}{B_2^{\alpha_j}} \right)^{\frac{1}{1-\alpha_j}} \left( T_2 p_2^* \right)^{\frac{\alpha_j\beta_j}{1-\alpha_j}}
\]

Thus, in a small open economy, causality runs from the exogenously given tariff rates and foreign prices to prices of home goods via (5) and (6), and then to unit factor costs via (9) and (10) and (simultaneously) to mark-up rates via (11) and (12).\(^{46}\) Assuming that the factors \( L \) and \( N \) are mobile between industries and that both goods are produced in equilibrium with no factor-intensity reversals, (9) and (10) then uniquely determine the factor prices \( w \) and \( q \) (this

---

\(^{45}\) Gil Skillman (in conversations at the Annual Political Economy Workshop, Queen Mary University of London, June 2007) has suggested that the underlying profit-maximizing behavior that yields equations (7) and (8) should be modeled explicitly. Without debating whether strict profit maximization is a good way of characterizing actual oligopolistic pricing, it may be noted that the qualitative behavior reflected in these equations has been shown to follow from standard profit-maximizing behavior by previous authors (e.g., Feenstra, 1989). All we have done, relative to existing models, is to assume a constant elasticity relationship for mathematical convenience.

\(^{46}\) The solutions for unit factor costs and mark-up rates are not independent of each other, since once domestic prices are determined, then determining either unit factor costs or the mark-up rate effectively determines the other.
corresponds to the equilibrium where the curves $c_1$ and $c_2$ intersect in Figure 1, above).47

For mathematical convenience, we convert these equations into growth rate form using an extended version of the famous Jones (1965) algebra. Changes in the prices of home goods (varieties) are obtained directly from logarithmic differentiation of (5) and (6), assuming that the $B_j (j = 1,2)$ are constants:

$$\hat{p}_1 = (1 - \beta_1)(\hat{p}_1 - \hat{T}_1)$$

$$\hat{p}_2 = (1 - \beta_2)(\hat{p}_2 + \hat{T}_2)$$

where a “$$\hat{}$$” indicates an instantaneous growth rate or proportional rate of change (i.e., for any variable $x$, $\dot{x} = dx / dx$). Thus, home prices rise if foreign prices are increasing, or if the foreign tariff on exports is lowered, or the home tariff on imports is raised, but in each case there is “partial pass-through” as long as $0 < \beta_j < 1$. From (9) and (10), on the assumption that all $B_j$ and $\Phi_j$ are constants, the proportional changes in unit factor costs are:

$$\hat{c}_1 = A_1(\hat{p}_1 - \hat{T}_1)$$

$$\hat{c}_2 = A_2(\hat{p}_2 + \hat{T}_2)$$

where $A_j = \frac{1 - \alpha_j - \beta_j}{1 - \alpha_j} \leq 1$. Changes in mark-up rates of firms (and hence in profit shares48) are then obtained either from (11) and (12), or from (13) through (16), and can be written as:

$$\hat{p}_1 - \hat{c}_1 = \left(\frac{\alpha_1 \beta_1}{1 - \alpha_1}\right)(\hat{p}_1 - \hat{T}_1)$$

---

47 This result is known as the “factor-price insensitivity lemma,” i.e., factor prices do not depend on factor supplies (“endowments”) in a free-trade equilibrium under these assumptions. See, e.g., Feenstra (2004). In effect, we have generalized this lemma to the case in which unit factor costs do not coincide with the prices of the goods due to positive profit mark-ups. Leamer (1998) expresses the same idea by showing that relative factor demand curves are horizontal for ranges of factor endowment ratios in which countries are incompletely specialized.

48 Since there are no raw materials or intermediate goods, the profit share of value added equals the price-cost margin: $\pi_j = (p_j - c_j)/p_j = \phi/1 + \phi$, which is monotonically increasing in the mark-up rate $\phi$ in each sector $j$. 
Thus, the mark-up rate rises (i.e., the price increases proportionally more than unit factor costs) in each sector if the tariff-adjusted foreign price increases, and falls if the tariff-adjusted foreign price decreases, provided that there is partial pass-through of the foreign price change or tariff change (i.e., \(0 < \beta_j < 1\)) and that the mark-up is flexible (\(0 < \alpha_j < 1\)).

To solve for the changes in factor prices \(\hat{w}\) and \(\hat{q}\), we must use a simultaneous equations approach. Logarithmic differentiation of the cost functions \(c_j(w, q)\) yields

\[
\begin{aligned}
\hat{c}_1 &= \theta_{L1}\hat{w} + \theta_{N1}\hat{q} \\
\hat{c}_2 &= \theta_{L2}\hat{w} + \theta_{N2}\hat{q}
\end{aligned}
\]

where \(\theta_j\) is the share of factor \(i\) in the unit cost of good \(j\) (thus, \(\theta_{Lj} = wL_j/c_j\) and \(\theta_{Nj} = qN_j/c_j\)). Combining equations (15) and (16) with (19) and (20), the resulting pair of equations can be expressed in matrix form as

\[
\begin{bmatrix}
A_1(\hat{p}_1^* - \hat{T}_1^*) \\
A_2(\hat{p}_2^* + \hat{T}_2^*)
\end{bmatrix}
= \begin{bmatrix}
\theta_{L1} & \theta_{N1} \\
\theta_{L2} & \theta_{N2}
\end{bmatrix}
\begin{bmatrix}
\hat{w} \\
\hat{q}
\end{bmatrix}
\]

and the solution for factor price changes is

\[
\begin{bmatrix}
\hat{w} \\
\hat{q}
\end{bmatrix}
= \frac{1}{|\Theta|}
\begin{bmatrix}
\theta_{N2} & -\theta_{N1} \\
-\theta_{L2} & \theta_{L1}
\end{bmatrix}
\begin{bmatrix}
A_1(\hat{p}_1^* - \hat{T}_1^*) \\
A_2(\hat{p}_2^* + \hat{T}_2^*)
\end{bmatrix}
\]

