Banco Central de Chile
Documentos de Trabajo

Central Bank of Chile
Working Papers

N° 374

Agosto 2006

TRADE LIBERALIZATION, PRICE DISTORTIONS, AND RESOURCE REALLOCATION

Roberto Álvarez Matías Braun

BANCO CENTRAL DE CHILE

CENTRAL BANK OF CHILE

Documentos de Trabajo del Banco Central de Chile
Working Papers of the Central Bank of Chile
Agustinas 1180
Teléfono: (56-2) 6702475; Fax: (56-2) 6702231

Documento de Trabajo
N° 374

Working Paper
N° 374

TRADE LIBERALIZATION, PRICE DISTORTIONS, AND RESOURCE REALLOCATION

Roberto Álvarez
Gerencia de Investigación Económica
Banco Central de Chile

Matías Braun
UCLA Anderson School of Management

Resumen

En este artículo se construye una medida de distorsiones de precios para 28 industrias manufactureras y una larga muestra de países en las ultimas cuatro décadas, Con esta medida, se presenta evidencia consistente con el argumento que cambios en precios relativos son un mecanismo importante a través del cual la apertura de una economía afecta diferentes medidas de desempeño. Primero, los resultados muestran que la distorsión agregada está negativamente asociada con medidas tradicionales del grado de apertura de una economía, y con el crecimiento del las exportaciones, las importaciones y el comercio total. Segundo, se encuentra que el incremento del comercio en episodios de liberalización comercial está positivamente relacionado a una reducción de la distorsión agregada. Tercero, la magnitud de la reasignación de recursos en estos episodios de liberalización esta positivamente asociada a la magnitud de los cambios en precios relativos. Esto es particularmente válido para sectores con retornos constantes a escala. Cuarto, los cambios en precios relativos a nivel de sectores están positivamente asociados a incrementos producción, productividad y el tamaño promedio de las firmas, pero negativamente relacionados al número de firmas. Finalmente, se encuentra que la teoría neoclásica del comercio es incapaz de explicar como los precios relativos cambian en estos episodios de liberalización comercial.

Abstract

We construct a time-variant, price-based measure of trade distortions in 28 manufacturing industries for a large sample of countries over the last four decades, documenting facts consistent with the argument that changes in relative prices are an important channel through which an economy's openness affects outcomes. First, we find that price distortions at the aggregate level are negatively associated with the degree of openness and the speed at which trade volume, exports, and imports grow. The negative association between trade outcomes and price distortions is fundamentally driven by the positive link between openness and price distortions. Second, increases in trade around the time of liberalization are positively related to a decline in aggregate price distortions for the sample of trade-liberalizing countries. Third, the extent of production reallocation is positively associated with the degree of relative price changes that occur around the time of liberalization, particularly across constant-return-to-scale sectors. Fourth, changes in relative prices at the industry level within countries are positively correlated with changes in output, productivity, and firm size, and negatively associated with the number of firms. Finally, we show that the neoclassical theory of trade does a poor job explaining how relative prices change during trade liberalization.

We thank Peter Schott for providing us with his data on industry capital-per-worker, Romain Wacziarg for discussions on trade liberalization data, and Sebastian Edwards for useful suggestions. We also thank participants at Economic History Proseminar at UCLA, specially Gonzalo Islas, Judith Frias, Naomi Lamoreaux, Jean-Laurent Rosenthal, and Ken Sokoloff.
E-mail: ralvarez@bcentral.cl.

1. Introduction

Many countries have opened-up their economies to international trade in recent decades. These episodes of liberalization provide a sort of natural experiment to explore the effect of trade restrictions. The empirical literature has been relatively successful in linking trade liberalization to increases in growth and trade flows, showing that economies with more liberal trade policies grow faster and trade more (see, for instance, Sachs and Warner 1995 and Wacziarg and Horn-Welch 2003). Systematic evidence regarding the effect of trade liberalization on changes in relative prices and reallocation is scarce, however. This paper is a first step towards filling this gap in the literature. In particular, we construct a simple measure of price distortions in 28 different manufacturing industries for a large sample of countries over the last four decades. We then ask whether there is a reduction in price distortions following trade liberalization, and whether cross-industry reallocation may be mapped to changes in relative prices.

Ignoring data availability issues, the lack of evidence on prices should come as a surprise since changes in relative prices lie at the core of traditional trade theories, and allow for a much more general framework to study the effects of policy reform. Indeed, it is the difference in relative prices across countries, whether due to technological reasons or varying resource endowments, that generate potential gains from trade and ultimately drive production specialization in a competitive, costless-trade setting. Focusing on prices also has the advantage of providing a cleaner benchmark since trade induces relative prices to equalize across countries under relatively general conditions and absent trade costs.

Once one concentrates on relative prices, questions of reallocation naturally arise. With the notable exception of Wacziarg and Seddon Wallak (2004)'s study of labor reallocation, most empirical work has considered only aggregate outcomes resulting from changes in trade policies (see for instance, Rose 2004, Santos-Paulino and Thirlwall 2004, Wacziarg and Horn-Welch 2003, and Giavazzi and Tabellini 2005). This is particularly worrisome since it is easy to build a case where a reduction in trade barriers does not

increase trade volume[1]. There is simply not much to offer in terms of answering basic questions such as: Which sectors are most likely to expand with trade reforms?; Do significant changes in factor reallocation across industries occur?; Are expanding industries easily explained by predictions from traditional trade models? Although documenting the positive aggregate outcomes of policy reforms is necessary for evaluating their desirability, identifying potential industry winners and losers remains critical in determining their feasibility.

Our major findings may be summarized as follows. First, at the aggregate level price distortions are negatively associated with the degree of trade openness in the economy and the speed at which the volume of trade, exports, and imports grow. Indeed, relationships between openness, trade distortions, and trade outcomes are not independent of each other: the negative linkage between trade outcomes and price distortions fundamentally drives the positive association between openness and trade outcomes. We confirm these findings by showing that, for a sample of liberalizing countries, the increase in trade around the time of liberalization is positively related to a decline in aggregate price distortions. Second, we find evidence of significant overall reallocation across industries. For constant-return-to-scale sectors, the extent of reallocation of inputs and production within liberalizing countries is, in turn, positively associated with the degree of relative price changes that occur around the time of liberalization. In contrast, no such relation is found for increasing-return-to-scale industries. Third, at the industry level, changes in relative prices within countries at the time of liberalization are positively correlated with changes in output and productivity measures and negatively associated with firm size. No significant correlation is found with imports or exports, though the sample used shrinks significantly. Finally, we find that measures of resource availability across countries and intensity of use across industries do not explain in a satisfactory manner how relative prices change around liberalization.

[1] In the context of a Heckscher-Ohlin model, Leamer (1988) derives a relationship between trade volume and tariff indicating that a reduction in tariffs does not necessarily increase trade volume. Several empirical works, though, continue to use trade volume as proxy for trade barriers (or the absence of them).

The remainder of this paper proceeds as follows. In the next section, we work out the basic hypothesis and describe our empirical approach. In section 3, we analyze the properties of our measures of price distortions and how it behaves during trade liberalization episodes. In section 4, we study the extent and direction of industry reallocation driven by changes in relative prices. In section 5, we use the implications of factor endowment-driven specialization to explain which industries are more or less likely to experience favorable changes in relative prices. Section 6 concludes.

2. Hypothesis and Empirical Approach

The relative prices of goods play a fundamental role in the classical and neoclassical theories of trade. It is the difference in relative prices across countries -whether due to technological reasons or factor endowments variations- that generate potential gains from trade and ultimately drive production specialization in a competitive, costless-trade setting. Under relatively general conditions and absent trade costs, specialization and trade induce relative price equalization across countries. Although the existence of trade costs (both natural and artificial or policy-generated) is apparent, there is little systematic evidence concerning their link to price and allocation differences across countries. Most empirical papers either focus on a cross-section of a reduced number of products (Aitken, 1992) or are specific to a particular country or a small group of countries[2]. This is mainly because of difficulties surrounding price measurement. Bradford's study (2003) for a sample of just six OECD countries shows how daunting this task may be in terms of defining what constitutes similar goods and cleaning the prices from differences in the cost of (i.e., potentially non-tradable) intermediate goods and services.

We take a different approach in this paper. Instead of attempting to document how relative prices differ across countries in relation to trade costs, we show how these prices change when countries open up to trade. In particular, we construct a simple measure of relative prices for 28 three-digit ISIC industries,

[2] See Anderson and van Wincoop (2004) for a survey of studies using prices as an indirect source of the magnitude of trade costs.

and then aggregate these prices in a measure of country-and-year-specific price distortions. The goal is to test two broad hypotheses regarding the relationship between prices and openness to trade: whether openness is associated with lower aggregate price distortions, and whether liberalization-induced changes in relative prices are related to changes in input and output reallocation. The time-series focus allows us to expand the sample of countries and sectors while at the same time significantly easing the concerns that arise in cross-sectional studies. So long as the sector-comparability across countries and other country-specific determinants of prices are rather stable over time, our conclusions will not depend critically on these issues.

The level of aggregation we use is dictated by data availability and the desire to construct a measure for a large number of countries. Of course, this implies that if relative prices within a 3-digit industry aggregate differ significantly under regimes of differing degrees of openness, then we will be missing an important part of the action. Fortunately, though, this problem biases against our hypotheses. If we are still able to find a significant relationship between relative prices and industry outcomes, then it will be in spite of this aggregation. Thus, our estimates may be interpreted as a lower bound of the impact of liberalization on resource reallocation.

