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Thesis

Is Globalisation Operating to Reduce Inflation: Evidence from Six OECD Countries

A thesis submitted in partial fulfilment of the requirements from the Master of Business Studies (Economics) at Massey University, Albany Campus

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Abstract

This paper relates openness to the decline in inflation by using panel data for six OECD (the USA, Japan, Canada, Portugal, Finland, and Australia) countries over the period from 1980 to 2006. I obtain industrial level data for twenty industries in each of the six countries in the timeframe and estimate the effects of increases in openness, through its effect on productivity and markups on inflation. The methods used to construct the variables in this paper follow methods introduced in Chen, Imbs and Scott (2004), and the estimations follow Chen, Imbs and Scott (2007). The results suggest openness reduces the rate of inflation in the short run. Furthermore, it also reduces short run productivity and markups. The long run results are ambiguous, however. The evidence that openness leads to anti-competitive effects in the long run is weak.

JEL Classification: E31, F12, F14, F15, L16

Keywords: Openness, Prices, Productivity, Markups

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Table of Contents

1. Introduction

The world nowadays is often called a *global village*. Information and products circulate very quickly among countries. Despite this, there are differences in the degree of openness between countries. Some countries establish policies to encourage trade liberalisation, while other countries are relatively more closed. Whether globalisation (in other word openness) has any impact on inflation is the subject of this paper.

This paper attempts to relate openness to the decline in inflation that has been observed in many countries. Rogoff (2006) argued that deregulation and globalisation are the factors supporting worldwide disinflation. Subsequently, some other studies have also found evidence that openness plays an important role in reducing inflation. There are also economists who hold the opposite opinion, believing that the decline in inflation is due to changes in monetary and fiscal policy, rather than an increase in openness. Romer (1993) emphasised the absence of precommitment in monetary policy. Chen, Imbs and Scott (2004) incorporated Romer's finding and claimed that openness induces decreases in markups, which then reduce the inflation bias of monetary policy. Eventually, inflation decreases. Moreover, they also found a direct effect of greater openness on price. In an updated version of their paper, Chen, Imbs and Scott (2007), demonstrate that openness leads to pro-competitive effects in the short run and anti-competitive effects in the long run. This paper follows these two studies and uses industry level data from six OECD countries (USA, Japan, Canada, Portugal, Finland and Australia) to estimate the short run and the long run impact of greater openness, through changes in productivity and markups on inflation.

The aim of this paper is to quantitatively verify the hypothesis of Chen, Imbs and Scott (2007), to test if globalization has impact on short run and long run industry performance. I use a new industry dataset from six OECD countries.

The findings in this paper suggest that short run competitive effects lower prices as markups are squeezed. Nonetheless, short run productivity also decreases, because of the decreased value added. Countries that are relatively more open are found to have lower prices, productivity, and markups in the short run. In the long run, however,

openness effects are ambiguous, with its influence on prices, productivity, and markups being weak.

The structure of this paper is as follows. Section 2 briefly reviews previous literature on different theories. Section 3 introduces the model estimated in this paper. Section 4 describes the data and the variables. Section 5 specifies the methodology. Section 6 states the short run and the long run empirical results. Section 7 runs a robustness check. Then, in Section 8 I give explanations for the differences between Chen, Imbs and Scott (2007) and this paper. The conclusion follows.

2. Literature Review

Most developed economies have observed a decline in inflation since the 1990s. Consequently, there have been several studies carried out on this topic from that period onwards. Based on the previous studies, the average rates of inflation are affected by several factors. For instance; the size of the economy, with smaller countries found to have lower inflation rates; the relative elasticity of wages, in that if the relative elasticity of wages is high, inflation tends to be high, and vice versa; the monetary policy adopted, as contractionary monetary policy decreases monetary supply and increases interest rates in order to combat inflation; and the degree of openness, as the more open a country, the lower the inflation will be in that country. Among the different theories that explain the decline in inflation, there are two major schools of thought. First, it is believed that the monetary policy of a country affects its inflation rate. More specifically, Romer (1993) showed how an absence of precommitment in monetary policy can lead to inefficiently high inflation. Chen, Imbs and Scott (2004) incorporated Romer's hypothesis into their study and showed that a decrease in the inflation bias of monetary policy reduces the rate of inflation. Furthermore, they added an alternative hypothesis, which views increased openness as reducing markups and raising productivity, therefore, lowering the overall price level. This means that rising import shares will bring a high level of competition, such that firms have to lower their prices to compete with others. In order to lower prices, firms would either reduce the profits they make, or lower their costs. One critical way to save costs is to cut labour costs, hence every worker in the company becomes more productive under this situation and this company survives in the competitive environment. Nevertheless, there are some firms that are less competitive and they are likely to go out of business. This is another reason for a higher level of productivity.