where \(\Theta\) is the 2x2 matrix on the RHS of (21). The determinant of this matrix is \(|\Theta| = \theta_{L1}\theta_{N2} - \theta_{L2}\theta_{N1}\), which is positive if good 1 is \(L\)-intensive (\(\theta_{L1}/\theta_{N1} > \theta_{L2}/\theta_{N2}\)) and negative if good 1 is \(N\)-intensive (\(\theta_{L1}/\theta_{N1} < \theta_{L2}/\theta_{N2}\)). Given that \(\theta_{L1} + \theta_{L2} = 1\) and \(\theta_{N1} + \theta_{N2} = 1\), it can easily be shown that \(|\Theta| = \theta_{L1} - \theta_{L2} = \theta_{N2} - \theta_{N1}\). For the sake of illustration, without loss of generality, we will assume that good 1 is \(L\)-intensive, which implies \(|\Theta| = \theta_{L1} - \theta_{L2} = \theta_{N2} - \theta_{N1} > 0\).
Although equation (22) looks deceptively standard, it differs from the conventional Jones algebra solution because the changes in foreign prices are only partially transmitted to domestic factor costs if $A_j < 1$ (which will be true as long as $\beta_j > 0$, i.e., as long as there is partial pass-through into domestic prices). From (22), the solutions for $\hat{w}$ and $\hat{q}$ are:

$$
\hat{w} = \frac{A_1 \theta_{N2}(\hat{p}_1^* - \hat{T}_1^*) - A_2 \theta_{N1}(\hat{p}_2^* + \hat{T}_2)}{\theta_{N2} - \theta_{N1}} \quad \text{and}
$$

$$
\hat{q} = \frac{-A_1 \theta_{L2}(\hat{p}_1^* - \hat{T}_1^*) + A_2 \theta_{L1}(\hat{p}_2^* + \hat{T}_2)}{\theta_{L1} - \theta_{L2}}
$$

which can be transformed into

$$
\hat{w} = A_1(\hat{p}_1^* - \hat{T}_1^*) + \frac{\theta_{N1}[A_1(\hat{p}_1^* - \hat{T}_1^*) - A_2(\hat{p}_2^* + \hat{T}_2)]}{\theta_{N2} - \theta_{N1}} \quad \text{and}
$$

$$
\hat{q} = A_2(\hat{p}_2^* + \hat{T}_2) - \frac{\theta_{L2}[A_1(\hat{p}_1^* - \hat{T}_1^*) - A_2(\hat{p}_2^* + \hat{T}_2)]}{\theta_{L1} - \theta_{L2}}.
$$

Because of the complexity of (25) and (26), we will consider a series of special cases in order to illuminate their implications. First, we consider an exogenous increase in the price of the foreign variety of good 1; then, we will consider equal-proportional tariff reductions in both sectors.

### 4.1 The effect of an increase in the foreign price

Consider first an increase in the price of the foreign variety of good 1 ($\hat{p}_1^* > 0$), holding the price of the foreign variety of good 2 and both tariff rates constant ($\hat{T}_1^* = \hat{p}_2^* - \hat{T}_2 = 0$). We know from (13) and (14) that $\hat{p}_1 = (1 - \beta_j)\hat{p}_1^* > 0 = \hat{p}_2$. By equation (17), the mark-up rate in sector 1 rises (this can also be seen by comparing equations 13 and 15, and noting that $1 - \beta_j > 0$), while by (18) the mark-up in sector 2 is unaffected. We can also infer from (26) that $\hat{q} < 0$, and therefore
\( \check{q} < 0 = \check{p}_2 < \check{p}_1 \), so the owners of factor \( N \) lose absolutely in terms of either good, 1 or 2. We infer from (25) that \( \check{w} > 0 \), which also implies \( \check{w} > \check{p}_2 \), so workers (owners of \( L \)) definitely gain in terms of good 2. However, in this model—unlike the traditional S-S model—it is ambiguous whether owners of \( L \) (the factor used intensively in the good that went up in price) gain or lose in terms of that good, i.e., there may or may not be a “magnification effect” for this factor in terms of the good in whose production it is used relatively intensively.

To see this, assuming that home-country workers may consume both the domestic and foreign varieties of good 1, note that under the assumptions maintained here, (25) combined with (13) implies that the real wage in terms of the home variety of good 1 rises (i.e., \( \check{w} > \check{p}_1 \)) if and only if \( \theta_{N1}/(\theta_{N2} - \theta_{N1}) > \alpha_i \beta_i/(1 - \alpha_i) \), and (25) implies that the real wage in terms of the foreign variety rises (i.e., \( \check{w} > \check{p}_1^* \)) if and only if \( \theta_{N1}/(\theta_{N2} - \theta_{N1}) > \beta_i/(1 - \alpha_i - \beta_i) \). Since \( \alpha_i \beta_i/(1 - \alpha_i) \) is the proportional response of the mark-up, the first inequality means that the magnification effect applies to the real wage in terms of the home variety of good 1 if and only if the adjustment in the mark-up is relatively small, compared with the ratio \( \theta_{N1}/(\theta_{N2} - \theta_{N1}) \), which is larger if the gap between the \( N \)-cost shares in the two sectors is relatively small. Since \( \beta_i \) reflects the degree to which the pass-through of a foreign price change is partial, then the magnification effect in terms of the foreign variety of this good will be smaller, the more partial is the pass-through of the foreign price change into the price of the domestic variety. Thus, the larger is \( \beta_i \), the more partial is the pass-through of the foreign price or tariff change, and the less likely it is that the magnification effect will hold for the factor used intensively in the good whose price has increased. If the magnification effect does not hold, then workers gain only if they consume relatively large quantities of good 2 and may lose if they consume relatively large...
quantities of good 1—the more so if they consume a lot of the foreign variety, whose price increases by more than the domestic variety, since \( \hat{p}_1 = (1 - \beta_1) \hat{p}^*_1 < \hat{p}^*_1 \).