We construct our price variables using industry-level data from UNIDO's dataset (2002). Consider the following measure of price for sector *i* in country *c* at time *t*:

$$p_{ict} = \frac{ValueAdded_{ict}}{Output_{ict}} = \frac{P_{ict}Q_{ict} - Intermediate.Inputs_{ict}}{P_{ict}Q_{ict}} \quad (1)$$

Assuming that the cost of intermediate inputs may be represented by:

$$Intermediate.Inputs_{ict} = \bar{c}_{ict}\alpha_{ict}Q_{ict} \quad (2)$$

where $\bar{c}_{ict}$ is the average cost of intermediate inputs and α_{ict} is the share of intermediates inputs in output. Plugging (2) in (1), we have that our industry price measure may be understood as:

$$p_{ict} = \frac{P_{ict}Q_{ict} - \bar{c}_{ict}\alpha_{ict}Q_{ict}}{P_{ict}Q_{ict}} = \frac{P_{ict} - \bar{c}_{ict}\alpha_{ict}}{P_{ict}} \quad (3)$$

The measure is simply the price net of the average cost of the intermediate input expressed as a fraction of the price. It increases monotonically with the good's price and decreases monotonically with the price of the intermediate input. The measure is neutral to percentage changes of the same magnitude in the price of the final output and that of the intermediate input. If both are tradables, for instance, a uniform ad-valorem tariff (or equivalent non-tariff barrier) on the final good and intermediate input would leave this measure unaltered[3].

Our measure of price distortions in industry *i* for country *c* in year *t* is defined as the portion of the prices computed in (3) that cannot be explained by a country's structural features over and above the component of these prices that is common to the industry across all countries at any given moment in time. That is, the price distortion is the residual of the following regression:

$$\log(p_{ict}) = \alpha + \delta_{it} + \delta_c + \varepsilon_{ict} \quad (4)$$

where δ_c is a country-specific effect, and δ_{it} is a set of year-sector dummy variables. The country fixed effects control for all time and industry-invariant country characteristics. These include the common effect of distance, differences in the prices of non-tradables, industrial policy, and the like. The year-sector effects correspond with the component of prices that is shared across all countries in each moment in time. We interpret this time-variant, industry-specific component as the unobservable international price. By using logs and including these two set of dummy variables, we construct our price distortion measure as the percentage difference relative to the (all-time) country-average and controlling for changes in prices that are sector-specific, and therefore do not depend on a country's trade policies.

For a given country at any point in time, the aggregate distortion is defined as the average of the absolute value of the residual in (4)[4]:

[3] Compared to (3), our measure of industry price in (1) is less demanding in terms of data.
[4] By using absolute values we avoid the fact that negative and positive changes in relative prices cancel out. Using average allows us to consider countries that do not have information for all 3-digit industries.

$$\hat{P}_{ct} = \sum_{i=1}^{I} \left|\hat{\varepsilon}\right|_{ict} / I \tag{5}$$

where I is the number of industries at the 3-digit ISIC.

To check the robustness of this measure, we also compute weighted average measures of distortions by using the share of each 3-digit sector in total manufacturing employment, value added, and output. The aggregate price distortion is given by:

$$D_{ct} = \sum_{i=1}^{I} w_{ict} \left|\hat{\varepsilon}\right|_{ict} / I$$

where w_{ict} are the weights defined by $x_{ict} / \sum_{i=1}^{I} x_{ict}$, with x defined alternatively as employment, value added, and output.

We are able to construct the aggregate price distortion measure for 101 countries and as many as 38 years[5]. Figure 1 shows the evolution of our measure around the episodes of trade liberalization documented by Wacziarg and Horn-Welch (2003). The liberalization date (libtime=0) corresponds with the year in which a country changed from closed to open. Taking a simple average across the 35 liberalizing countries in our sample, it is apparent that the distortion tends to fall following trade liberalization. The figure also shows that using different weights does not change the basic message.

We have also constructed the aggregate distortion measure taking prices for the United States and all other countries that are classified as always open according to Wacziarg and Horn-Welch (2003)[6]. These measures are highly correlated with our benchmark indicator and behave similarly around trade liberalization (see Figure 2). Our measure of price distortion, however, does not assume that domestic prices in countries classified as open are more reflective of international ones. Even though the assumption is applied only to a small sub-sample of the countries, our measure is more desirable

[5] Due to missing data not all countries have information for all years.
[6] These countries are Hong-Kong, Norway, Puerto Rico, Switzerland, Thailand, the United Kingdom, the United States, and Yemen.

conceptually because it was constructed precisely to show that countries that are more open have industry prices more similar to unknown international ones.

3. Aggregate Price Distortions and Trade Liberalization

In this section we explore the properties of the aggregate price distortion measure. We first show that our measure conveys information that is consistent with what previous measures of trade distortion indicate. We then document that, as expected, the measure turns out to be negatively correlated with the degree of openness both across countries and over time for the average economy, even after controlling for variables that proxy demand factors, trade costs, and the quality of institutions. Finally, we show evidence of a positive correlation between openness and trade outcomes. Of course, these exercises should not be taken as evidence of a causal relationship from trade openness to price distortions and then to real effects. This is because the decision to open up or not is likely to be dependent on the extent to which price distortions change as a result. Price and quantity are jointly determined as well. The aim here is solely to provide evidence consistent with the channel proposed.

The final link in documenting this mechanism is to show that the change in the aggregate price distortion measured around trade liberalization does a good job in explaining differences in trade outcomes and the extent of reallocation across industries exhibited within the group of liberalizing countries. In the following section we complement these aggregate results by showing how the outcomes at the industry level behave in a way that is consistent with the notion that trade liberalization affects outcomes by restoring relative prices to free-trade levels.

3.1 Aggregate Results

Table 1 presents the correlation (and significance levels) between the different versions of our aggregate price distortion indicator and other measures of openness to trade. We consider two distortion

measures based on deviations of volume of trade from a gravity-based benchmark computed by Hilcox and Kastner (2002), tariffs (import duties as a share of total imports, from World Development Indicators), and the ratio of total trade, exports, and imports to GDP. The different versions of the price distortion measure are positively and very significantly correlated both with each other and with the quantity-based and tariff measures. In most cases they are also negatively correlated with the outcome-based indicators. This correlation is particularly strong and significant when the value added and labor-weighted versions are used. In general, Table 1 suggests that our measure of price distortion is indeed capturing variation in the panel data that is also identified by more traditional variables that measure distortions. Note, however, that the volume of exports and imports is more strongly associated with tariffs and Hilcox and Kastner variables than with our price distortion measures. This should not come as a surprise since quantitative measures of protection are constructed using trade-flow data. What is striking about the correspondence with our price-based measure of distortions is that this has been constructed without use of trade data and is not based on any specific trade model.

3.2 Openness, Price distortions, and Trade

Table 2a looks at whether the price distortion measure is correlated with the degree of openness present in the economy. Column (1) shows a strong and highly significant negative correlation for the pooled data. The same result is obtained when looking only at cross-country variations in the data in Column (2). While in the typical closed country local prices deviate by 30% on average from the world component, they do so by around one third less (on average 21%) in open economies. The economic magnitude drops to about half when the correlation controls for GDP-per-capita, but remains highly significant (see Column 3). Not surprisingly, poorer countries exhibit a higher level of price distortions. In columns (4) through (11) we verify that in general price distortions appear to be associated with trade costs and the quality of institutions in the expected way. When all of these variables are considered at the same time, only per-capita-GDP and inflation enter significantly. The correlation between price

distortions and openness across countries is not explained away by these other country characteristics.

When we focus only on within-country variation (i.e. when we include both country and year fixed effects in the specification) the data tell the same basic story (see Table 2b). When compared to their closed level, countries that have opened-up for trade exhibit a level of price distortions 3.5 points lower, representing a reduction of between 10 and 15%. Per-capita-GDP and inflation are again correlated with the price distortion measure but do not account for the relationship between price distortions and openness to trade.

We next evaluate the relationship between trade outcomes and price distortions and ask whether this relation is likely to be mediated by openness to trade. To account for the many potential determinants of trade that we can only imperfectly measure, we use the growth rate in the volume of trade, imports, and exports as the dependent variables instead of their levels or ratios relative to GDP.

Columns (1), (5), and (9) in Table 3a show that the volume of trade has grown significantly faster in more open economies in the pooled, cross-country, and the within-country dimensions of the data. Columns (2), (6), and (10) show that faster growth is also negatively associated with the level of price distortions. All these relations are very significant in statistical terms. They are also relevant in an economic sense: the rate of growth in trade volume is twice as high in open economies (7% vs. 3.5% per annum), and a one point standard deviation decrease in price distortion is associated with a one percentage point higher growth rate. When we include both the degree of openness and the level of price distortions (Columns 3, 7, and 11) the coefficient for the distortion drops in magnitude and becomes almost always insignificant, while that of trade openness remains essentially unchanged. It is indeed the case that price distortions negatively associated with growth in trade volume are fundamentally driven by the positive connection between trade openness and volume of trade. Said differently, it is precisely the variation of distortions that one can explain with the degree of openness that appears to be correlated with the trade outcomes. This is consistent with the mechanism in which opening up reduces price distortions, and this reduction in turn causes trade to grow.

Since the effect of trade costs and institutional quality are likely to affect the level rather than the growth rate of trade volume, we focus on demand-related determinants when exploring whether the result is due to omitted-variable bias. The growth of world GDP and the real exchange rate are correlated with the growth in the volume of trade but in a way that does not modify our conclusions above (see columns 4, 8, and 12). In Table 3b we replicate the basic specifications described above to explain separately the effect on exports and imports. The message is essentially the same, although imports seem more responsive than exports.

