

(i) The technical progress associated with the automation of the economy and the new economy can also affect relative wages.

*Table 1: changes in relative incomes of first, fifth and ninth deciles
 1979-1989 various advanced countries (D1 is lowest)*

Country	d9/d5	d5/d1	d9/d1
USA	12.0%	11.0%	24.3%
UK	9.0%	5.0%	14.5%
Canada	3.0%	8.0%	11.2%
New Zealand	4.0%	5.0%	9.2%
Japan	5.0%	0.0%	5.0%
Australia	2.0%	2.0%	4.0%
Finland	3.0%	0.0%	3.0%
Austria	2.0%	0.0%	2.0%
Germany	1.0%	-12.0%	-11.1%
Italy	-3.0%	-23.0%	-25.3%

Source: Slaughter 1999.

(ii) As the table shows, the increase in inequality is largely an Anglo-Saxon phenomenon. However, Continental Europe has mostly experienced sharp rises in unemployment, leading Davis (1997) and others to argue that they have suffered similar trade and/or technological shocks, but their inflexible labour markets mean unemployment has risen rather than unskilled wages falling.

(iii) Most studies that analyze "the marked change in inequality in the United States or the United Kingdom - whether using a price-based approach or an alternative analysis of content - concluded that technical change had a greater impact than trade. Nevertheless, there are still major systematic problems in these works.

❖ The Stolper-Samuelson Theorem

a- Birth of a theorem

According to Samuelson (1994), cooperation on Wolfgang Stolper's efforts to reconcile the new general business theory with the work of former economists has arisen: "How can Haberler and Tosip be right in the necessary damage to multi-factor factors such as the work of US tariffs, In the long run, free trade will increase the demand for relative goods in the country, and thus divert labor to the labor market. To local industries, where labor is more productive, and classical economists typically lack a single working model or, equally, that production factors are used in varying proportions both within and between industries, and in both cases, trade can not have redistribution effects within Although the teachers and citizens of Samuelson recognized the impact of the change in the ratio of factors to income shares, their analyzes were based on a partial equilibrium model of a protected industry. Goods from Supposed to be the biggest. Thus, real wages were expected to rise, at least in terms of imported goods, and most likely in general, although the impact would depend on the relative importance of exported goods exported in total labor expenditures⁽¹⁾. The General Trade Theory of the General Budget presented by Elie Hecker and Beryl O'Haleen opened a new investigative line that focuses on differences in the intensity of relative factors across industries and differences in the abundance of relative factors between countries⁽²⁾ Stolper and Samuelson adopted this approach and adopted the standard Hachser-Ohlin terminology now to refer to the proposition that "each country will export those goods that are produced by relatively abundant production factors and will import those goods where relatively rare factors are important..

⁽¹⁾ Stolper and Samuelson provide illustrative quotations and references. One quote from Haberler rejects the possibility of equalization of wages across countries unless labor is internationally mobile. As of 1941, Stolper and Samuelson agreed, noting that "there will be a tendency—necessarily incomplete—toward an equalization of factor prices" due to trade. A few years later, however, Samuelson (1948, 1949) would show that, under stipulated conditions, free trade alone is sufficient to equalize factor prices. A footnote to Samuelson (1949) indicates that Abba Lerner presented essentially the same result in a 1933 paper prepared for a seminar at the London School of Economics. Perhaps due to Samuelson's acknowledgment, the paper was finally published as Lerner (1952).

⁽²⁾ Ohlin's landmark treatise was published by Harvard University Press in 1933. The basic work by Heckscher and by his student Ohlin had been available a decade earlier, but only in Swedish. Heckscher's seminal 1919 article.

b-The Stolper-Samuelson analysis

Formalizing the logic of the Heckscher-Ohlin model, Stolper and Samuelson assumed two homogeneous goods **A** and **B**, each produced under constant returns to scale using labor **L** and capital **K**, but with good **A** using more capital relative to labor than good **B**. The two factors were assumed fixed in total supply but freely mobile between the country's two industries:

$$L_A + L_B = \bar{L} \text{ and } K_A + K_B = \bar{K}.$$

The two full-employment conditions together imply that the economy's overall capital-labor ratio k can be expressed as the weighted average of the capital-labor ratios k_A and k_B used in the two industries:

$$\lambda_A k_A + \lambda_B k_B = \bar{k},$$

where $\lambda_A = L_A / \bar{L}$ and $\lambda_B = L_B / \bar{L}$ are the shares of the total labor supply used in the two industries, $\lambda_A + \lambda_B = 1$. Thus, as the production mix moves toward specialization in good **A** and λ_A approaches unity, the capital-labor ratio used in **A** production must fall toward \bar{k} .