Putting these results together, we can see that any of the following sets of inequalities may hold in this situation:

\[ (27a) \quad \hat{w} > \hat{p}^*_1 > \hat{p}_1 > \hat{p}_2 = 0 > \hat{q} \quad \text{or} \]
\[ (27b) \quad \hat{p}^*_1 > \hat{w} > \hat{p}_1 > \hat{p}_2 = 0 > \hat{q} \quad \text{or} \]
\[ (27c) \quad \hat{p}^*_1 > \hat{p}_1 > \hat{w} > \hat{p}_2 = 0 > \hat{q} . \]

Thus, it is possible, contrary to the standard S-S theorem, for both primary factor owners to lose, if pass-through is very partial and if the owners of the factor used intensively in producing the good that went up in price consume relatively large quantities of that good (especially the foreign variety). In this respect, one could say that firms potentially may gain at the expense of all their hired, non-produced inputs.

A parallel set of results obtains when the price of the foreign variety of the imported good 2 increases, holding the price of the foreign variety of good 1 and both tariffs constant. In this case, in which \( \hat{p}^*_2 > 0 \) and \( \hat{p}^*_1 = \hat{T}_1 = \hat{T}_2 = 0 \), the same logic as above implies that the following three sets of inequalities are possible:

\[ (28a) \quad \hat{q} > \hat{p}^*_2 > \hat{p}_2 > \hat{p}_1 = 0 > \hat{w} \quad \text{or} \]
\[ (28b) \quad \hat{p}^*_2 > \hat{q} > \hat{p}_2 > \hat{p}_1 = 0 > \hat{w} \quad \text{or} \]
\[ (28c) \quad \hat{p}^*_2 > \hat{p}_2 > \hat{q} > \hat{p}_1 = 0 > \hat{w} . \]

The condition for (28b) to apply is \( \theta_2/(\theta_{12} - \theta_{12}) < \beta_2/(1 - \alpha_2 - \beta_2) \), while the condition for (28c) to apply is \( \theta_2/(\theta_{12} - \theta_{12}) < \alpha_2 \beta_2/(1 - \alpha_2) \). Again, the factor used intensively in producing the good whose price did not change definitely loses absolutely in terms of either
consumption good, 1 or 2, while the factor used intensively in producing the good that went up in price may either gain or lose in terms of the latter good (even though it definitely gains in terms of the other good). If the pass-through is very partial, and if the factor \((N)\) used intensively in the latter good consumes a relatively large quantity of that same good (especially the foreign variety), then that factor can possibly lose (in which case both primary factors lose).

To summarize these results, we can state the following **Generalized Stolper-Samuelson-Kalecki (GSSK) theorem**: A rise in the price of the foreign variety of one good, holding the price of the other good and both tariff rates constant, has the following effects:

- The price of the home variety of the same good rises, but (assuming partial pass-through) by a smaller proportion than the rise in the price of the foreign variety, while the nominal price of the other good is unaffected;

- The mark-up rate rises in the industry that produces the good which increased in price, and the profit share also rises in that sector, while the mark-up and profit share in the other sector are unchanged;

- The average profit share for the whole economy increases, and the increase is greater the more that resources are reallocated to production of the good that went up in relative price;

- The real price (wage or rent) of the primary factor used intensively in the good whose price did not increase definitely falls, measured in terms of either good, but

- The real price (wage or rent) of the factor used intensively in the good whose price increased may either rise or fall; it definitely rises in terms of the other good, but it may either rise or fall in terms of the home and foreign varieties of the good that went up in price; the more partial the pass-through into the domestic price, the greater the likelihood that this factor will lose in terms of the good in which it is intensively used—in which case, the overall gains or losses to that factor depend on the composition of its owners’ consumption bundle.

The GSSK theorem is illustrated in Figure 2 for a rise in the foreign price of good 1. If, as in the conventional S-S analysis, the goods were perfect substitutes (so there was no partial pass-through) and the goods markets were perfectly competitive (implying zero profits), then the foreign price curves \(p_1^*\) and \(p_2^*\) would also represent unit factor costs in the home country. If \(p_1^*\) rises to \(p_1'\) while \(p_2^*\) remains constant, factor prices would shift from the levels marked by a
superscript “0” to the levels marked by a superscript “3,” and the proportional rise in \( w \) (from \( w^0 \) to \( w^3 \)) would be greater than the proportional rise in \( p_1^* \), signifying a definite magnification effect for the factor used intensively in the good whose price increased (\( L \) in this example).

**Figure 2.** Effects of an increase in the foreign price with partial pass-through compared with full pass-through

However, with positive (but flexible) profit mark-ups and partial pass-through of the foreign price increase for good 1, the home country prices \( p_1 \) and \( p_2 \) would differ from the foreign prices \( p_1^* \) and \( p_2^* \) (home prices are not shown in Figure 2 to avoid cluttering the diagram), and the unit cost curves would be at the levels \( c_1 \) and \( c_2 \) (which must be below the
home price curves, although they could be either above or below the foreign price curves). Assumption of partial pass-through, the unit cost curve for industry 1 shifts up (from \( c_1 \) to \( c_1' \)) by a smaller proportion than the rise in either \( p_1 \) or \( p_1^* \) (compare equations 13 and 15, and note that \( A_1 < 1 - \beta_1 \)). Then, when \( w \) rises from \( w_1 \) to \( w_2 \), even though this change in \( w \) is proportionally greater than the change in \( c_1 \), we cannot be sure whether the change in \( w \) is proportionally greater or less than the changes in \( p_1 \) and \( p_1^* \). The result is what we call an “attenuated Stolper-Samuelson effect” (the smaller shift from \( w_1 \) to \( w_2 \)) instead of the “traditional Stolper-Samuelson magnification effect” (the larger shift from \( w_0 \) to \( w_3 \)), and the former occurs because owners of firms that produce the good that went up in price take advantage of the price increase to raise their mark-ups, and hence do not pass the entire price increase through to their hired factors \( L \) and \( N \). The more partial is the pass-through, the smaller will be the shift in \( c_1 \), and hence the greater is the likelihood that \( L \)-workers could lose in terms of good 1.