3.2 An Event Study for Trade Liberalizations

In Table 4 we perform an event study of the effects of trade liberalization on trade outcomes. For each liberalizing country we compute the growth changes in trade volume, exports, and imports as the difference between the average growth rate of each variable in the five years prior to liberalization and the five years following it. Similarly, we compute the percentage change in the aggregate price distortion measured around the liberalization year. We no longer ask as in Table 3 whether the higher growth rate in trade that we find in countries with fewer distortions is due to the fact that these countries are more open to trade. Rather, we ask directly if the *changes* in price distortion that occur around trade liberalization can help explain the *change* in the rate of trade growth.

The first column shows that the average liberalizing country experiences an increase of 6 points in the trade volume growth rate. This is consistent with the evidence presented in Table 3 regarding the positive relationship between the degree of openness and trade outcomes. However, the effect is around twice as large as the one obtained when comparing open to closed economies, suggesting that the decision to open up is likely not exogenous. Though this sample selection issue complicates the interpretation of the correlation between openness to trade and trade outcomes, it will not have an effect on what we have to say about the role of price distortion reductions since we only consider countries that have liberalized. Columns (7) and (10) document that imports are much more responsive to liberalization than exports are.

Adjustment costs in the reallocation of resources in the productive sector and the loss of implicit exports subsidies are probably behind this result. Again, since quantity and price variables are jointly determined, we do not establish causality here, but simply show that the increase in trade exhibited in the countries that liberalized is not inconsistent with the notion that the reason why open countries trade more is because they are subject to less price distortions.

Column (2) shows that the differences in changes in the aggregate price distortion that occur around trade liberalization are strongly correlated with the different outcomes for volume of trade across the liberalizing countries. In each case the coefficient for the change in aggregate price distortion is negative and statistically significant, meaning that the larger the reduction in aggregate price distortion, the larger the increase in volume of trade growth. The same is true for exports and imports, as shown in columns (8) and (11). The economic magnitude of the effect is big: while trade volume growth increases by 13 points for the countries in the top quartile of the distortion reduction, it does so by only around 3 points for those in the bottom quartile. Figure 3 confirms that this result is not driven by a few outliers but seems to be a robust pattern in the data. Columns (3), (4), and (5) check that the result is also robust to different ways of aggregating the industry-level price distortions. Finally, columns (6), (9), and (12) reveal that changes in external conditions around the date of liberalization do not account for this effect.

4. Trade Liberalization and Reallocation

In this section we study the direction and the extent of reallocation associated with trade liberalization episodes. To do that, we use information about changes in relative prices around liberalization. First, we investigate whether there is a relationship between changes in relative prices and several industry outcomes. It is expected that industries with positive variations in relative profitability should expand more than those experiencing negative changes. Second, we analyze the relationship between overall changes in relative prices and the extent of reallocation. This is an important issue because events of trade liberalization may have been associated with different reductions in tariffs or other trade barriers. In other

words, when going from a closed to an open economy the overall changes in relative prices and the consequent reallocation may be different across countries. We investigate whether countries experiencing larger variations in relative price are also those with larger effects across industries.

4.1 Changes in Relative Prices and the Direction of Reallocation

In this section we concentrate on the industry-level data to determine whether changes in relative prices are positively correlated with changes in output and the use of inputs. We also present evidence of within-industry reallocation effects, specifically on labor productivity, the number of firms, and firm size. In simple terms, what we want to test is whether industries experiencing larger incremental growth in relative prices are also those that experience larger increases in output (and input demand). To control for other changes that may affect manufacturing industry as a whole, all outcome variables are measured relative to the average industry. In the same way, given that all industries are affected by price variations, we compute price changes relative to the median industry[7].

We estimate the following regression:

$$d\log X_{jc} = \alpha + \beta d\hat{P}_{jc} + \delta_j + \delta_c + \varepsilon_{jc} \qquad (6)$$

where $d\log X$ is the difference (in logs) of the variable X under study (employment, investment, value-added, exports, imports, firm size, number of firm, and labor productivity), and $d\hat{P}$ is the industry price change with respect to the median for all manufacturing industries (in percentage points). Both variables are measured around a trade liberalization episode. We also include country and industry fixed effects.

The parameter β measures the extent at which changes in industry relative prices are associated to changes in industry variables. It has to be acknowledged that we are not estimating a causal relationship between both variables. Changes in relative prices are endogenous and depend on supply and demand

[7] Results are similar when using the mean industry price changes.

conditions. This estimation, however, is useful to analyze whether industries respond to changes in relative prices liberalization episode occurs[8].

We estimate a short-run and a long-run version of equation (6). Defining *t* as the year of liberalization, the short-run version compares changes between the 5-year pre-liberalization period (*t*-5 to *t*-1) and the 5-year post-liberalization period (*t*+1 to *t*+5). In the long-run version, the pre-liberalization period is compared to the second 5-year post-liberalization period (*t*+6 to *t*+10). This distinction is useful to investigate whether the effects of trade liberalization are short-lived or more permanent in nature.

The first question we address is whether liberalization-induced price changes are associated with input reallocation. We use two measures, the employment ratio and the investment ratio (investment over value added). The results listed in the first column of Table 6 are consistent with the idea that an increase in relative prices is associated with an increase in employment share, though the effect is not significant at standard levels. Unexpectedly, although not significant, the coefficient for the investment ratio is negative. Our results show that there is no important reallocation of factors within the manufacturing industry, at least for 3-digit industries. Using a complementary methodology to Wacziarg and Seddon Wallak (2004), we find similar results. Thus, it may be argued that simply distinguishing between open and closed economies is not responsible for the weak link between reforms and reallocation. We compute the relative changes associated with trade liberalization and we also find results consistent with insignificant input reallocation between manufacturing industries.

Our second question is whether liberalization-induced price changes are associated with output and trade variables. The results in columns (3) through (5) contrast with those we obtain for input reallocation. In fact, we find evidence of a larger expansion in terms of output for sectors in which there is a larger increase in relative prices. This evidence is consistent with the notion that trade liberalization-induced changes in relative prices generate variations in specialization patterns. Output expands significantly more in those industries favored by trade reforms. In the case of trade flows, the evidence is less robust. Even

[8] In the next section, we explore more in detail which factors can explain these industry price changes.

though the signs of the parameters are as expected- positive for exports and negative for imports- neither is significant.

Finally, in columns (6) through (8) we analyze the effect of changes in relative prices on the number of firms, firm size (in terms of employment), and labor productivity (defined as value-added-per-worker). This evidence is consistent with recent theoretical models exploring the impact of reductions in trade costs on industry dynamics (Melitz, 2003). In these models a reduction in trade costs increases the profitability of entering export markets. Within-industry firm heterogeneity implies that less efficient firms exit and more efficient ones capture a larger portion of the market. If this is the case then we should expect trade liberalization episodes to be accompanied by reductions in the number of firms. If more-efficient firms are also larger, then we would expect an increase in average firm size. Evidence of country-specific rationalization effects has been provided, but there is no systematic cross-country support so far[9].

The results shown in columns (6) and (7) suggest that these rationalization effects are rather plausible. For firm size, the parameter associated with changes in relative prices is positive and significant, and negative and significant for the number of firms. Thus, these results show that in those industries with larger increases in relative prices there is a reduction in the number of firms and an increase in average firm size. In column (8) we present evidence for the relationship between labor productivity and relative prices, which is positive and significant. Hence, we find evidence consistent with the notion that the extent of relative price changes around trade liberalization is also positively related to changes in productivity[10].

[9] See, for example, Roberts and Tybout (1996) for an early contribution on the microeconomic impact of trade reforms in several developing countries. More recently, see Head and Ries (1999) and Trefler (2004) for Canada.

[10] It is difficult in the absence of detailed firm-level data to identify if this increase in labor productivity is a within-firm or within-industry phenomenon. However, our results on the effect of relative prices on the number of firms and size suggest that part of the effect is within-industry, i.e., factor reallocation from less to more productive firms. Pavcnik (2002) shows evidence for Chilean plants indicating that most of the increase in productivity is due to within-industry reallocation. See Bartelsman et. al. (2004) for evidence in a sample of industrial and developing countries.

Table 6 shows the results for a longer period of time. For most variables the effect of changes in relative prices turns out to be insignificant. We are able, however, to uncover a lasting effect on value-added share and labor productivity. It is worth noting that the parameter tends to be smaller than that obtained for the shorter period (table 5), suggesting that expansionary and productivity effects associated with changes in relative prices tend to decline over time.

4.2 Changes in Relative Prices and the Extent of Reallocation

One of the typical concerns regarding trade reforms is the magnitude of resources reallocation (Krueger, 1983). If trade reforms generate large reallocations, the short-run effect may be negative in the presence of labor immobility. Whenever workers are unable to move from *loser* to *winner* industries, there is the risk that unemployment will increase significantly. Is the reallocation associated with trade reforms large or small? From a theoretical point of view, the answer is complex. Neoclassical and new trade theories differ about their reallocation predictions. In the standard Heckscher-Ohlin model, for instance, with industries displaying constant returns to scale (CRS) and differing in input intensities, the impact of trade liberalization occurs mainly *between* industries. In such a case we would expect a "large" reallocation with expansion in industries where the economy has comparative advantages and resources moving away from import-competing industries. Thus, large modifications in relative prices should go hand-in-hand with extensive reallocation *between* industries.

In contrast, models with increasing returns to scale (IRS) and monopolistic competition suggest that the extent of resources reallocation would be negligible. Trade liberalization generates reallocation within industries with countries specializing in a lower number of varieties, but expanding the output of each variety (Krugman, 1979). In industries characterized by IRS and monopolistic competition, we would expect that changes in relative prices are relatively unconnected from reallocation between industries.

To analyze whether the extent of reallocation differs for different types of industries, we make use of a classification of 3-digit industries according to whether they are exhibit CRS or IRS. We take this classification method from Antweiler and Trefler (2002), who find that a third of all manufacturing industries are characterized by IRS, and a similar percentage by CRS. The rest of the industries are not robustly classified.