2.1 Monetary Policy Effects

Romer, D. (1993)

In this paper Romer argued that, "…in a one-time game without binding precommitment, the equilibrium rate of inflation is inefficiently high, and output remains at its natural rate" (p. 869). A cross-country data set (114 countries), beginning

in 1973, was used. The basic specification was a regression of the log of average inflation on a constant, and the degree of openness. Other three control variables were also considered; 1) real income per capita served as a general measure of development, 2) dummy variables for OECD membership and the various regions, and 3) dummy variables for the use of the CPI, rather than the GDP deflator, to measure inflation. The results show a negative and significant relation between inflation and openness. There are two other explanations. First, to control for the endogeneity of openness, a country's land area and population are chosen as instrumental variables. The results provide no evidence, however, that the possible endogeneity of the import share is the source of a negative association between openness and inflation. The second explanation considers the government budget and seignorage, rather than the absence of precommitment in the monetary policy, however, three pieces of evidence strongly suggest that these factors do not account for the negative association between openness and inflation. The final result shows that the link between openness and inflation is weaker in countries that are more politically stable, and that have more independent central banks. There is no link between openness and inflation among the most highly developed countries. As the benefits of unanticipated monetary expansion decreased with the degree of openness, average rates of inflation are lower in smaller, more open economies. That the absence of precommitment in monetary policy leads to inefficiently high average levels of inflation is essential in understanding inflation in most of the world.

Terra, C.T. (1998)

This paper followed Romer (1993) by pooling the full sample of 114 countries and averaging the data over the full period from 1973 to 1990. Terra found the same result. Then the sample was divided into four groups according to indebtedness level and the timeframe was separated into two periods. These were the predebt crisis period from 1970 to 1981, and the debt crisis period from 1982 to 1990. After running the same regression, Terra suggested that, "…the negative link between inflation and openness Romer found may be largely driven by the responses of severely indebted countries (SICs) to the debt crisis of the 1980s" (p.641). Based on Romer (1993), Terra provided further criteria that show the link between openness and inflation to be significant. That is evidence from her empirical study showing that the negative relation can only be found in SICs during the debt crisis, and that it is not applicable for other countries and/or during other time ranges. Terra concluded that, "…countries that 'overborrowed'

are precisely the ones with less precommitment in monetary policy, and therefore the negative link between inflation and openness is stronger among them" (p.646).

Romer, D. (1998)

Romer (1998) replied to Terra's paper, listing three points that suggested that the channel Terra proposed accounts for only a modest part of the overall relation. First, Terra's results did not justify her claim. As seen from the results reported in Terra (1998), the negative relation between openness and inflation is large and significant for the SICs in the pre-crisis period, though it is weaker than during the crisis period. This negative relation is also found in the less indebted countries. Second, Terra's mechanism encounters both conceptual and empirical difficulties. Conceptually, a borrowing country can run a trade deficit rather than a surplus, however, her mechanism operates in reverse. Empirically, according to her mechanism, indebted countries need to run trade surpluses to repay their debts. In fact, there is no evidence that the SICs ran larger surpluses than other countries. Third, the alternative interpretation of Terra's findings is consistent with Romer's proposed explanation. Terra's result may explain some of the variation over time, but it cannot account for the overall relation, or for its variation with indebtedness.

Razin, A. and Loungani, P. (2005)

The marginal rate of substitution between the output gap and inflation was introduced in this paper. The purpose of using this rate was to explain how globalisation forces induce monetary authorities to place greater emphasis on reducing the inflation rate than on narrowing the output gap. Razin and Loungani (2005) demonstrate that, if an economy opens up to international trade in goods, and integrates into the world capital markets, the central bank puts heavier weight on inflation relative to the output gap. Hence, they conclude that globalisation lowers inflation.

Rogoff, K. (2006)

In this paper, Rogoff analysed the role of global factors from the perspective of both goods and assets markets. Rogoff argued that, despite globalisation weakening the control of individual central banks through both goods and assets price arbitrage, and global factors helping to shape monetary decisions, domestic monetary authorities still

retain strong control over medium and long-term inflation trends, even in very open economies.

2.2 Openness Effects

Lane, P.R. (1997)

This study proved that, because a more open country suffers more from the negative terms of trade effect of an expansion in domestic output, it gains less from surprise inflation and, hence, has less inflation. It also claimed, however, that the relation between inflation and trade openness holds not only for large countries, but also for economies too small to affect international relative prices. Cross country data from 114 countries from 1973 to 1988 was utilised in the linear regressions. The empirical estimation of the average inflation rate used in the study is a function of; the share of imports in GDP, total GDP, and a set of control variables which include political instability and per capita income. The summary statistics show a negative correlation between openness and inflation, for both the full sample and the OECD sample. Then, the data was divided into two groups, being wealthy countries and OECD countries. After controlling for country size, the coefficients of openness in both regressions are found to be negative. In order to avoid the problem that openness and inflation are linked, *natural openness,* as constructed in Lee (1993), was used as the measure of trade. This variable can be interpreted as a policy-independent measure of openness. The result generally supports the inverse relation between inflation and openness. In this paper, Lane extended Romer (1993) and illustrated that the gains to surprise monetary expansion and, hence, the incentives to inflate, are lower in a more open economy, even when the economy is too small to affect international relative prices. Moreover, the openness effect is strengthened when country size is included as a control variable.