### 4.2 Reciprocal Trade Liberalization

Suppose that there are equal-proportional tariff reductions in the home and foreign countries, i.e.,

\[
\hat{T}_1^* = \hat{T}_2 = \hat{T} < 0; \quad \text{for simplicity, the prices of the foreign varieties do not change (} \hat{p}_1^* = \hat{p}_2^* = 0)\).
\]

Clearly, from (13) and (14), the changes in the home prices are

\[
\hat{p}_1 = -(1 - \beta_1)\hat{T} > 0
\]

\[
\hat{p}_2 = (1 - \beta_2)\hat{T}.
\]

It is also easy to see from (17) and (18) that, provided there is partial pass-

---

49 In drawing Figure 2 we have assumed that the domestic unit factor cost curves are below the foreign price curves, although this is not strictly necessary if home varieties are superior in quality. What is critical to the analysis here is that the shifts in the unit cost curves are proportionally smaller than the shifts in the corresponding price curves.

50 If the foreign producers also have partial pass-through of the tariff changes, they will adjust the prices of their varieties to the tariff reductions. In that case, what would matter to the home country would be the net changes in the tariff-adjusted foreign prices, \( \hat{p}_1^* - \hat{T}_1^* \) and \( \hat{p}_2^* + \hat{T}_2^* \). A broader analysis incorporating both home and foreign partial pass-through simultaneously in two large countries will be the subject of a future extension of this paper.
through in both sectors ($\beta_j > 0, j = 1,2$), the mark-up rate (and profit share) will rise for firms in industry 1 (the export sector) and fall in industry 2 (the import-competing sector). If either sector has full pass-through ($\beta_j = 0$), then the mark-up in that sector will not change.

Using (25) and (26), the changes in the prices of the primary factors in response to the equal-proportional tariff reductions in this situation can be reduced to

$$
\hat{w} = \frac{-\left(A_N \theta_{N2} + A_2 \theta_{N1}\right)}{\theta_{N2} - \theta_{N1}} > 0
$$

and

$$
\hat{q} = \frac{\left(A_2 \theta_{L1} + A_1 \theta_{L2}\right)}{\theta_{L1} - \theta_{L2}} < 0
$$

Thus, factor $L$ definitely gains relative to the other factor $N$, but with both goods prices changing, it is not obvious whether real factor prices (wages and rents) rise or fall in terms of both goods (as implied by the S-S magnification effect) or not. Since the prices of the foreign varieties are held constant here, we focus on the real factor prices in terms of domestic goods. Evidently, the real price of the factor used intensively in export goods in terms of the imported good ($w/p_2$ in this example) rises and the real price of the factor used intensively in import-competing production in terms of the exported good ($q/p_1$ in this example) falls. However, it is not clear whether the changes in real factor prices are “absolute” or magnified, in the sense that the price of each factor rises or falls in terms of the good in which it is used intensively, i.e., does $w/p_1$ increase and does $q/p_2$ decrease? This depends on the degree of partiality of the pass-through of the tariff reductions in the industry in which each factor is used relatively intensively.

Whether $w/p_1$ increases depends on whether

$$
\hat{w} = \frac{-\left(A_N \theta_{N2} + A_2 \theta_{N1}\right)}{\theta_{N2} - \theta_{N1}} > 0
\quad \hat{p}_1 = -(1 - \beta_1)\hat{T}
$$
or \( \frac{A_2 \theta_{N2} + A_2 \theta_{N1}}{\theta_{N2} - \theta_{N1}} > 1 - \beta_1 \), which (using the definition of \( A_1 \)) boils down to \( \frac{\alpha_i \beta_i \theta_{N2}}{1 - \alpha_i} < (A_2 + 1 - \beta_i) \theta_{N1} \) or, equivalently, \( (A_2 + 1 - \beta_i)(1 - \alpha_i)/\alpha_i \beta_i > \theta_{N2}/\theta_{N1} > 1 \). In general, if both sectors have partial pass-through (so that \( \beta_i > 0 \) and \( 0 < A_2 < 1 \)), it is not obvious whether these inequalities hold or not, but it is easily seen that these inequalities must hold in the special case of full pass-through in sector 1 (i.e., \( \beta_i = 0 \)). Thus, the more that \( \beta_i \) exceeds 0, i.e., the more partial is the pass-through in the sector in which \( L \) is used intensively, and the higher is the ratio \( \theta_{N2}/\theta_{N1} \) (i.e., the wider the gap in factor intensities between the two sectors), the greater is the likelihood that these inequalities will be reversed and \( w/p_1 \) will decrease. In the latter situation, whether \( L \)-workers gain or lose will depend on their consumption bundle, contrary to the S-S result in which it does not matter which goods the factor owners consume.

Similarly, whether \( q/p_2 \) falls depends on whether

\[
\hat{q} = \frac{(A_2 \theta_{l1} + A_2 \theta_{l2}) \hat{T}}{\theta_{l1} - \theta_{l2}} < (1 - \beta_2) \hat{T}_2
\]

which is equivalent to \( \frac{(A_2 \theta_{l1} + A_2 \theta_{l2}) \hat{T}}{\theta_{l1} - \theta_{l2}} > 1 - \beta_2 \), or \( \frac{\alpha_2 \beta_2 \theta_{l1}}{1 - \alpha_2} < (A_1 + 1 - \beta_2) \theta_{l2} \), or

\( (A_1 + 1 - \beta_2)(1 - \alpha_2)/\alpha_2 \beta_2 > \theta_{l1}/\theta_{l2} > 1 \). If sector 2 has full pass-through (so \( \beta_2 = 0 \)) then this inequality definitely holds, and \( q/p_2 \) necessarily falls; otherwise, the higher is \( \beta_2 \) (i.e., the more partial the pass-through in the sector which uses \( N \) intensively), and the higher is the ratio \( \theta_{l1}/\theta_{l2} \) (i.e., the greater the gap in factor intensities), the more likely that this inequality could be reversed and \( q/p_2 \) would rise (in which case, the real gains or losses to factor \( N \) would depend on its owners’ consumption bundle).