We examine the relationship between the extent of price changes and variations in employment and value-added share around liberalization episodes. Our measure of the extent of changes in relative prices is the mean of the absolute value of each industry-level change before and after liberalization. A larger value indicates more extensive changes in relative prices. In the same way, we compute the extent of changes for employment and output. For each liberalizing country, we have information on the extent of changes in relative prices, output and employment for the 5-year pre-liberalization period and the 5-year post-liberalization period.

The relationship between changes in prices and the extent of reallocation is estimated for three different samples: (i) all industries, (ii) CRS industries, and (iii) IRS industries. The results are displayed in Table 7 and Figures 4 through 9. In general, our results reveal that the relationship between changes in relative prices and variation in employment shares is relatively weak. Though positive, the coefficient is not significant for all industries. However, the coefficient is positive and significant for CRS industries. The relationship is much stronger and statistically significant for value-added shares. As expected, this result comes primarily from the behavior of CRS industries since the link between the extent of relative price changes and reallocation is absent in IRS sectors.

5. Explaining Changes in Relative Prices

Given that changes in relative prices appear to play a role in reallocation following trade liberalization, the question whether of one can predict these price changes based on traditional trade

models comes naturally. In the literature on the political economy of trade protection there are several theoretical models to explain protection levels across industries. Recently, the second generation of empirical work has moved to a more structural approach that links theory and data directly[11]. Most of these models, however, are very difficult to estimate because some of the variables affecting cross-industry protection are unobserved by the econometrician. For example, in the theoretical model by Grossman and Helpman (1996), tariffs are a decreasing function of the fraction of specific capital in the sector that is owned by the median voter.

Other empirical works have used information that is only available for a handful of countries. In the political contributions approach, tariffs depend on import-demand elasticities and domestic political organization. Gawande and Bandyopadhyay (2000) and Goldeberg and Maggi (1999) have obtained information on these variables for the United States. Others have extended the empirical evidence to Turkey and Australia (Mitra et. al. 2002, McCalman, 2004). This sort of evidence, however, is limited to specific countries.

In this section we use a less structured approach to analyze the general implications of the neoclassical model of trade. Opening up for trade should increase the relative price of sectors where the economy has comparative advantages. The Heckscher-Ohlin model is useful here since it would allow us to *a-priori* identify the sectors with comparative advantage based on country factor endowments and industry factor intensities. For example, in a simple two goods and two factors model, the capital-abundant country specializes in the capital-intensive good and the labor-abundant country in the labor-intensive good. This implies that in labor-abundant countries trade liberalization should reduce the relative domestic price of capital-intensive goods.

Generalization of this statement to higher dimensions is more complicated. As a rule, however, we expect interactions between country factor abundance and industry factor intensities to tell us something

[11] On this topic see Gawande and Krishna (2003) for a recent survey of theoretical approaches and empirical evidence.

about how protection changes with trade liberalization episodes. Specifically, we expect changes in relative prices to be positively correlated with the interaction between factor intensity and factor abundance. Consider the following regression model:

$$d\hat{P}_{jc} = \alpha + \delta_c + \beta_1 (k/l)_j + \beta_2 (k/l)_j (k/l)_c + \beta_3 (h/l)_j + \beta_4 (h/h)_j (h/h)_c + \beta_5 nr_j + \beta_6 nr_j nr_c + \varepsilon_{jc} \qquad (7)$$

where $(k/l)_c$, $(h/l)_c$, and $(nr)_c$ are relative endowments, and $(k/l)_j$, $(h/l)_j$, and $(nr)_j$ are industry factor intensities of physical capital, human capital, and natural resources, respectively. δ_c is a country fixed effect. A positive coefficient for the interaction implies that as we increase the factor endowment, the relative price of the good that uses it intensively increases.

Data for endowments and intensities come from Braun (2002). Each country's resource availability is measured as the logarithm of physical capital-per-worker, the logarithm of the average number of years of formal education in the population, and the logarithm of natural resources-per-capita. The first is based on an aggregate investment series that comes from the Global Development Network Growth Database, which was compiled and updated from the original source by Easterly and Sewadeh (2002). The education variable comes from Barro and Lee (2000) and corresponds with the average of the 1985, 1990, and 1995 figures. The indicator for natural resources is taken from the World Bank's "Expanding the Measure of Wealth" publication, and includes minerals and fossil fuels, timber, non-timber forest benefits, cropland, and pastureland, net of what is labeled as protected areas.

Each industry's factor utilization intensity is measured by investment intensity, a wage-based index of human capital intensity, and a dummy variable for natural resource intensity. Investment intensity corresponds with the median of the ratio of gross fixed capital formation to value added in the United States in each industry from the 1986 to 1995. The index for human capital intensity is the median from 1986 to 1995 of the industry's mean wage over that of the whole U.S. manufacturing sector. Both are computed from UNIDO's dataset. Natural resource intensity is a dummy variable that takes a value of 1 for the following industries (and 0 otherwise): wood products, except furniture; paper and products;

petroleum refineries; miscellaneous petroleum and coal products; other nonmetallic mineral products; iron and steel; and nonferrous metals. The implicit assumption in using factor intensities for U.S. industries as representative of factor intensities in other countries is that technological differences around the world are not so strong as to change the ranking of intensities across industries.

Recently, Schott (2003) has shown that differences in factor intensities are not necessarily attributable to technological differences, but may be explained by the fact that traditional industry classifications hide considerably heterogeneity. What it is classified as "textiles" in 3-digit ISIC industries is actually a different product in China and Italy, for example. "Textiles" in China are produced with a larger proportion of unskilled labor than in Italy, consistent with differences in the relative abundance of factors in both countries. Using capital-per-worker for each of the 28 industries, Schott groups them into three different Hecksher-Ohlin aggregates and documents the existence of two diversification cones: countries with low endowments of capital-per-worker produce the low capital-intensive and the intermediate capital-intensive goods, and countries abundant in capital produce the intermediate capital-intensive and the high capital-intensive goods.

Using this classification of industries, and taking as base the labor-intensive aggregate, we estimate the following equation:

$$d\hat{P}_{jc} = \alpha + \beta_1 D_j^I + \beta_2 D_j^I (k/l)_c + \beta_3 D_j^H + \beta_4 D_j^H (k/l)_c + \varepsilon_{jc} \qquad (8)$$

where D_j^I is a dummy variable for 3-digit industries in the intermediate Heckscher-Ohlin aggregate and D_j^H is a dummy variable for industries in the high-capital intensity Heckscher-Ohlin aggregate. The intuition for the interpretation of the sign of the parameters follows closely to that in equation (7). If changes in relative prices are consistent with factor endowment-driven specialization, then both β_2 and β_4 should be positive. This would be consistent with the notion that prices increase more in capital-intensive industries for countries that are relatively more abundant in capital.

We use two measures of changes in prices. First, we use the difference between the sector and the median of the manufacturing industry for each country. However, even though theoretical models suggest a link between changes in relative prices, factor endowments, and intensities, they are silent with respect to the magnitudes of such changes. To account for this we also consider a discrete version of our dependent variable (1 if the change in price is higher than the median in the country, and zero otherwise), and estimate a Probit model. The results in Table 8 show that interactions between factor intensities and factor endowments are not very successful to explain changes in relative prices around trade liberalization episodes. In columns (1) and (2), we estimate the model assuming that industry factor intensities are the same across countries. None of the parameters are significant, and only the interaction between physical capital intensity and physical capital endowment has the expected sign. Thus, the standard neoclassical model does a poor job in explaining how relative prices change during trade liberalization.

In columns (3) and (4) we use Schott (2003)'s classification of grouping 3-digit ISIC sectors in three Heckscher-Ohlin industry aggregates. The results are similar to those presented in columns (1) and (2). In general, the parameters for the interactive variables are not significant. Moreover, only in the Probit model is the parameter for the interaction between capital abundance and the high-capital intensity Heckscher-Ohlin aggregate positive. The only evidence that seems robust is that changes in relative prices tend to be lower for the intermediate Heckscher-Ohlin aggregate[12].

In sum, we find that changes in relative prices are not easily explained through simple implementation of the neoclassical trade model. Our results show that the relationship between factor endowments and factor intensities tell us very little about across-industry changes in protection following trade liberalization episodes.

[12] None of these results change if we define our explanatory variables in other ways. We have estimated the same model using discrete variables rather than continuous ones, interacting capital intensities with income-per-capita rather than factor abundance. We have also included natural resource abundance and natural resource intensity in columns (3) and (4).

6. Conclusions

In this paper we present a simple and intuitive measure of price distortions to study changes over time and across industries for a large sample of countries. We use the measure to explore the link between trade liberalization and changes in relative prices in a systematic way. This is critical since in most theoretical models the main effect of reducing or eliminating trade barriers is to close the gap between domestic and international prices.

Our basic message is that changes in relative prices across sectors do indeed seem to be a key part of the mechanism though which outcomes change following trade liberalization. This finding supports the classical and neoclassical theories of trade since their primary focus is on cross-industry trade and how trade liberalization generates worldwide price convergence. In this regard, we show that changes in relative prices are generally accompanied by reallocation between industries, but that these effects tend to be larger in terms of production rather than in terms of input reallocation. This result is consistent with either productivity gains generated by the liberalization process or with reallocation occurring within industries.

Indeed, our measures of price changes seem to be related to intra-industry reallocation. We have found evidence that larger increases in industry-relative prices are associated with increases in firm size and reductions in the number of firms. These reallocation and rationalization effects are consistent with recent models of firm heterogeneity in the so-called new theory of trade.

Finally, our results show how difficult seems to explain why certain sectors are more favored and other sectors less favored by liberalization episodes. In general, our findings suggest that simple implementation of comparative-advantage theories are unsuccessful in predicting relative price changes following liberalization reforms.