Factor mobility and perfect competition together imply that the equilibrium factor returns w and r are equal across industries, and the return to each factor is equal to the value of its marginal product in that industry:

$$w = p_A \frac{\partial A}{\partial L_A} = p_B \frac{\partial B}{\partial L_B}, \quad r = p_A \frac{\partial A}{\partial K_A} = p_B \frac{\partial B}{\partial K_B}.$$

The ratio of the marginal physical products of the two factors must therefore be equal across industries:

$$\frac{\partial A / \partial K_A}{\partial A / \partial L_A} = \frac{\partial B / \partial K_B}{\partial B / \partial L_B}.$$

Stolper and Samuelson used an Edgeworth-Bowley box diagram to represent the model geometrically. Each point in the box represents a feasible full-employment allocation of the factors between the two industries⁽³⁾.

⁽³⁾ This appears to be the first use of the Edgeworth-Bowley box to analyze efficient production—earlier uses of the diagram had dealt with efficiency in exchange.

Points along the contract curve indicate alternative efficient allocations of the two factors between industries and thus alternative efficient output combinations for the economy, with a one-to-one correspondence between points on the contract curve and points on the economy's production possibility frontier. At the corners of the box representing specialization in one of the two products, the capital-labor ratio in the industry of specialization must equal the country's overall capital-labor ratio. In between, where both goods are produced, the capital-labor ratios in the two industries change systematically, with both falling monotonically as the economy moves from production only of labor-intensive **B** toward production only of capital-intensive **A**. as a consequence of the changing capital-labor ratios in the two industries, the physical marginal product of labor must fall, and the physical marginal product of capital must rise, in both industries as the economy produces more **A** and less **B**. The actual output combination produced depends on the relative price P_A/P_B although their original motivation was to shed new light on the effect of protection on wages, Stolper and Samuelson avoided further consideration of the details of trade by focusing on the resulting change in the domestic relative price of the goods⁽⁴⁾. Their result is thus applicable to a change in relative price that occurs for any other reason. Trade would reduce the relative price of the import-competing good, which by the Heckscher-Ohlin theorem was assumed to be labor-intensive **B** for the United States, a labor-scarce country⁽⁵⁾. The lower relative price of good **B** would cause a shift in the economy's production toward good **A**—a movement along the production possibility frontier and the contract curve in the Edgeworth-Bowley box. If each industry were to use the same factor proportions as before, the change in output mix would raise the country's total demand for capital and reduce its total demand for labor. Given fixed total factor supplies and full employment of both factors before and after the rise in relative price of good **A**, the new output mix would thus be feasible only if both industries were now to employ a lower capital-labor ratio, or equivalently, if there was a rise in the rental-wage ratio facing the firms in both industries. These lower capital-labor ratios imply a lower marginal physical product of labor in both industries and thus an unambiguously lower real wage (and higher real rental) measured in terms of *either* good. This outcome is independent of the pattern of consumption.

⁽⁴⁾Samuelson (1939) used the same simplification in examining a country's gains from trade.

⁽⁵⁾This was of course long prior to Leontief (1954) and illustrates the ready acceptance by international economists of the empirical validity of the Heckscher-Ohlin theory.

❖ **Wages, technology, endowments and trade in a competitive general equilibrium**

In order to see how Stolper-Samuelson changes the determination of relative wages, we start by looking briefly at general equilibrium in a closed but competitive economy. Production in industry i , Y_i is a function of technology, τ , and the employment of skilled and unskilled labour, S_i and U_i :

$$Y_i = Y_i(\tau, S_i, U_i) \quad (1)$$

Given competition, prices are equal to marginal cost (the zero profit condition), which is a function of technology and factor wages:

$$P = C(\tau, W_s, W_u) \quad (2)$$

Relative wages are a function of relative employment of the two factors,

$$W_s/W_u = W(\tau, S_i/U_i) \quad (3)$$

Factor markets are assumed to clear:

$$\begin{aligned} \sum S_i &= S; \\ \sum U_i &= U; \end{aligned} \quad (4)$$

In the simplest case, where there is just one industry with a *single representative firm*, a rise in the relative endowment of one factor can only affect wages through technical substitution in production⁽⁶⁾. The only factors which affect relative wages are endowments and factor-biased technical progress⁽⁷⁾. Figure 1, below, shows the relationship between endowments and wages in a *two-good, two factor model*, where industry 2 is more intensive in skilled labour S . The curves slope down, reflecting factor substitution within both industries. However, There is now a possibility of substitution in consumption between the two authorities, so debt default can have less impact on wages. The naive discontent shows the relationship between waif and relative wages in this case. - With two commodities, wages can also be affected by changes in tastes (the increasing rise in preference for skill-intensive good) or biased technological change in the sector, which changes the relative production costs of goods. Whether relative height

⁽⁶⁾The relevant elasticity of substitution is usually assumed to be in the order of -1.

⁽⁷⁾Factor-biased change is where, at a given factor price, the amount of one factor used relative to another changes.

productivity in industry 2 benefits relative skilled wages depends on whether the increased consumer demand for good 2 outweighs the reduction in employment per unit of production - ie if the elasticity of substitution in consumption exceeds unity.

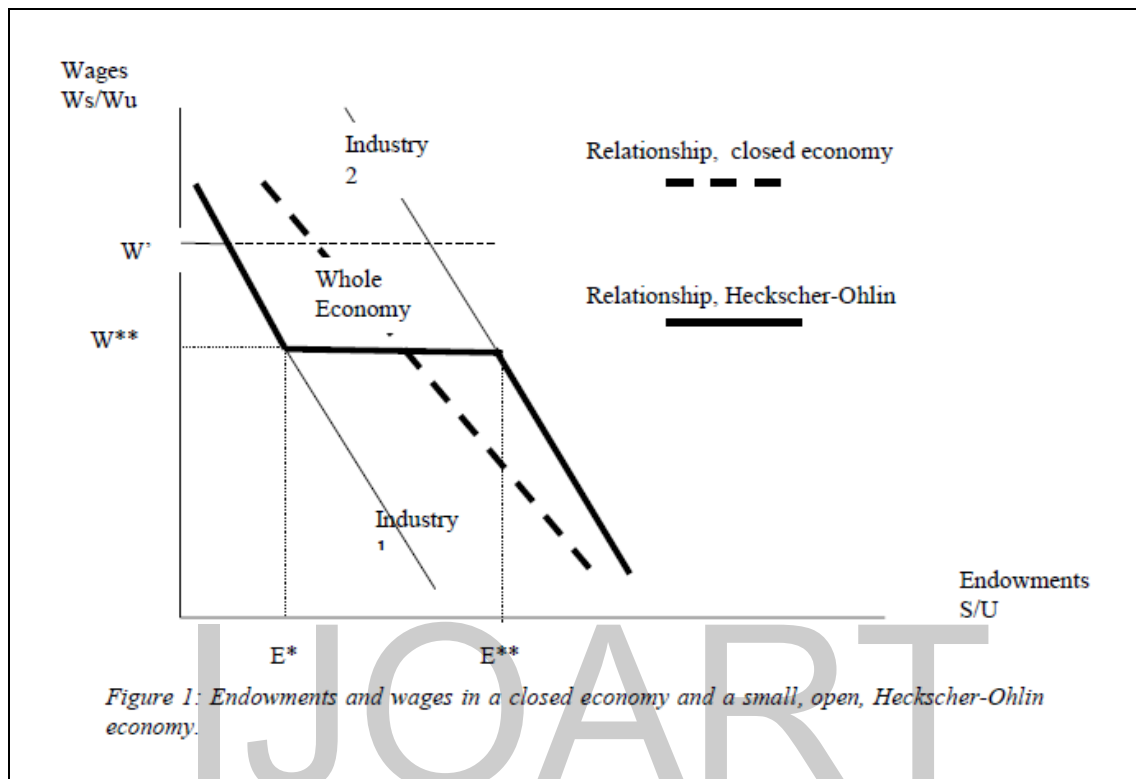


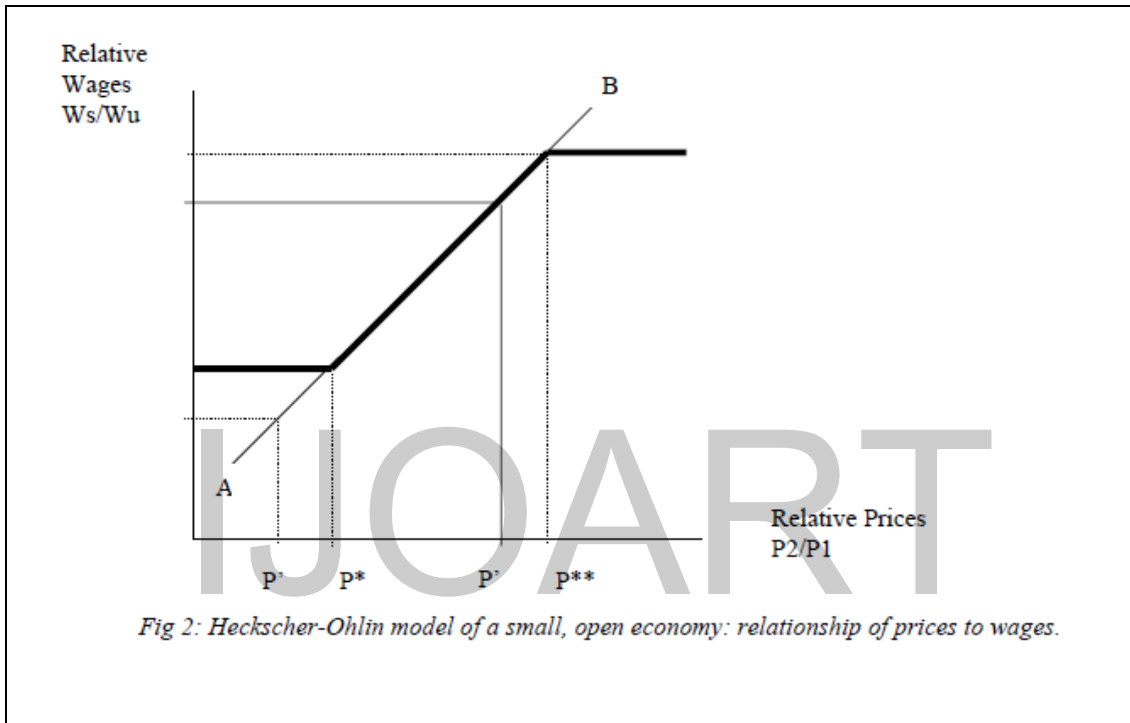
Figure 1: Endowments and wages in a closed economy and a small, open, Heckscher-Ohlin economy.

In figure 1, the relationship between endowments and wages in an *open, H-O economy* is shown by the thick solid line. Comparison with dashed line for a closed economy shows that in the H-O case, rather than producing both goods, and gradually shifting towards good 2 as relative skill endowments S/U rise, the economy is now completely specialised in good 1 at skill endowments less than E^* and completely specialised in good 2 at skill endowments greater than E^{**} . Between those two levels the country will produce both goods, with both skilled and unskilled wages set on international markets at a wage ratio W^* , which is the wage ratio at which the two industries are equally profitable (given world prices and technology). Points to note are:

- 1) Substitution in consumption plays no part in determining wages, output or employment in a small, open H-O economy. Prices of the two goods are set on world markets and unaffected by patterns of domestic demand.
- 2) Over the range E^* to E^{**} , changes in endowments do not affect relative wages. Outside that range, the economy behaves like a single representative firm model.

3) If the relative price of good 2 rises, the economy will switch to good 2 at a higher relative skilled wage, say W' on Fig 2.

On Figure 2, the sloping line AB shows the combination of relative wages which satisfies the two zero-profit conditions (equation 2) simultaneously. In a closed economy, we can basically interpret prices as being a function of wages (with some feedback via consumer preferences).



By contrast, in a small, open H-O economy, the causative direction is solely from (exogenous) world prices to relative wages. Higher relative prices for good 2 mean higher skilled wages. However, this Stolper-Samuelson relationship only holds between P^* and P^{**} - outside this range, the economy is completely specialised in one good or another, and relative wages are determined by endowments and technology of a single representative firm within the one industry in which the country is specialised. Far from complete specialisation, say at P , a small change in endowments will not affect relative wages. However, it does shift the range where the economy is not specialised, say to between P' and P'' . Sector-biased technical progress is very important. Assuming the country is not specialised, a 10% reduction in the unit costs (at base wages) of producing good 1 has the same effects on shares of production,

employment and relative wages as a 10 % rise in the price of good 1. By contrast, Haskel and Slaughter (1998) point out that factor bias has little effect in this model.