Thus, we can state the following corollary to our GSSK theorem for reciprocal trade.
**liberalization**: Equal proportional reductions in the foreign tariff on home exports and the home tariff on imports, holding foreign prices constant, have the following effects:

- The price of the home variety of the export good rises and the price of the home variety of the imported good falls, but (assuming partial pass-through) by a smaller proportion than the change in the tariff;

- The mark-up rate rises in the export industry and falls in the import-competing industry, unless either industry has full pass-through in which case there is no change in its mark-up;

- The profit share also increases in export production and falls in import-competing production (again, assuming partial pass-through); the change in the economy-wide average profit share depends on the relative weights of the two sectors in aggregate value added, but the weights are likely to shift in favor of the export good (for which the profit share increased) to the extent that resources are reallocated to that sector;

- The primary factor used intensively in the export industry gains *relative* to the primary factor used intensively in the import-competing industry, and the former factor definitely gains absolutely in terms of the imported good while the latter factor definitely loses absolutely in terms of the export good.

- The existence of S-S magnification effects depends on the degree of pass-through of the tariff reductions to domestic prices—the greater the pass-through (i.e., the less partial) in each sector, the greater is the likelihood of a magnification effect for the factor used intensively in that sector. If pass-through is sufficiently partial in either sector, then the factor used intensively in that sector may not have a magnification effect, and its real gain or loss will depend on its owners’ consumption bundle.

These effects of reciprocal trade liberalization are illustrated in Figure 3. The domestic price of good 1 rises while the domestic price of good 2 falls, and the unit factor costs shift in the same direction as the price for each good but (assuming partial pass-through) by a smaller proportion. The changes in factor prices with positive mark-ups and partial pass-through (from $w^1$ to $w^2$ and from $q^1$ to $q^2$) are smaller than they would be, if mark-ups were zero and there was full pass-through (from $w^0$ to $w^3$ and from $q^0$ to $q^3$). Although it may not be apparent from this diagram, it is mathematically possible (as shown above) for the increase from $w^1$ to $w^2$ to be proportionally smaller than the increase in the price of good 1 (from $p_1$ to $p_1'$) and for the decrease from $q^1$ to $q^2$ to be proportionally smaller than the decrease in the price of good 2 (from...
This would require a relatively large difference in factor intensities between the two sectors (so that $c_1$ would be much steeper than $c_2$) and relatively little (very partial) pass-through (so that the shifts in $c_1$ and $c_2$ would be very small).

**Figure 3.** Simultaneous trade liberalization in both industries with partial pass-through

To summarize, if there is partial pass-through of changes in tariffs or foreign prices, then those changes are partially absorbed by changes in profit mark-ups, thereby diminishing the impact on the unit costs of the primary factors of production, and hence attenuating the effects on the prices of those factors. If the pass-through is sufficiently partial in any given sector of the economy, then the factor used intensively in that sector may not experience a S-S magnification effect in response to a change in either tariff rates or foreign prices, and the gains or losses to that factor will depend on the consumption bundle of its owners. In fact, it is possible, if mark-ups are
sufficiently flexible (i.e., pass-through is very partial), for owners of firms in industries whose prices rise to gain at the expense of owners of both primary factors.

5. Trade in Intermediate Goods, Outsourcing, and Globalization

As noted in section 2, some of the impact of international trade on prices of primary factors may come through “outsourcing,” i.e., vertical trade in intermediate inputs, within a given industry. This section briefly addresses how the analysis of trade with imported intermediate goods can be modified to incorporate profits modeled as oligopolistic rents determined by a mark-up, similar to the analysis in the previous section. Although there are many ways of modeling intermediate goods, we use a very simple model from Feenstra (2004, pp. 106-11) in which there is one final good, \( z \), that is produced using inputs of two intermediate goods, 1 and 2 (for simplicity, no other inputs are used in final goods production).\(^{51}\) The intermediate goods in turn are produced using only inputs of the primary factors \( L \) and \( N \).\(^{52}\)

Home and foreign intermediate goods are assumed to be perfect substitutes in production and to be sold in perfectly competitive markets, while—and here we differ from Feenstra—the final good is assumed to be nationally differentiated and produced by oligopolistic firms with

\(^{51}\) It is important to think of the “final goods” sector as including the services of distribution, warehousing, and retailing, which are necessary to bring products to final consumers (but usually forgotten in trade models). In many product lines, the cost of the (imported) manufactured article is a relatively small percentage of the retail price (see Pollin, Burns, and Heintz, 2004). Heintz (2006) demonstrates theoretically how companies with significant market power and brand-name identification can capture some of the gains from outsourcing (i.e., decreased prices of imported manufactured articles), thereby only partially passing-through the gains to consumers. In a sense, many manufactured consumer products are merely intermediate inputs for the retailers who ultimately sell them, following massive sales efforts (packaging, advertising, etc.), at grossly inflated, heavily marked-up prices.

\(^{52}\) Feenstra’s original model also includes capital \( K \) as an input into intermediate goods, but it is irrelevant to his results since he assumes that the cost share of \( K \) is the same in both intermediate industries (i.e., \( \theta_{k1} = \theta_{k2} \)) so we simplify and omit \( K \). Feenstra’s approach is used instead of Steedman’s to avoid the conundrums about prices of intermediate goods that inevitably arise (regardless of whether there are positive or zero profits) when intermediate goods are modeled as being used in each other’s production. As discussed earlier, Steedman (2005) showed that those complexities do not alter effects of changes in intermediate goods prices on the prices of the primary factors.
positive mark-ups.\textsuperscript{53} Both final goods and intermediate goods are traded and, for simplicity, we assume free trade with no tariffs or other barriers. Thus, the prices of home and foreign varieties of intermediate goods 1 and 2 must be equal (i.e., \( p_1 = p_1^* \) and \( p_2 = p_2^* \)), but the prices of home and foreign varieties of the final good \( z \) may differ (\( p_z \neq p_z^* \) in general).