References

Aitken, Brian J. 1992. “Measuring Trade Policy Intervention. A Cross-Country Index of Relative Price Dispersion,” WPS 838, World Bank, January.

Anderson, James and Eric van Wincoop. 2004. “Trade Costs,” *Journal of Economic Literature*, 42(3): 691-751.

Antweiler, Werner and Danile Trefler 2002. “Increasing Returns and All That: A View from Trade”, *American Economic Review*, 92(1):93-119.

Barro, Robert J. and Jong-Wha Lee. 2000. “International Data on Educational Attainment: Updates and Implications,” CID Working Paper No. 42.

Bartelsman, Eric, Haltiwanger, John and Stefano Scarpetta. 2004. “Microeconomic Evidence of Creative Destruction in Industrial and Developing Countries,” *IZA Discussion Paper* No. 1374.

Bradford, Scott. 2003. “Paying the Price: Final Goods Protection in OECD Countries,” *Review of Economic and Statistics*, 85(1): 24-37.

Braun Matias. 2003. “Financial Contractibility and Assets' Hardness,” mimeo, University of California Los Angeles.

Easterly, William and Mirvat Sewadeh. 2002. *Global Development Network Growth Database*. World Bank, Washington, DC.

Gawande, Kishore and Pravin Krishna. 2003. “The Political Economy of Trade Policy: Empirical Approaches” in E K Choi and James Harrigan (eds.): *Handbook of International Trade*, Volume I. Basil Blackwell.

Gawande, Kishore and Usree Bandyopadhyay. 2000. “Is Protection for Sale?A Test of the Grossman-Helpman Theory of Endogenous Protection,” *Review of Economics and Statistics*, 89:139-152.

Giavazzi, Francesco and Guido Tabellini. 2004. “Economic and Political Liberalizations,” *Journal of Monetary Economics*, 52(7):1297-1330.

Goldberg, Penelopi K. and Giovanni Maggi. 1999. “Protection for Sale: An Empirical Investigation,“ *American Economic Review*, 89: 1135-1155.

Grossman, Gene M. and Elhanan Helpman. 1996. “Electoral Competition and Special Interest Politics,” *Review of Economic Studies*, 63: 265-286.

Head, Keith and John Ries. 1999. “Rationalization Effects of Tariff Reductions," *Journal of International Economics* 47(2): 295-329.

Hiscox, Michael J. and Scott L. Kastner. 2002. “A General Measure of Trade Policy Orientations,” mimeo.

Krueger, Anne. 1983. *Trade and Employment in Developing Countries*, Vol. 3, Chicago: Chicago University Press.

Krugman, Paul. 1979. “Increasing Returns, Monopolistic Competition and International Trade,” *Journal of International Economics*, 9: 469-479.

Leamer, Edward E. 1988. “Measures of Openness,” in Robert Baldwin (Ed.): *Trade Policy and Empirical Analysis*. Chicago University Press.

McCalman, Phillip. 2004. “Protection for Sale and Trade Liberalization: an Empirical Investigation,” *Review of International Economics*, 12(1): 81-94.

Melitz Marc J. 2003. “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity,” *Econometrica*, 71(6): 1695-1725.

Mitra, Devashish. Dimitrios D. Thomakos and Mehmet A. Ulubasoglu. 2002. “Protection for Sale in a Developing Country: Democracy Vs. Dictatorship,” *Review of Economic and Statistics*, 84(3): 497-508.

Roberts, Mark J., and James R. Tybout. 1996. *Industrial Evolution in Developing Countries*. Oxford University Press, New York, N.Y.

Rose, Andrew K. 2004. “Do We Really Know That the WTO Increase Trade,” *American Economic Review*, 4(1): 98-114.

Sachs, Jeffrey. D. and Andrew M. Warner. 1995. “Economic Reform and the Process of Global Integration”, *Brookings-Papers-on-Economic-Activity*. 0 (1): 1-95

Santos-Paulino, Amelia and A P. Thirlwall. 2004. “The Impact of Trade Liberalisation on Exports, Imports and the Balance of Payments of Developing Countries”. *Economic Journal*, 114(493): 50-72.

Schott, Peter K., 2003. “One Size Fits All? Heckscher-Ohlin Specialization in Global Production,” *American Economic Review* XCII: 686-708.

Trefler, Daniel. 2004. “The Long and Short of the Canada-U.S. Free Trade Agreement,” *American Economic Review*, 94(4): 870-895.

Tybout, James R. 2003. “Plant-and Firm-Level Evidence on “New” Trade Theories,” in E K Choi and James Harrigan (eds.): *Handbook of International Trade*, Volume I. Basil Blackwell.

Tybout, James R. and M. Daniel Westbrock. 1995. “Trade Liberalization and Dimensions of Efficiency Change in Mexican Manufacturing Industries,” *Journal of International Economics*, 39(1–2): 53–78 .

Tybout. James R., Jaime De Melo,. and Vitorio Corbo. 1991. "The Effects of Trade Reforms on Scale and Technical Efficiency: New Evidence from Chile”, *Journal of International Economics* 31: 231-50.

Wacziarg, Romain and Karen Horn Welch. 2003. “Trade Liberalization and Growth: New Evidence”. NBER, Working Paper 10152.

Wacziarg, Romain and Jessica Seddom Wallak. 2004. “Trade Liberalization and Intersectoral Labor Movements,” *Journal of International Economics*, 64: 411-439.

Table 1: Trade and Distortion Measures: Correlations

	Aggregate Price Distortion	Aggregate Price Distortion (Q-weighted)	Aggregate Price Distortion (V.A.-weighted)	Aggregate Price Distortion (L-weighted)	Hiscox-Kastner Aggregate Quantity Distortion (Basic)	Hiscox-Kastner Aggregate Quantity Distortion (Augmented)	Tarrifs	Volume of Trade (% of GDP)	Exports (% of GDP)	Imports (% of GDP)
Aggregate Price Distortion	1									
Aggregate Price Distortion (Q-weighted)	0.818***	1								
Aggregate Price Distortion (V.A.-weighted)	0.771***	0.840***	1							
Aggregate Price Distortion (L-weighted)	0.838***	0.848***	0.843***	1						
Hiscox-Kastner Aggregate Quantity Distortion (Basic)	0.233***	0.208***	0.309***	0.254***	1					
Hiscox-Kastner Aggregate Quantity Distortion (Augmented)	0.219***	0.199***	0.304***	0.243***	0.990***	1				
Tarrifs	0.431***	0.349***	0.372***	0.424***	0.446***	0.444***	1			
Volume of Trade (% of GDP)	-0.017	-0.025	-0.109***	-0.039*	-0.450***	-0.436***	-0.144***	1		
Exports (% of GDP)	-0.041**	-0.048**	-0.126***	-0.064***	-0.444***	-0.432***	-0.216***	0.939***	1	
Imports (% of GDP)	0.008	-0.001	-0.086***	-0.013	-0.419***	-0.404***	-0.067***	0.949***	0.782***	1

Table 2a: Price Distortions and Openness to Trade: Pooled and Cross-Country

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Open to trade	-0.073***	-0.092***	-0.030**	-0.068***	-0.077***	-0.091***	-0.123***	-0.097***	-0.107***	-0.092***	-0.039**
	(0.014)	(0.016)	(0.014)	(0.021)	(0.016)	(0.017)	(0.025)	(0.017)	(0.024)	(0.018)	(0.016)
ln(GDP per capita)			-0.033***								-0.036***
			(0.007)								(0.011)
ln(GDP)				-0.011**							0.004
				(0.005)							(0.007)
ln(Distance to Major Markets)					0.024*						-0.007
					(0.012)						(0.011)
Landlocked						0.001					
						(0.025)					
De Facto Exchange Rate Fixity							-0.003				
							(0.011)				
Black Market Premium								-0.02***			-0.0001
								(0.004)			(0.000)
Government Expenditure to GDP									-0.050		
									(0.072)		
CPI Inflation										0.001*	0.001***
										(0.001)	(0.000)
Constant	0.300***	-	-	-	-	-	-	-	-	-	-
	(0.013)										
Observations	2727	2727	2562	2562	2727	2727	1532	2224	1425	2477	1973
# of Countries	102	102	97	97	102	102	94	100	82	97	92
R-squared	0.086	0.146	0.245	0.165	0.165	0.146	0.167	0.176	0.204	0.149	0.257
Country FE	No	No	No	No	No	No	No	No	No	No	No
Year FE	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 2b: Price Distortions and Openness to Trade: Within-Country

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Open to trade	-0.035**	-0.044**	-0.037***	-0.043*	-0.050***	-0.053**	-0.035**	-0.054***
	(0.016)	(0.018)	(0.017)	(0.025)	(0.017)	(0.025)	(0.017)	(0.020)
ln(GDP per capita)		-0.053**						-0.057
		(0.026)						(0.040)
ln(GDP)			0.010					
			(0.033)					
De Facto Exchange Rate Fixity				-0.003				
				(0.006)				
Black Market Premium					0.002*			0.003
					(0.001)			(0.002)
Government Expenditure to GDP						-0.132		
						(0.256)		
CPI Inflation							0.002***	0.001***
							(0.0004)	(0.0003)
Constant	-	-	-	-	-	-	-	-
Observations	2727	2562	2562	1532	2224	1425	2477	1973
# of Countries	98	97	97	94	100	82	97	92
R-squared	0.556	0.558	0.553	0.622	0.577	0.615	0.563	0.578
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 3a: Effects on Volume of Trade