❖ **Empirical application: single equation models**

This work usually uses reduced econometric models derived from general equilibrium structures Hachsher-Ohlin. Most concluded that the increase in wage inequality in the Organization for Economic Co-operation and Development (OECD) was mainly the result of the skilled biased technical change, not trade. While the authors directly refute the Hickerscher-Ohlin model as their justification, much information is abandoned when the model falls into one equation. For example, an equation relating to wage changes is estimated in price changes - but a simultaneous equation cannot be estimated in relation to changes in output or labor. The above studies do not examine the effects of their estimated equations for changes in output or labor versus actual observations. The important issue of full privatization is that the models assume only one smooth relationship between prices and wages, rather than the opposite seen in figure 2. For this reason, it is useful to compare these models in general terms Balance models, calibration of actual data.

❖ **Empirical studies of a small, open economy: General Equilibrium models**

In this section, we summarize the results of recent studies covering the analysis of changes in wages in developed countries (mostly from the UK) to different causes, using H-O and a variety of other formulas that investigate the effects of various new H-O assumptions. The models consist of a series of simultaneous equations (mainly 1-4 above), calibration of simplified data in different countries. The calibration can be one or two years. This is a double calibration technique described in Abrego and Woolley. Basically, we need to assume the model- Structure and elasticity of substitution between factors of production, in addition to a few other parameters in some of the changing models. Several studies conducted by Abrego, Woolley, Edwards, and Woolley use a British database for the years 1979 and 1995 with the following main features:

- 1) A rise in the average skilled/unskilled earnings ratio from 1.22 to 1.58.
- 2) A rise in the skilled share of total employment from 52% to 41 %.

3) A rise in output of skill-intensive goods by 36 % and a rise in output of unskilled-intensive goods of 20 % from 1979-95.

4) A fall of 7.9% in the relative traded price of unskilled-intensive goods (derived from Neven and Wyplosz).

The decomposition either by simulating the effect on the 1979 observations is made to change only one of the standard price or appearance or technological variables to its 1995 value or bring about a change in a series of small steps (effectively chain sequence - see Koz and Rizman (2000)). Summary of the basic results processed in the table 2.

TABLE 2: Decomposition of UK wage differential change 1979-95 by double-calibrated⁷

General equilibrium methods	Of Which				Total
	Trade	Other Factors	Technical Change	Endowment Changes	
1) Heckscher-Ohlin (Edwards + Whalley)	136.60%	-36.60%	-35.73%	-0.87%	100.00%
2) Differentiated goods (Abrego + Whalley) Consumption el subs = 2.5 Consumption el subs = 1.5	3.9%	#N/A	96.1%*	#N/A	100.00%
	0.2%	#N/A	99.8%*	#N/A	100.00%
4) Wage bargaining (Abrego)	22.6%	#N/A	77.4%*	#N/A	100.00%
5) Ricardo-Viner (Edwards + Whalley)#	13.37%	86.63%	213.74%	-127.12%	100.00%
6) Ricardo-Viner (Abrego + Whalley)#	17%	-68%	211%	-144%	100.00%
7) Partial mobility (Edwards+ Whalley)	44.54%	55.46%	163.81%	-108.34%	100.00%

* technical change, factor endowments and factor quality changes were not differentiated.

while the two studies used similar basic data, they employed different calibration and decomposition methods.

❖ **General equilibrium models of a small, open, Heckscher-Ohlin economy.**

Perhaps the first general equilibrium study applied to the Organization for Economic Cooperation and Development (OECD) recently was François and Nelson (1998), which views the United States of America. In fact, this traditional starting point is traditional enlightenment (skillful and unskilled), a