Melitz (2003)

This paper analysed a new channel for the impact of trade on industry structure and performance, which works through intra-industry reallocation. Melitz claimed that export market entry costs makes exporting unaffordable for less productive firms. Hence, due to firm heterogeneity; in terms of productivity differences; only more productive firms export, while less productive firms serve their domestic market, with the least productive firms exiting the market. Eventually, more productive firms gain

market share and make profit from trade, while less productive firms lose both, with some not surviving. This explains why aggregate industry productivity increases in export markets.

Melitz and Ottaviano (2005)

The theory of firm heterogeneity, as developed in Melitz (2003), was still applied in this paper. Furthermore, endogenous markups was incorporated into the paper. The authors found that market size also affected markups and the productivity of firms. Since bigger markets have more product variety, firms in this kind of market are more productive and they need to set lower markups. The probability of survival in such markets is lower in comparison with smaller markets, and the competition is tougher. As the aggregate productivity is higher, however, firms secure a greater number of sales and, therefore, earn higher profits.

Ihrig, Kamin, Lindner and Marquez (2007)

By estimating standard Phillips curve inflation equations for 11 industrial countries, and using these estimates to test several predictions of the globalisation and inflation hypothesis, the authors did not find evidence to support that globalisation affects the level of inflation. They argued, however, that globalisation may affect inflation through another channel, that of net exports. The authors found that; 1) the correlation between real domestic demand and real GDP decreases, 2) the share of net exports to GDP increases, and 3) the movements in domestic demand are offset by changes in net exports. All these findings indicate that domestic demand becomes small in relation to GDP and any fluctuations in domestic demand do not cause much change in GDP. Therefore, the stabilizing role of net exports becomes more important. The authors concluded that globalisation affects net exports and, hence, either helps to stabilise real GDP, output gaps and inflation, or allows domestic demand to fluctuate more widely without destabilising GDP.

Borio, C. and Filardo, A. (2007)

Borio and Filardo stated that the trend in inflation is to become lower and more stable around the globe, especially since the 1990s. They agreed that this is because monetary policy has become much more effective. They also found, however, that this point of view failed to consider the role of global factors. In this paper Borio and Filardo explore

a complementary, rather than an alternative, explanation, emphasising the important role of globalisation in influencing the inflation process. They stated that globalisation contributes to a decline in inflation. In order to elaborate their theory, the authors developed two stylised approaches. One is the *country-centric* approach, which is consistent with the monetary policy method of modelling inflation and focused on country-specific factors. The other is the *globe-centric* approach, which emphasises the importance of the global counterpart. Although the two approaches are polar opposites, the authors stressed that they do not differ in their fundamental view of the inflation process and the only difference between the two is the way in which they treat national borders. To summarise, the country-centric approach treats international and global factors as exogenous, whereas the globe-centric approach treats many influences on country-specific developments as endogenous. The method testing for the impact of global factors extends the traditional Phillips curve specifications. The empirical results support the hypothesis that the globe-centric view becomes more relevant for domestic inflation determination, which is in opposition to the findings of Ihrig, Kamin, Linder and Marquez (2007). Borio and Filardo argued that the reason why the previous paper did not find the relation between globalisation and inflation was due to the biases in their specification. After filtering out the disinflationary trend from the data, Borio and Filardo concluded that global factors appear to have supplanted the role of domestic measures of economic slack (output gap). Even though globalisation affects the inflation process, monetary policy still has implications, because of lags, the risk of systematic errors, and the effectiveness of the domestic monetary policy.

Chen, Imbs and Scott (2004)

Beside monetary and fiscal policy effects, greater openness was also considered as a factor that reduces inflation in this paper. It works through two channels. One is a direct effect. As openness increases, the level of competition rises. As a result, markups are reduced in order to lower prices, with productivity being increased as a consequence of reducing costs. The other channel is that lower markups reduce the inflation bias of monetary policy, which has the most substantial impact on inflation. Two datasets were investigated. They both focused on EU manufacturing data (industrial data at the two-digital NACE (revision 1) level). One dataset included eight countries and twenty-one industries from 1988 to 2000, which did not contain markups. This data suggested that, in the short run, openness has a more substantial role in reducing prices

and, in the long run, openness mainly works through productivity. The other dataset included seven countries and ten industries from 1989 to 1999 and markups were included in the data. Estimations of this data showed that the openness effect operates via both productivity and markups. Moreover, productivity was found to play a greater role than markups in affecting prices and the long run effects of the two factors were found to be larger than the short run effects. The authors concluded when monetary policy remains unchanged, with the fall in markups and the rise in productivity being induced by increased import shares reducing aggregate inflation.