	Volume of Trade Growth											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Open to trade	0.034***		0.031***	0.038***	0.031***		0.028***	0.030***	0.035***		0.033***	0.029***
	(0.005)		(0.005)	(0.005)	(0.005)		(0.005)	(0.005)	(0.008)		(0.008)	(0.008)
Aggregate Price Distortion		-0.072***	-0.035	-0.014		-0.068***	-0.030	-0.029		-0.066**	-0.057*	-0.054*
		(0.024)	(0.023)	(0.022)		(0.024)	(0.022)	(0.022)		(0.033)	(0.032)	(0.031)
World GDP Growth				0.013***								
				(0.001)								
ln(Real exchange Rate)				0.003**				0.003*				0.024**
				(0.002)				(0.002)				(0.011)
Constant	0.035***	0.073***	0.046***	-0.015	-	-	-	-	-	-	-	-
	(0.003)	(0.007)	(0.007)	(0.010)								
Observations	2205	2205	2205	2173	2205	2205	2205	2173	2205	2205	2205	2173
# of Countries	89	89	89	87	89	89	89	87	89	89	89	87
R-squared	0.031	0.010	0.033	0.082	0.124	0.109	0.125	0.130	0.188	0.184	0.190	0.192
Country FE	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Year FE	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 3b: Effects on Exports and Imports

	Exports Growth						Imports Growth					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Open to trade	0.016***		0.018***	0.021*		0.022**	0.024***		0.023***	0.052***		0.050***
	(0.006)		(0.006)	(0.010)		(0.010)	(0.007)		(0.007)	(0.009)		(0.009)
Aggregate Price Distortion		-0.013	0.012		-0.007	-0.001		-0.049**	-0.017		-0.080**	-0.068*
		(0.025)	(0.027)		(0.041)	(0.041)		(0.024)	(0.023)		(0.040)	(0.037)
Observations	2306	2306	2306	2306	2306	2306	2306	2306	2306	2306	2306	2306
# of Countries	95	95	95	95	95	95	95	95	95	95	95	95
R-squared	0.062	0.057	0.062	0.114	0.112	0.114	0.079	0.075	0.080	0.132	0.127	0.134
Country FE	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Effects of Price Distortions on Trade: Event Study

	Volume of Trade Growth						Exports Growth			Imports Growth		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Change in Aggregate Price Distortion		-0.118**				-0.131***		-0.092**	-0.083**		-0.137**	-0.172***
		(0.046)				(0.043)		(0.044)	(0.038)		(0.052)	(0.051)
Change in Aggregate Price Distortion (V.A.-weighted)			-0.009**									
			(0.004)									
Change in Aggregate Price Distortion (Q-weighted)				-0.065**								
				(0.032)								
Change in Aggregate Price Distortion (L-weighted)					-0.068**							
					(0.031)							
Change in World GDP Growth						-3.623**			-2.080			-5.130***
						(1.504)			(1.734)			(1.640)
Change in Real exchange Rate						0.070***			0.075***			0.068***
						(0.020)			(0.019)			(0.023)
Constant	0.060***	0.050***	0.097***	0.054***	0.058***	0.040***	0.033**	0.025*	0.015	0.085***	0.072***	0.062***
	(0.015)	(0.013)	(0.024)	(0.014)	(0.014)	(0.010)	(0.015)	(0.013)	(0.012)	(0.018)	(0.015)	(0.013)
Observations	35	35	35	35	34	34	35	35	34	35	35	34
R-squared	-	0.153	0.082	0.070	0.105	0.402	-	0.093	0.282	-	0.141	0.362

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Sectoral Effects of Relative Price Changes, 5-year Period

	(1) Employment	(2) Investment	(3) Value-added	(4) Exports	(5) Imports	(6) Size	(7) Firms	(8) Labor Productivity
Relative price change	0.147	-0.231	1.061***	0.223	-0.026	0.309**	-0.207**	0.845***
	(0.089)	(0.242)	(0.102)	(0.178)	(0.108)	(0.120)	(0.096)	(0.103)
Constant	0.003	-0.044	0.095	0.001	0.087	0.057	-0.047	0.083
	(0.039)	(0.086)	(0.059)	(0.139)	(0.089)	(0.049)	(0.052)	(0.065)
Observations	937	676	983	646	666	621	667	936
R-squared	0.18	0.17	0.31	0.21	0.31	0.31	0.31	0.44
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses *significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Sectoral Effects of Relative Price Changes, 10-year Period

	(1) Employment	(2) Investment	(3) Value-added	(4) Exports	(5) Imports	(6) Size	(7) Firms	(8) Labor Productivity
Relative price change	0.033	-0.101	0.654***	-0.190	0.107	0.036	-0.003	0.635***
	(0.076)	(0.194)	(0.115)	(0.207)	(0.106)	(0.063)	(0.045)	(0.091)
Constant	-0.002	-0.026	0.122	-0.144	-0.004	0.126	-0.121	0.120
	(0.080)	(0.157)	(0.109)	(0.183)	(0.110)	(0.077)	(0.075)	(0.083)
Observations	630	395	638	359	362	286	286	630
R-squared	0.16	0.22	0.23	0.35	0.44	0.22	0.22	0.35
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry F.E	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses *significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Extent of Relative Price Changes and Reallocation: Event Study

	All Industries		CRS Industries		IRS Industries	
	Employment	Value-Added	Employment	Value-Added	Employment	Value-Added
	(1)	(2)	(3)	(4)	(5)	(6)
Mean change in prices	0.019	0.044***	0.183*	0.207***	-0.022	0.072
	(0.018)	(0.016)	(0.107)	(0.044)	(0.057)	(0.078)
Constant	0.007*	0.005	0.013	0.004	0.042***	0.043**
	(0.004)	(0.003)	(0.022)	(0.009)	(0.014)	(0.020)
Observations	34	34	39	39	34	34
R-squared	0.03	0.19	0.07	0.37	0.00	0.03

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Table 8: Change in Relative Prices, Factor Endowments, and Factor Intensities

	(1) OLS	(2) Probit	(3) OLS	(4) Probit
Natural resources intensity (NRI)	0.079	0.466		
	(0.220)	(0.391)		
Human capital intensity (HKI)	-0.016	-0.050		
	(0.139)	(0.210)		
Physical capital intensity (KI)	-2.691	-1.464		
	(3.926)	(4.101)		
NRI * Natural resources abundance	-0.008	-0.054		
	(0.024)	(0.055)		
HKI* Human capital abundance	-0.025	-0.002		
	(0.196)	(0.313)		
KI * Physical capital abundance	0.314	0.145		
	(0.428)	(0.438)		
KL Intermediate H-O			-0.032**	-0.041*
			(0.013)	(0.025)
KL High H-O			-0.011	0.007
			(0.017)	(0.017)
KL Intermediate H-O* Physical capital abundance			-0.002	-0.005
			(0.005)	(0.008)
KL High H-O* Physical capital abundance			-0.001	0.004
			(0.006)	(0.006)
Constant	0.002	-	0.008	-
	(0.052)	-	(0.007)	-
Observations	769	769	807	807
R-squared	0.02	-	0.01	-