The production functions are as follows:

\[
y_z = f_z(y_1 - x_1, y_2 - x_2) \quad (31)
\]

\[
y_j = f_j(L_j, N_j), \quad j = 1, 2 \quad (32)
\]

where \( x_j \) is net exports of intermediate good \( j \). The price-cost equation for final goods incorporates a positive profit mark-up \( \phi_z > 0 \),

\[
p_z = (1 + \phi_z)[p_1 a_{1z} + p_2 a_{2z}] = (1 + \phi_z) c_z(p_1, p_2), \quad (33)
\]

while the price-cost equations for the intermediate goods reflect the zero profit assumption

\[
p_j = w a_{ij} + q a_{xj} = c_j(w, q), \quad j = 1, 2. \quad (34)
\]

Assuming free trade in intermediate goods in a small, price-taking country, the home prices of intermediates are pinned down by the prices of the foreign perfect substitutes (recall \( p_1 = p_1^* \) and \( p_2 = p_2^* \)), and these in turn uniquely determine the unit factor cost of producing final goods, \( c_z(p_1^*, p_2^*) \). The profit mark-up on final goods is variable, however, and final goods producers have to take into account both their unit factor cost \( c_z \) and the price of the foreign variety \( p_z^* \) in setting their mark-ups or, equivalently, their prices (in relation to those costs).

In this setting, having both a pass-through equation like (5) or (6) and a mark-up equation like (7) or (8) for the final goods sector would overdetermine the model. We can use either type of equation, however, and we use a mark-up equation similar to (7) or (8) assuming that final

\textsuperscript{53}Here we assume as a “stylized fact” that markets for final goods are more oligopolistic, and involve more differentiated products, than markets for intermediate goods, and hence as a simplification we assume that the latter are perfectly competitive. The analysis could of course be modified to allow partial pass-through in intermediate goods.
goods producers take account of both foreign prices and home unit costs in setting home prices:

\[(1 + \phi_z) = \Phi_z (p_z^*/c_z)^{\alpha_z}, \quad \Phi_z \geq 1, \quad 0 \leq \alpha_z < 1.\]

Combining (33) and (35), the price of home final goods is a geometrically weighted average of the foreign price of final goods and domestic unit costs (of intermediate inputs):\(^{54}\)

\[p_z = \Phi_z p_z^* \left[ c_z (p_1^*, p_2^*) \right]^{1-\alpha_z} = \Phi_z p_z^* \left[ p_{1z}^* + p_{2z}^* \right]^{1-\alpha_z}.\]

In effect, (36) is a reduced-form solution for the price of domestic final goods, since all the (foreign) prices on the right-hand side are exogenously given in a small country, and (35) easily becomes a reduced form solution for the mark-up once we substitute the unit factor costs and world prices of the intermediate goods:

\[(35') \quad (1 + \phi_z) = \Phi_z \left[ p_z^*/[c_z (p_1^*, p_2^*)] \right]^{\alpha_z} = \Phi_z \left[ p_z^*/[p_{1z}^* + p_{2z}^*] \right]^{\alpha_z}.\]

Converting to growth rates and assuming that \(\Phi_z\) is a constant, the solution for the change in the mark-up can be written as

\[(37) \quad \dot{\phi}_z = \alpha_z \left[ \dot{p}_z^* - (\theta_{1z} \dot{p}_1^* + \theta_{2z} \dot{p}_2^*) \right],\]

where \(\theta_{iz}\) is the share of intermediate input \(i\) in the unit cost of final good \(z\), and \(\theta_{1z} + \theta_{2z} = 1\).

Now, suppose that, as a result of the entry of several large, \(L\)-abundant countries into the global economy, the world price of the (less skilled) labor-intensive intermediate good \(p_1^*\) falls. Assuming (initially) that the world price of final goods stays constant,\(^{55}\) the fall in the world price of the \(L\)-intensive intermediate good (\(\dot{p}_1^* < 0\)) necessarily increases the mark-up in the home final goods industry in the proportion \(-\alpha_z \theta_{1z} \dot{p}_1^* > 0\). Thus, “outsourcing” is a simple and direct way for domestic firms that produce final goods to increase profit margins, providing that

---

\(^{54}\) Under conventional neoclassical assumptions, the input-output coefficients for the final good are also uniquely determined by the world prices of the intermediate inputs, \(a_{1z} = a_{1z}(p_1^*, p_2^*)\) and \(a_{2z} = a_{2z}(p_1^*, p_2^*)\).

\(^{55}\) The case in which the world price of final goods also falls will be discussed below.
they have sufficient oligopoly power not to fully pass-through the cost savings to consumers.  

With regard to the primary factors, it is easy to see that the fall in $p_1^*$ must also redistribute income relatively in favor of $N$ and against $L$. Converting the two equations (34) into growth rate form and subtracting one from the other, we obtain

$$
(38) \quad \hat{p}_1 - \hat{p}_2 = (\theta_{L1} - \theta_{L2})\hat{w} - (\theta_{N2} - \theta_{N1})\hat{q} = (\theta_{L1} - \theta_{L2})(\hat{w} - \hat{q})
$$

since (assuming intermediate good 1 is $L$-intensive) $\theta_{L1} - \theta_{L2} = \theta_{N2} - \theta_{N1} > 0$. This then solves for the change in the relative factor price:

$$
(39) \quad \hat{w} - \hat{q} = \frac{\hat{p}_1 - \hat{p}_2}{\theta_{L1} - \theta_{L2}}
$$

which will be negative, since (in this example) $\hat{p}_1 < 0$ and $\hat{p}_2 = 0$.  

The preceding analysis assumes that the world price of final goods $p_z^*$ remains constant when the world price of the $L$-intensive intermediate good $p_1^*$ falls. If globalization also reduces $p_z^*$, then according to (37) the net effect on the profit mark-up will depend on the relationship between $\hat{p}_1^*$ and $\hat{p}_z^*$. If the world prices of final goods and $L$-intensive intermediate goods fall by equal percentages, then mark-ups on final goods will be squeezed rather than increased. Generally, if $\hat{p}_z^* < \theta_{L1}\hat{p}_1^* < 0$, then the mark-up will fall, while if $\theta_{L1}\hat{p}_1^* < \hat{p}_z^* < 0$, then the mark-up will rise. Note that, for all these results, it is not necessary to assume whether the small country experiencing these effects is an exporter or importer of either the intermediate good 1 or the final good $z$; it is sufficient that the country produces those goods in a free-trade equilibrium.

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56 This result is similar to the hypothesis of Milberg (2007, p. 2) that “the enormous expansion of global value chains has brought a lowering of input costs to lead firms, allowing them to maintain and even increase cost markups, and thus profit rates, even during a period when domestic (U.S.) product market prices were not moving upward at historical rates.”