Chen, Imbs and Scott (2007)

In this paper the authors improved their previous estimation by focusing on the difference between the short run and long run effects and used an error correction model to test the short run and long run effects simultaneously. They emphasised that firm location is fixed in the short run. The decision of whether to export depends on costs, which include transport costs and tariffs determined in the foreign economy. Therefore, low transport cost firms can afford to export and supply foreign markets. High transport cost firms cannot afford to export and, therefore, produce for the domestic market only. In the short run, an increase in openness means an increase in product varieties. As a result, consumers have more choice and the product elasticity of demand rises. Under this circumstance, firms have to lower their prices by reducing markups. Consequently, high cost domestic firms and foreign firms are eliminated, with only low cost and high productivity domestic firms surviving and overall average productivity increases. In contrast, firms can choose their location in the long run. Instead of exporting, they can relocate and move to a foreign market. Eventually, in the long run increased openness may lead to anti-competitive effects. Moreover, the effects of openness on productivity and markups also reverse in the long run.

3. Theory

3.1 Demand and Supply

Chen, Imbs and Scott (2007) applied the consumption utility function introduced in Melitz and Ottaviano (2005). The market demand for the product varieties in each industry is then equal to the number of consumers in the economy multiplied by the inverse demand for each variety, which is linear in price. Nevertheless, the price elasticity of demand depends on the number of firms in each industry (Ottaviano, Tabuchi and Thisse, 2002), rather than the sales income of the firms (Dixit and Stiglitz, 1977). Therefore, according to this demand function, trade liberalisation affects the number of firms in each industry and eventually influences the aggregate industry performance. This demand function also applies to the foreign market. On the supply side, labour and technology are the factors of production. In the domestic market, labour is perfectly mobile between firms in the same industry, as no wage differences are possible. Therefore, differences in unit costs are only due to technological reasons. In contrast, as labour is not perfectly mobile across countries, wage differences may exist in different markets. Thus, differences in unit costs may be produced through wage, or technological, differences. In an open economy, firms can choose whether to produce for the domestic market, or for the foreign market. Firms will incur transport costs and tariffs if they decide to export to foreign markets. In the short run, it is not possible for the firms to move into the foreign market. They are confronted by the question that how much to produce for the domestic market and for the foreign market. Based on the assumptions made in Melitz (2003) and Melitz and Ottaviano (2005), costs for firms in each industry follow a Pareto distribution. Aggregate industrial prices and average costs are both positively dependent on the unit cost of the marginal domestic (foreign) firm achieving zero sales. Markups are the difference between the aggregate price and the average cost, which means that they are also positively related to the unit cost of the marginal domestic (foreign) firms achieving zero sales. Productivity is negatively related to the threshold cost. The same applies in regards to the foreign economy.

3.2 Trade Liberalisation

In the short run, transport costs determine the volume of exports. As firm location is fixed, exporting is the only way to serve the foreign market. In this case, transport costs

directly influence the decision and ability to export. Therefore, only low cost and more productive firms can afford to export. Bernard and Jensen (1999), Aw, Chung and Roberts (2000), and Clerides, Lack and Tybout (1998) studied different markets, but all found that more productive firms expand into export markets gradually. In the model, as a country opens up to international trade, the number of product varieties in the market increases. This induces a fall in markups and prices. Foreign exporters and less productive domestic competitors exit the market. Low cost and high productivity firms remain producing for the market. The long run effect is distinct from the short run, because firms can choose their location. Moving to a foreign market can save in transport costs and just incurs fixed production costs. In the presence of increased competition due to trade liberalisations, firms move to a relatively closed economy and export to the domestic market. The reason for this is that the decrease in trade costs is more profitable than staying in the domestic market. This leads to a fall in markups and prices, and a reduction in productivity. If, however, fixed costs are not consistent and depend on transport costs, the long run results change dramatically. As stated in Melitz and Ottaviano (2005), trade liberalisation leads to the number of firms serving the domestic market increasing, rather than decreasing, as the fall in trade costs is offset by the decrease in domestic fixed costs. Hence, the long run effects of trade liberalisation are ambiguous. Whether the number of firms remaining in the domestic market will increase, or decrease, depends on which of the two effects is greater. If the effect of falling trade costs is greater than the effect of falling domestic fixed costs, firms move to a foreign market and the total number of firms remaining in the domestic market is reduced, and vice versa.