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%

Figure 1: Price Distortions and Trade Liberalization Episodes

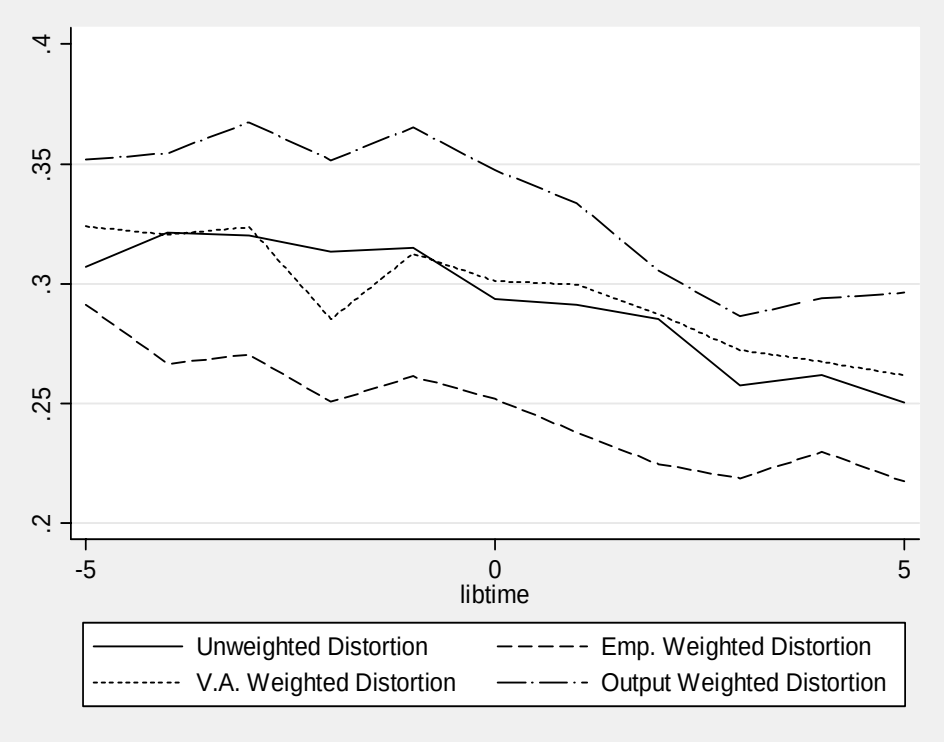


Figure 2: Price Distortions and Trade Liberalization Episodes

Alternative Benchmarks

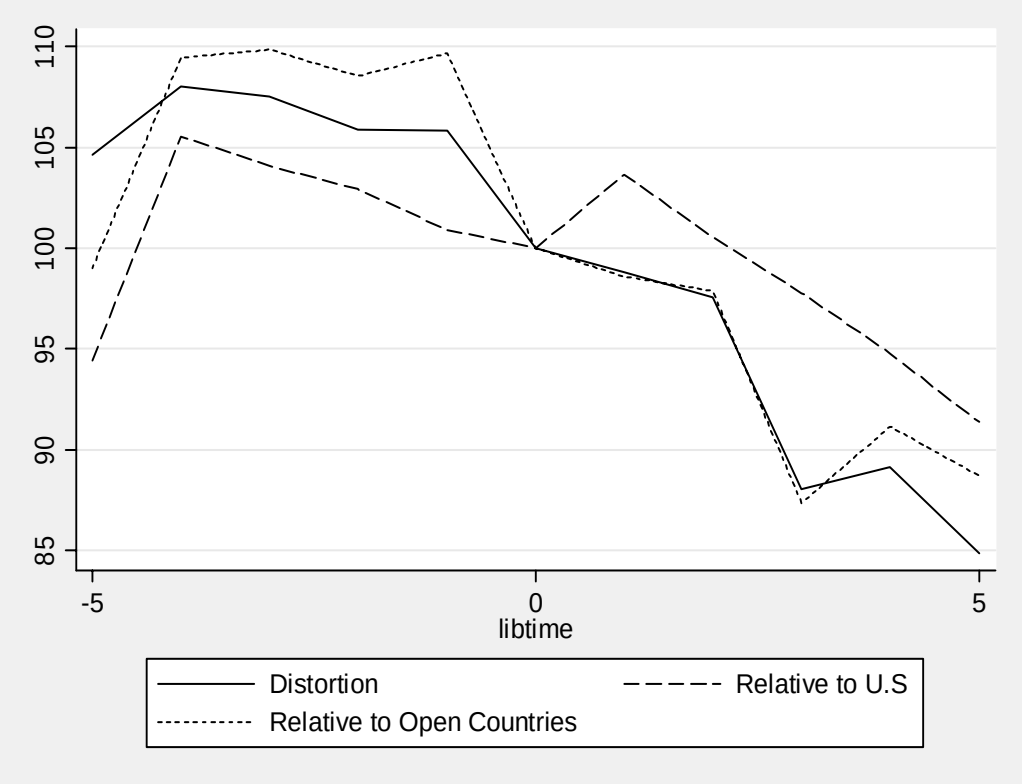


Figure 3: Effects of Price Distortions on Trade: Event Study

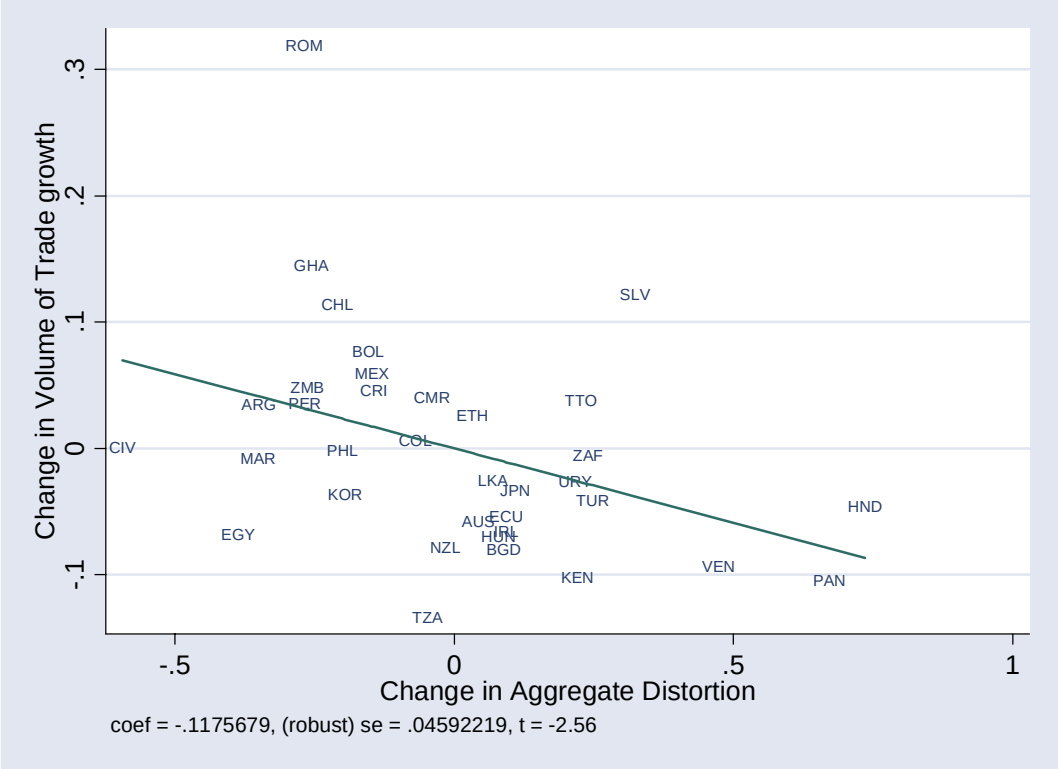


Figure 4: Total Reallocation, Employment Shares

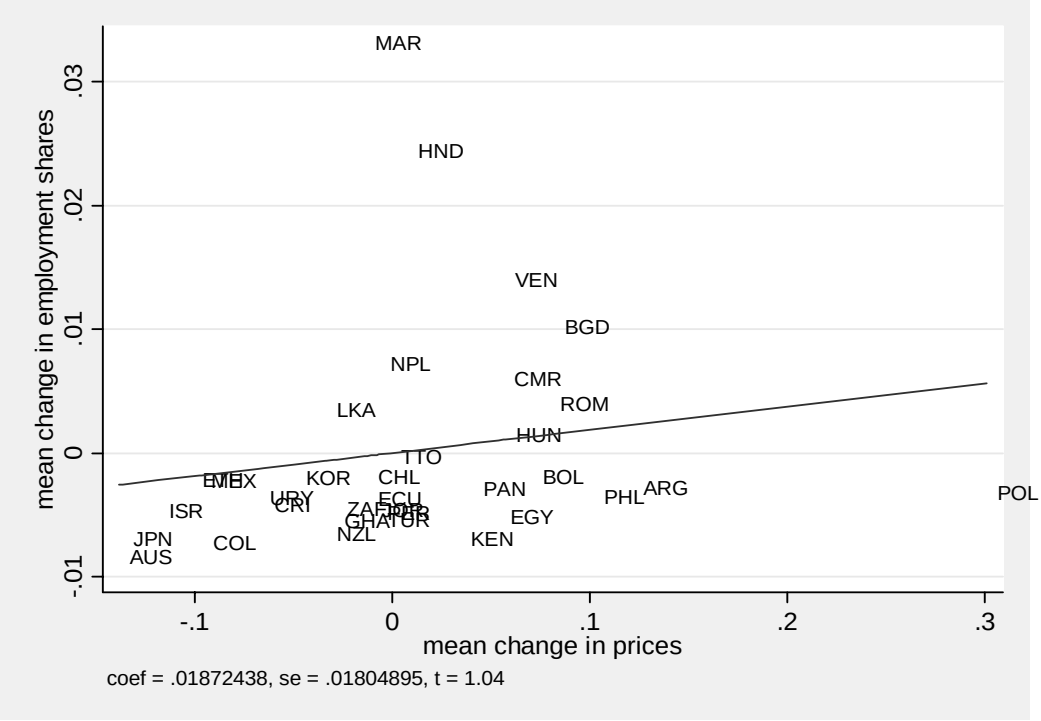


Figure 5: Total Reallocation, Value-Added Shares

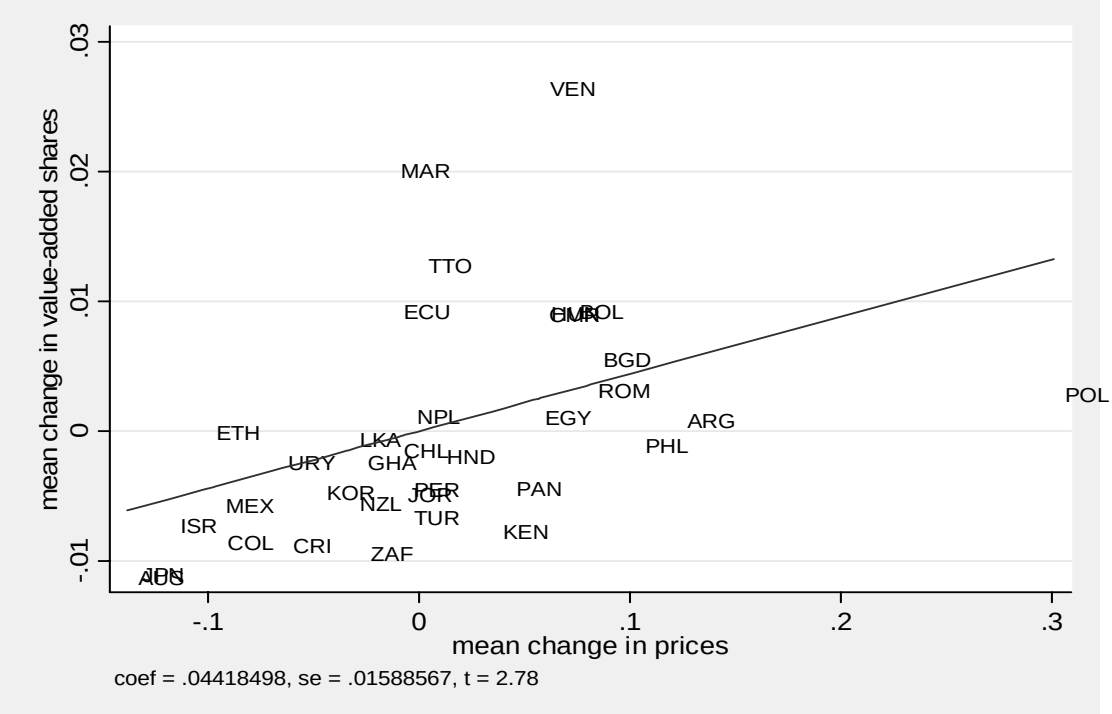


Figure 6: Total Reallocation in CRS Industries, Employment Shares

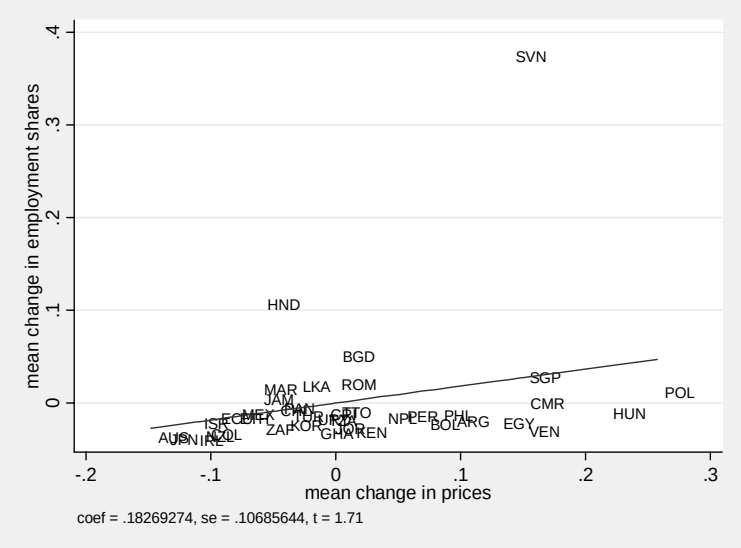


Figure 7: Total Reallocation in CRS Industries, Value-Added Shares

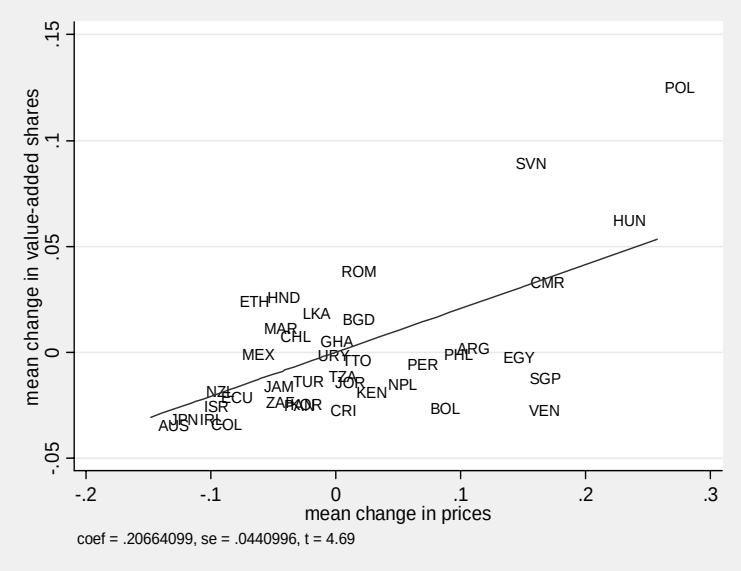


Figure 8: Total Reallocation in IRS Industries, Employment Shares

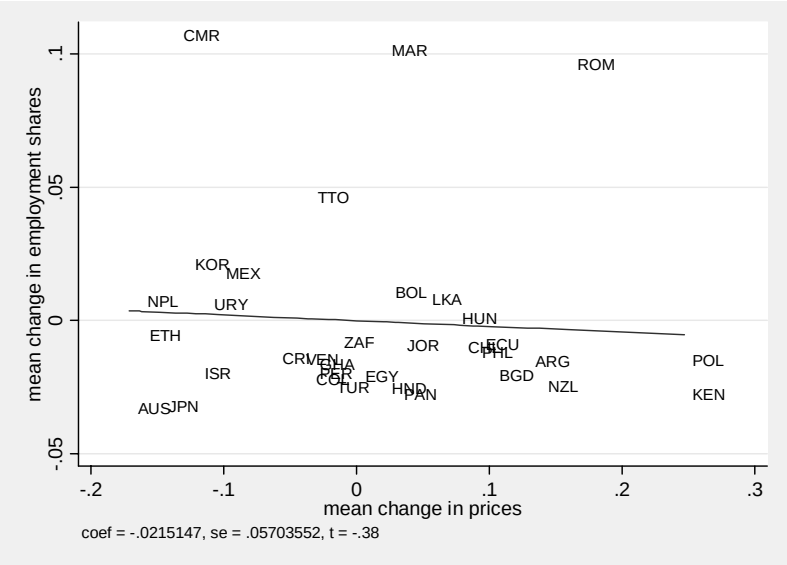
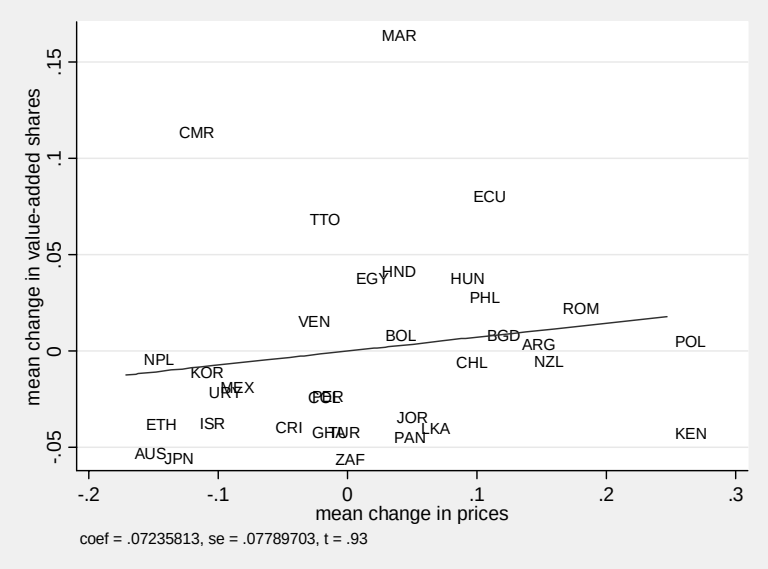


Figure 9: Total Reallocation in IRS Industries, Value-Added Shares



Documentos de Trabajo
Banco Central de Chile

Working Papers
Central Bank of Chile

NÚMEROS ANTERIORES

PAST ISSUES

La serie de Documentos de Trabajo en versión PDF puede obtenerse gratis en la dirección electrónica: www.bcentral.cl/esp/estpub/estudios/dtbc. Existe la posibilidad de solicitar una copia impresa con un costo de $500 si es dentro de Chile y US$12 si es para fuera de Chile. Las solicitudes se pueden hacer por fax: (56-2) 6702231 o a través de correo electrónico: bcch@bcentral.cl.

Working Papers in PDF format can be downloaded free of charge from: www.bcentral.cl/eng/stdpub/studies/workingpaper. Printed versions can be ordered individually for US$12 per copy (for orders inside Chile the charge is Ch$500.) Orders can be placed by fax: (56-2) 6702231 or e-mail: bcch@bcentral.cl.

DTBC-373 Agosto 2006
Openness Can be Good for Growth: The Role of Policy Complementarities