model consisting of two factors (skilled and unskilled), a model modified by the introduction of cross-sectoral linkages, product differentiation in the Armington type, (Whether that is the difference between the Krugman product) in the intensive and skilled sector. Its analysis focuses on the relative importance of commercial relics under different model structures, a calibration of US data for 1995. The presence or absence of "propagation" effects is observed (where changes in factor prices are amplified relative to changes in product prices due to changes in demand for factors due to The changes in the sectoral output and / or the absolute winner or the losers under the different models in which Francois and Nelson mimic a default drop of 1 in the price of unskilled goodness find that magnification occurs only when the model assumes that the goods are homogeneous, Form m With homogeneous goods, there are also distinct winners and losers (skilled and unskilled workers, respectively). When commodities are distinct, the zoom collapses and both workers can fully win from improved trade conditions. Abrego Wohley (2000) uses the traditional H-O model with two factors (skilled and unskilled) and the Sultan (a convertible, skilled, intensive and unskilled product) to analyze the change in wage inequality in the UK to trade and technology components. They build the UK economy as a commodity price watchdog in global markets, and take production factors fully across sectors, but not globally. Commercial shocks are shaped as changes in relative global prices, and shocks technology as a sector Neutral technical change, decomposed through the first separate solution to trade and technology shocks and then to both shocks, allowing the separation of the contribution of each worker to increase wage inequality. Two main findings are highlighted. First, there are in fact multi-form specifications of model 10 consistent with the marked change in inequality in the UK, but each provides different decomposition results. Moreover, trade for some specifications is the main source of change in inequality, while the main source is technology for others. If the balance structure is not clearly defined, it is not possible to draw meaningful conclusions from low-profile estimates.

❖ **Implications of Heckscher-Ohlin General Equilibrium studies**

It is very difficult to reconcile observed changes in wages, prices, and outputs with a simple H-O model. 12. With regard to most reasonable flexibility assumptions, the H-O model is highly sensitive, given the limited scope of the production function and even small changes in global prices tend to produce full specialties. This is not what was observed in terms of output: for example, in the UK, while the output of skill-intensive industries grew more than unskilled industries (36% versus 20% between 1979 and 1995) Of the industrial sector, which was expended by changing the price of HO. As a result, the only equation

that has been reduced in the section above should probably be. (3) is considered an ad hoc experimental declines, not as applications to a core model of the organization. This is important because, in most models other than the strict H-O formula, relative factors play an important role, yet trade-based literature has completely ignored these problems. Given practical problems with the simple H-O model, it is worth considering the impact of other model structures on trade, technology, endowments, and wages.

Summary and Conclusions

The labour economics literature affect biased technological change, changes in skills, laws and bargaining as the main determinants of inequality. By contrast, commercial factors in the Hecker-Ohlen-Samuelson literature and business factors, in the form of changes in global prices, changes in openness to trade policies and neutral sector-wide technological change are all important factors. This suggests that the explanation for increases in inequality in the UK and the US is due either to increased access to imports from developing countries or through technological improvements that lead to increase commercialization of skill-intensive products. No single country is likely to affect workers' wages. While experimental research based on single-equation models found evidence of the "Stolper-Samuelson effects" of globalization, the general balancing work shows that these observed results do not, in fact, correspond to the H-O model. Indeed, this model involves very rapid changes in customization in response to either price or technological shocks, so that the economy quickly reaches full privatization: therefore, the changes observed in practice are much more. Matches modified templates. We are studying general equilibrium studies by Abrego Endolley, Edwards and Wohley based on the mitigation of various H-O assumptions (permitting distinct goods, wage equalization, fixed factors and/or mobility). - This suggests that the results of literature H-O must be taken with caution. Indeed, most alternatives examine the direction of trade effects on wages implicitly Stolper-Samuelson, namely that unskilled wages in developed countries will decline in the face of trade liberalization but greatly reduce the magnitude of this effect. However, The multi-faceted version of the Hecker-Ohlin model makes the linkage between trade in developing countries and wages in developed countries more active and fragile. In light of this, we propose that studies on the regression of the single equation be considered primarily as ad hoc empirical studies, rather than as direct attempts to estimate the H-O economy. Despite its implicit conclusions about the effects of Stoller-Samuelson's wage trade, which was a contributing factor, it is probably not the main factor. It is generally consistent with some of the general equilibrium structures that we have discussed.

There are important caveats. In particular, studies of this type should not rule out that these factors have had an important impact on relative wages (despite some simpler HO models suggested). We also believe that there is a strong argument for further investigation into general equilibrium disassembly operations, expansion of the analysis to include multi-country models and the effects of various market structures. New business theory may be important- Long-term effects of deviation and policy, should be investigated as well.

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