There is another channel through which openness reduces price in the short run; the inflation bias of monetary policy. In a relatively closed economy, prices tend to be high, due to monopoly power. Nevertheless, the monopoly produces a socially sub-optimal level of output (Frank and Bernanke, 2007). The government then intervenes in the market in order to raise the level of output closer to the socially optimal level. This is commonly achieved through the application of stimulatory monetary policy, which leads to higher level of inflation. In this sense, monetary policy in a country with a large number of monopolies has an inflationary bias. An increase in globalisation, however, increases the degree of competition domestically, which lowers the pricing power of monopolists. This means that globalisation brings the domestic output closer to a

socially optimal level and, thus, lowers the incentive of the government to stimulate the economy's GDP. That is to say, increases in openness also lower the inflationary bias of monetary policy. Consequently, prices fall. This channel is, however, out of the scope of this paper and is not empirically tested here.

3.3 Model

Following Chen, Imbs and Scott (2007), an error correction model is utilised. All variables are measured in logarithms and solved for the long run equilibrium. An error correction model is then obtained:

$$\Delta Yt = \beta 0 \Delta Xt + (\beta 1 - 1)(Yt\text{-}1 - \Phi - \theta Xt\text{-}1) + et \qquad (1)$$

In this simplified expression, the difference term on the right hand side captures the short run relation between the independent variable and the dependent variable. The error correction term captures the long run relation. To use this model, the variables need to be non-stationary in a unit root sense (Kennedy, 2008), which will be tested later in Section 5.5. In fact, there are more than one difference terms and more lags are used in explaining the effects of openness on prices, productivity and markups, but the manipulations are the same as in the specification above.

3.3.1 Openness (Import Share)

Transport costs are the key parameter determining openness in this model. If the import transport costs rise, domestic openness will fall. An increase in domestic openness will lead to a fall in import transport costs. The same applies to the foreign market.

3.3.2 Prices

The short run prices depend on openness and the number of domestic firms. Increases in the number of domestic firms lead to lower prices and increases in the number of foreign firms have a positive effect on prices. The long run prices depend on openness and market size, as measured by Gross Domestic Product (GDP). Domestic GDP should have a negative impact on growth in prices and foreign GDP should have a positive impact.

3.3.3 Productivity

Short run domestic productivity depends positively on domestic openness and the number of domestic firms. Foreign openness and number of firms have the opposite effect on domestic productivity. In the long run, both market size and labour costs matter. Larger GDP economies have higher productivity, while smaller GDP countries have lower productivity. Assuming labour costs depends on wages only, a rise in domestic wages has a negative impact on productivity and, if domestic wages fall, productivity increases.

3.3.4 Markups

In this model, markups are affected negatively by openness and the number of firms over the short run. In the long run, openness has a positive impact on markups, with larger GDP countries having lower markups.

4. Data and Variables

4.1 Data

I have obtained data from the OECD STAN database, Data Stream, IMF (International Monetary Fund) database, the Bank for the Accounts of Companies Harmonised (BACH) database, the US Census Bureau, the US Department of Labour, Statistics Canada, the Australian Statistics Bureau, the Bank of Japan, and the Japanese Ministry of Economy, Trade and Industry. I chose the US, Japan, Australia, Portugal, and Finland as the study countries at first, however, due to the scarcity of data (some variables are not available for particular industries in every year), Canada was then added to extend the dataset. This was because Canada is one of the world's major economies and would provide useful information for this study. The dataset is an unbalanced panel data set, which covers the period from 1980 to 2006 for the six OECD countries. I used industrial level data for twenty industries in these countries, disaggregated at the two-digit NACE (revision 1) level. In Appendix A I provide the sources of data for each country. Appendix B provides the BACH industry groupings and correspondence with NACE (revision 1) industries as reference material. Although data used in this paper are not from BACH only, data from other sources also follows these industry groupings.