57 Here we follow Feenstra (2004, pp. 109-10), but ignoring his capital input $K$.

58 We do not bother with the S-S-type matrix analysis here, because we have no need to determine how the changes in $w$ and $q$ relate to changes in the prices of goods 1 and 2, since in the present case the latter are intermediate goods that are not consumed directly by factor owners.
This analysis can be summarized in the following “fundamental theorem of globalization”:

Holding other factors (including world prices of final goods) constant, a fall in the world price of less-skilled-labor-intensive intermediate inputs will lead to higher profit mark-ups (and a higher profit share) and redistribute income (relatively) against less-skilled labor and in favor of other factor owners (skilled workers and/or natural resource owners) in all countries that are open to trade, regardless of whether those countries are importers or exporters of the less-skilled-labor-intensive intermediate goods. The same qualitative effects will result even if the price of the finished good also falls, provided that its price falls by less than the decrease in the price of the less-skilled-labor-intensive intermediate input multiplied by its share in the cost of the finished good.

Stated in other words, outsourcing of less-skilled-labor-intensive intermediate inputs leads to an upward redistribution of income away from less-skilled workers and toward both corporate profits and higher-income factor owners (more skilled labor or landowners).

This could explain why income distribution has shifted in favor of both profits and more-skilled wages and against less-skilled wages in both countries that import less-skilled-labor-intensive intermediate goods (such as the United States) and countries that import them (such as Mexico). Of course, this result obtains only when the world price of the final good does not fall by a sufficient degree to offset the competitive benefits for domestic firms that produce final goods. However, any squeezing of domestic profit mark-ups as a result of lower foreign prices of final goods—especially ones that are intensive in less-skilled labor—only increases the incentive for domestic firms to outsource more of their intermediate inputs from countries with lower less-skilled wages, w.

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59 See, for example, Mishel, Bernstein, and Allegretto (2006) on increasing wage inequality in the United States, and Revenga and Montenegro (1998) and Hanson (2004) on the same phenomenon in Mexico. Chiquiar 2008 offers some contrary evidence on Mexico, but his results (showing rising relative wages of less-skilled workers) are confined to workers in the border region with the United States and his measures of exposure to globalization do not include the relative price changes emphasized in the S-S theorem.
6. Conclusions: Implications, Limitations, and Extensions

The analysis in this paper has significant implications for the political economy of protectionism and trade liberalization. As in a standard S-S analysis, we would expect owners of (primary, non-produced, non-capital) factors of production to be more favorably inclined toward protectionism if their factor is used relatively intensively in an import-competing activity, and more favorably inclined toward free trade if their factor is used more intensively in an export industry. However, after including the effects of partial pass-through of tariff changes on the profits of firms, we find that these interests of the primary factor owners may be muted or even possibly reversed for factors (a) that are used intensively in industries with very partial pass-through, and (b) whose owners consume large amounts of the good in which they are intensively used. Thus, the existence of partial pass-through of changes in tariffs (or foreign prices) transforms the model more in the direction of a specific factors model, in which the returns to the mobile factor(s) may depend on consumption patterns.

The above considerations apply only to the income of primary, non-produced factors, such as different types of natural resources or skill grades of labor. In contrast, the interests of business owners are aligned solely with whether their firms produce exported or import-competing goods, rather than which industry is more “capital-intensive.” Trade liberalization is likely to reduce profits for firms in import-competing industries and increase profits for firms in export industries, regardless of the capital intensity of these industries. This result also resembles the outcome in a specific factors model in which particular types of capital equipment are immobile in each industry (export and import-competing). In the specific factors model, the owners of industry-specific factors gain from free trade if their factor is immobile in an export
industry and lose if their factor is immobile in an import-competing industry.

However, the reason why “capitalist” (firm) interests align this way in the present model is different from the reason why the same result obtains in the specific factors model. In this paper, it is oligopolistic pricing-to-market behavior that leads firms to increase mark-ups on exported goods and decrease mark-ups on import-competing goods when trade barriers are reduced. What matters is not whether the physical capital goods are specific to a particular industry (though they are likely to be), but rather how the pricing strategies that oligopolistic firms adopt in response to either favorable export opportunities or intensified import competition cause them to adjust their mark-ups. This is the Kaleckian aspect of the analysis: the distribution of income between capital and other inputs is determined by oligopolistic pricing behavior.60

This analysis leaves open the question of whether “capitalists” (business interests) in general are more likely to support protectionist or free-trade policies. Our analysis suggests that this depends fundamentally on two things: (1) the relative weight of export and import-competing industries in the national economy; and (2) the degree to which firms (in any industry, whether exporting or import-competing) can outsource key intermediate goods that can be produced more cheaply abroad. Historically, in early capitalism, such outsourcing was difficult due to “natural” barriers to trade (e.g., high costs of transportation and slow communications), and most tradable goods industries were import-competing, so capitalist classes in most countries (other than Britain, the first country to industrialize) tended to support protectionism.61 However,

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60 In the specific factors model, what drives the results for the immobile factors is the fact that their scarcity rents increase in sectors where production has to increase for export and decrease in sectors where production has to decrease because of imports. In the standard specific factors model, there is only one mobile factor while there are two specific ones, while in the present model we have two mobile factors and hence our results are somewhat of a halfway house between specific factors and S-S. Trade theory aficionados will note, however, that we effectively have a model with more factors (3) than goods (2), which generally leads to a breakdown of standard H-O results.