Roberto Chang, Linda Kaltani y Norman Loayza

DTBC-372 Agosto 2006
Market Reforms and Efficiency Gains in Chile
Raphael Bergoeing, Andrés Hernando y Andrea Repetto

DTBC-371 Agosto 2006
Sovereign Debt in the Americas: New Data and Stylized Facts
Kevin Cowan, Eduardo Levy-Yeyati, Ugo Panizza y Federico Sturzenegger

DTBC-370 Agosto 2006
Identifying Fiscal Policy Shocks in Chile and Colombia
Jorge E. Restrepo y Hernán Rincón

DTBC-369 Julio 2006
Bank Ownership and Lending Behavior
Alejandro Micco y Ugo Panizza

DTBC-368 Julio 2006
Inflation Targeting in Dollarized Economies
Leonardo Leiderman, Rodolfo Maino y Eric Parrado

DTBC-367 Junio 2006
El Banco Central de Chile en Comparación con los Bancos Centrales del Mundo
Marcelo Ochoa y Klaus Schmidt-Hebbel

DTBC-366 Junio 2006
An Alternative Measure of Core Inflation
Michael Pedersen

DTBC-365 Junio 2006
Chile's Economic Growth [El Crecimiento Económico de Chile]
Klaus Schmidt-Hebbel

DTBC-364 Mayo 2006
Metas de Inflación y el Objetivo de Pleno Empleo
José de Gregorio

DTBC-363
Skill Premium in Chile: Studying the Skill Bias Technical Change Hypothesis in The South Mayo 2006
Francisco A. Gallego

DTBC-362 Mayo 2006
Setting the Operational Framework for Producing Inflation Forecasts
Jorge Canales-Kriljenko, Turgut Kisinbay, Rodolfo Maino y Eric Parrado

DTBC-361 Mayo 2006
Estimaciones de *NAIRU* para Chile
Jorge Restrepo

DTBC-360 Abril 2006
Central Bank Independence and Monetary Policymaking Institutions: Past, Present, and Future
Alex Cukierman

DTBC-359 Febrero 2006
The Consumption-Real Exchange Rate Anomaly: non-Traded Goods, Incomplete Markets and Distribution Services
Jorge Selaive y Vicente Tuesta

DTBC-358 Febrero 2006
Autonomía de Bancos Centrales: la Experiencia Chilena
Luis Felipe Céspedes y Rodrigo Valdés

DTBC-357 Diciembre 2005
Global Inflation
Matteo Ciccarelli y Benoît Mojon