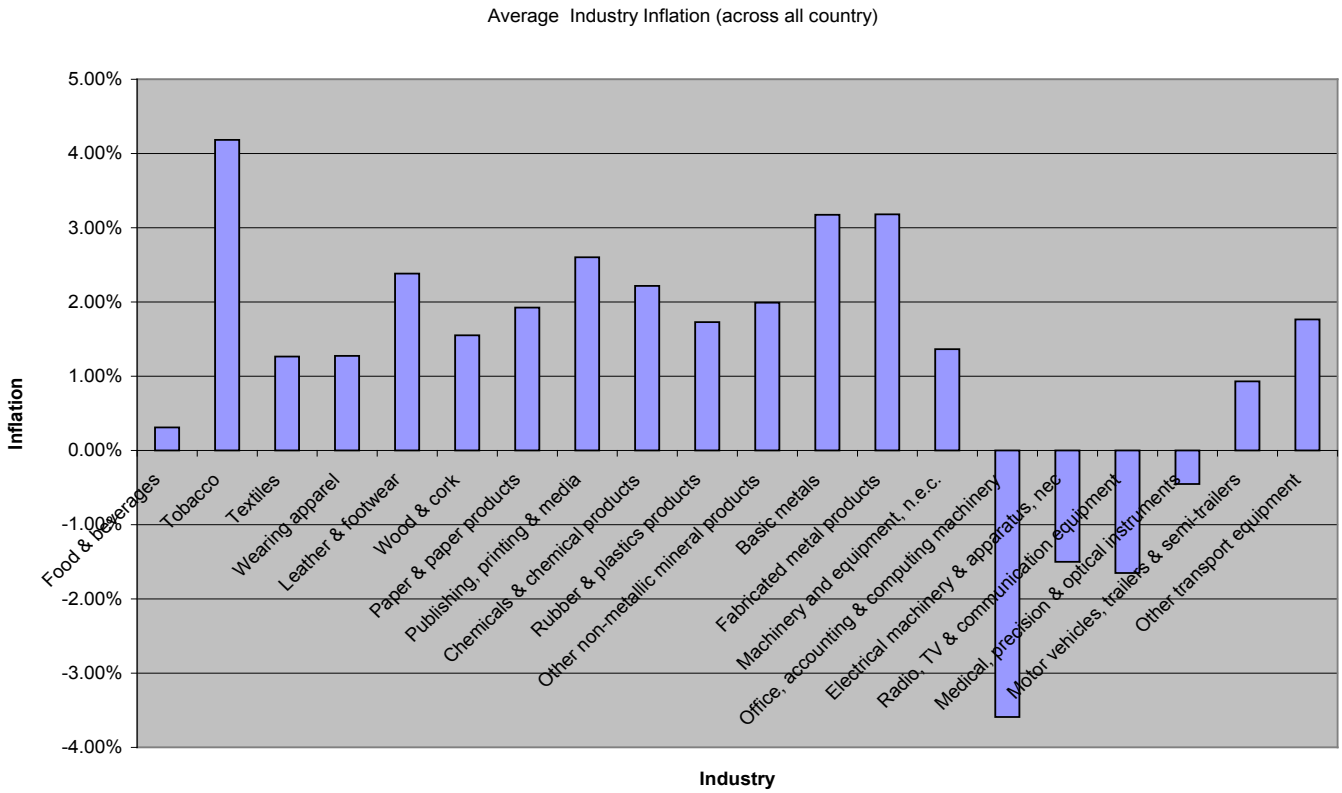
4.2 Variables

The methods I use to construct the variables follow Chen, Imbs and Scott (2004).

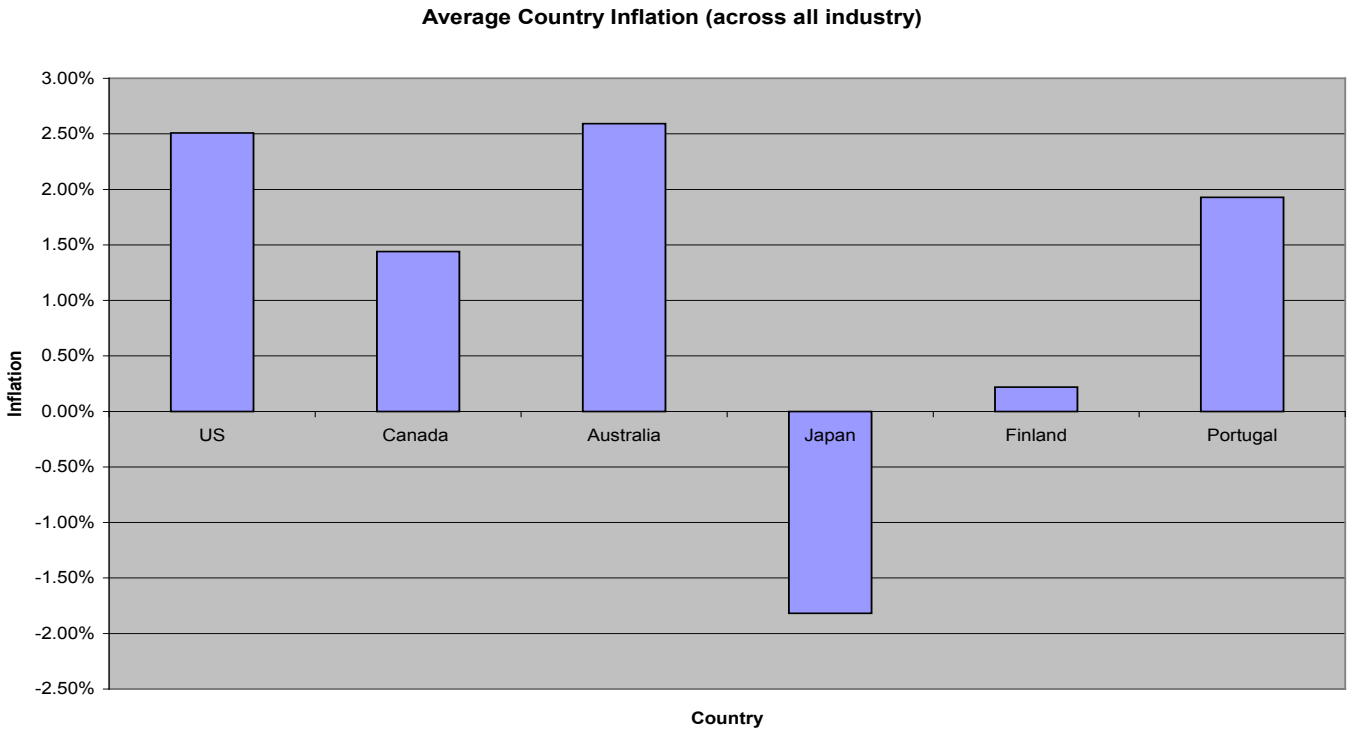
1. ***Inflation*:** Measured by the Producer Price Index (PPI). As I use industrial price data, the PPI is the appropriate measure of inflation in this study. The PPI value for December of each year is utilised as the measure for that year. During the collection of the PPI, a measurement problem encountered is that the PPI for Japan is not calculated by any of the source databases, and the Bank of Japan only collates output price indices. Therefore, I use the output price indices as the proxy for the PPI of Japan. As it can also be used to calculate sector-specific inflation rates, the PPI reflects how the inflation rate in different industries changes when openness and markups change. Therefore, the output price index is appropriate in this case. Unfortunately, the data are not available for the whole