61 That is, they supported protectionism at home, while (like good mercantilists) favoring open markets for their exports abroad—often achieved through colonial or neo-colonial domination. Also, early industrial capitalists tended to support free importation of raw materials, which can be seen as an early form of “outsourcing” inputs.
in modern times, as export interests have gained ascendancy and outsourcing has (for various well-known reasons\textsuperscript{62}) become much easier, the preponderance of interests has shifted in favor of trade liberalization. Moreover, \textit{trade liberalization creates a self-supporting dynamic}: since liberalization induces the expansion of export activities and the shrinkage of import-competing activities, and also makes it more feasible to import intermediate goods, it tends to increase the weight of the very business interests that are likely to benefit from further liberalization. Thus, \textit{as trade liberalization causes a nation’s industrial composition to shift toward export industries, the interests of capitalists (firm owners) as a group become more and more identified with further liberalization policies.}

This approach can therefore help to explain why capital owners in a wide range of countries and sectors today often support trade liberalization policies, aside from occasional sector-specific pleadings for protection or subsidies. Corporate business interests are the \textit{main} supporters of “free trade” policies \textit{globally} today, in many capital-scarce developing countries as well as in capital-rich industrial countries\textsuperscript{63}. This is contrary to all traditional views in which owners of capital should have opposite interests in different countries, depending on whether the countries export manufactured or agricultural products (Ricardo), the countries’ export industries are capital- or labor-intensive (H-O), or capital is immobile in export versus import-competing industries (specific factors). In contrast, the policy positions of primary factors such as labor and landed interests more often align with factor endowments and intensities (for example, American

\textsuperscript{62} These reasons include the industrial development of lower-wage, developing countries and the revolutions in communications, transportation, and information technology that have facilitated offshore production, all of which have been accelerated by the global mobility of capital and technology, in addition to the trade liberalization policies that have been adopted by most nations.

\textsuperscript{63} For example, it was big business groups in Canada, the United States, and Mexico that lobbied for free trade agreements (FTAs) among these countries, in spite of the supposed scarcity of capital in Mexico and the fact that Canada is land- (not capital-) abundant. Of course, there are still individual industries in these countries in which firms seek protection, such as the U.S. steel and lumber industries, but the preponderance of business interests was in favor of the FTAs in all three countries.
unions and European farmers tend to be protectionist).

In recent times, when most countries have much lower trade barriers and more open markets than in the past, attention has shifted away from the effects of trade liberalization per se toward the effects of changes in global market conditions on countries that are already open to trade—which may be interpreted as “globalization” effects. In this spirit, we have emphasized throughout this paper that our analysis can be applied to the effects of changes in world prices on the distribution of income in a small country with free trade, as well as the effects of changes in tariff rates in countries that have tariffs in place. Generally speaking, lower world prices of final goods that are intensive in less-skilled labor reduce profit mark-ups in industries that use less-skilled labor more intensively, and also redistribute income away from less-skilled workers and toward more-skilled labor or land owners. The negative effect on profits, however, creates an incentive to outsource intermediate goods that are intensive in less-skilled labor, and as long as world prices of the final goods fall by less than a certain proportion of the fall in world prices of the intermediate goods, this outsourcing enables finals goods producers to restore their profit mark-ups, while continuing to put downward pressure on the wages of the less-skilled workers.

The analysis in this paper was conducted with simple models that were intended to showcase the core logic of combining a Kaleckian view of profits with a S-S approach to the prices of primary factors. Thus, the analysis is limited in several key respects, which imply the need to extend the paper in various directions. We used a two-good, two-factor HOS framework for

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64 For example, Johnson and Stafford (1993) showed that, in a Ricardian model with three commodities in which the countries are incompletely specialized in one of the commodities, a technological improvement in the incompletely specialized sector in one country will lower the real wage in the other country. Samuelson (2004) generalized Johnson and Stafford by analyzing a variety of cases in which a foreign technological improvement can lower a home country’s welfare by diminishing the latter’s gains from trade. Feenstra and Hanson (1996, 1997) analyzed how international movements of capital can shift the distribution of income in favor of relatively more skilled labor in both the parent and host counties, when there is a continuum of labor skills and the movement of capital leads to a shift of medium-skilled jobs to the lower-wage country. Gomory and Baumol (2000) analyzed how trade with increasing returns to scale can generate multiple free-trade equilibria, giving rise to a zone of conflicting interests for countries with relatively similar industrial structures. See Palley (2006) for a review of some of this literature.
expository purposes, but the model could be extended to a multi-good, multi-factor HOV framework to be made more empirically relevant. The model assumed a small, price-taking country, but the analysis needs to be extended to two (or more) large countries in which the home country’s trade policies can affect foreign prices (so that, for example, we can incorporate partial pass-through of home country tariffs into foreign export prices). The model assumed that primary (non-capital) factor markets were perfectly competitive, but the case in which some factor prices (e.g., of various types of labor) are determined by bargaining power also needs to be considered. Although we did not assume identical technology between the home country and the rest of the world, neither did we explicitly model the nature of the international differences in technology or the effects of different types of technological change on income distribution.

At the microeconomic level, we assumed fixed parameters (constant elasticities) to represent the partial pass-through and flexible mark-up behavior of the firms. Although these constant-elasticity behavioral propensities were not derived from strict optimizing behavior, they capture the results of previous modeling exercises involving both optimizing and rule-of-thumb behavior. Nevertheless, the behavioral underpinnings of these relationships (optimizing or otherwise) could be further explored. In terms of the macroeconomic “closure,” the modeling framework in this paper assumes full (or fixed) employment of the primary factors and ignores linkages between international trade and finance, including the international capital flows and trade imbalances. In effect, these are pure “barter” models of trade. In future work, we intend to explore other macroeconomic “closures” that could enable interactions between the trade and financial sides of international economic relations, and highlight the possibility of trade following absolute advantages in monetary costs rather than comparative advantages in relative costs.

Finally, this paper implies certain testable hypotheses for empirical research on how
international trade affects income distribution. Preliminarily, we might suggest the following testable implications of the present models ("factors" here always means primary factors):

- The profit share should increase in industries where prices of competing foreign products rise and decrease in industries where prices of competing foreign products fall, and the degree to which this occurs should be correlated with the degree to which the pass-through of changes in foreign prices (or tariff rates or exchange rates) is partial;

- S-S effects should be stronger for factors that are used intensively in industries with more full pass-through, and weaker for factors that are used intensively in industries with more partial pass-through.

- The predictive power of a multi-factor S-S model should be enhanced by not treating capital in the same way as other factors, and instead modeling effects of trade on profits by the extent of pass-through (and adjustment of mark-ups) in an industry.

- Changes in world prices of final and intermediate goods that use less-skilled labor intensively should have symmetrical effects on factor prices (wages and/or rents), but opposite effects on profits of final goods producers.
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