time range for every single industry, but the existing data will still provide some significant clues. In order to make the PPI (the OPI in the case of Japan) for each year comparable, I establish a variable, named the *Scaled PPI*. First, I set 2000 as the base year. Therefore, the PPI in 2000 for every industry is one unit, and then we use every other year divided by the base year and multiplied by one to obtain a numerical value for the particular year. Then the inflation rate is calculated by using the current year's *Scaled PPI* minus the previous year's *Scaled PPI,* then divided by the previous year's *Scaled PPI*. Table 1 shows the average, minimum, and maximum country inflation rates across all industries. Australia has the highest average inflation rate, at 2.59% for the years from 1980 to 2006, and Japan has the lowest average inflation rate at -1.82%. Table 2 shows the average, minimum, and maximum industry inflation rate across all countries from 1980 to 2006. The highest average industry inflation rate appears in the Tobacco industry, at 4.18%. The lowest is for the Office, accounting, and computing machinery industry, at -3.59%. The graphs below show the average industry inflation and the average country inflation rates.

Graph 1

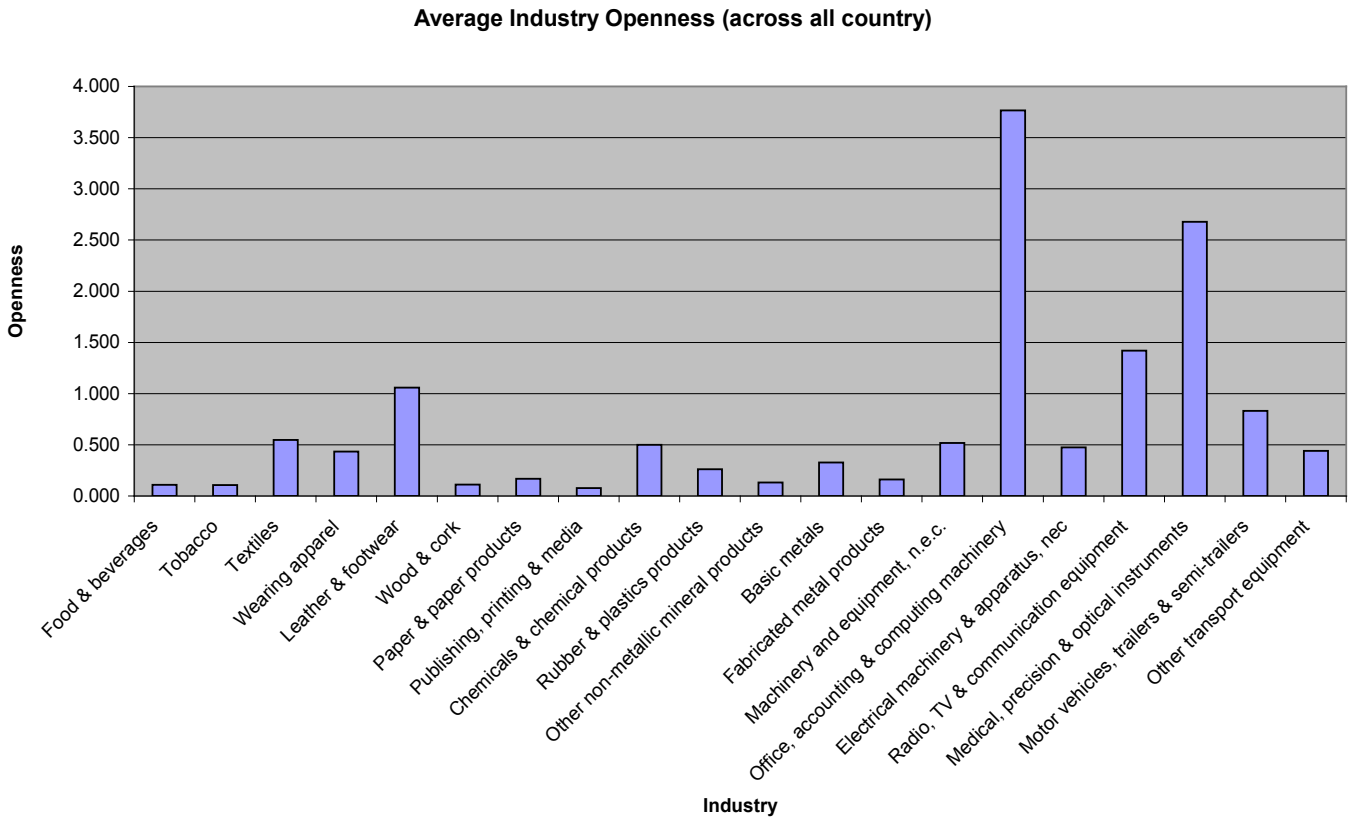


Graph 2

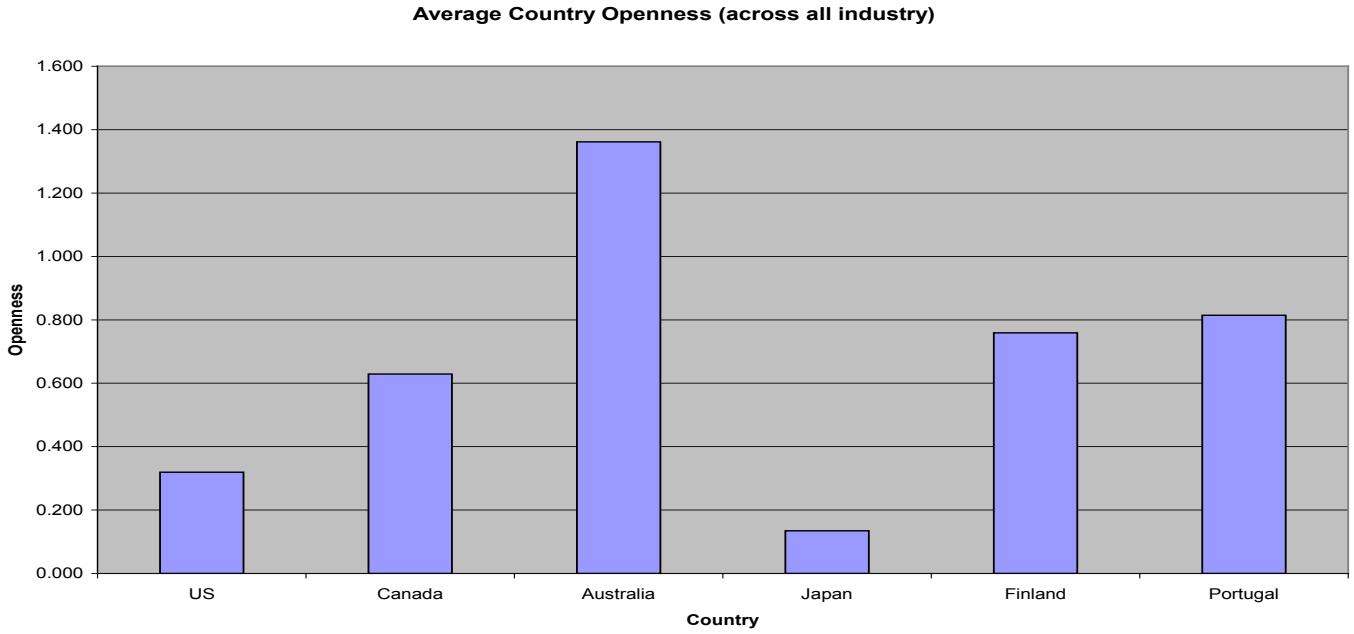


2. ***Openness***: Imports of goods at the base price are divided by production (gross output) at the base price. This is slightly different from the method used in Chen, Imbs and Scott (2004). They use total turnover, rather than output, as the denominator in their paper, because they wish to focus on imports relative to domestic consumption. It is, however, very difficult to obtain total turnover data. Hence, I use production as a substitute, which also makes sense in revealing the share of imports. As shown in Table 3, Australia is the most open country and Japan is the most closed country in the study, with the rates of openness of the two countries being 1.361 and 0.134, respectively. The highest average industry openness in Table 4 is 3.766, which appears in the Office, accounting and computing machinery industry. Publishing and printing has the lowest degree of openness, at 0.077. Average industry openness and average country openness are shown in the graphs below.

Graph 3

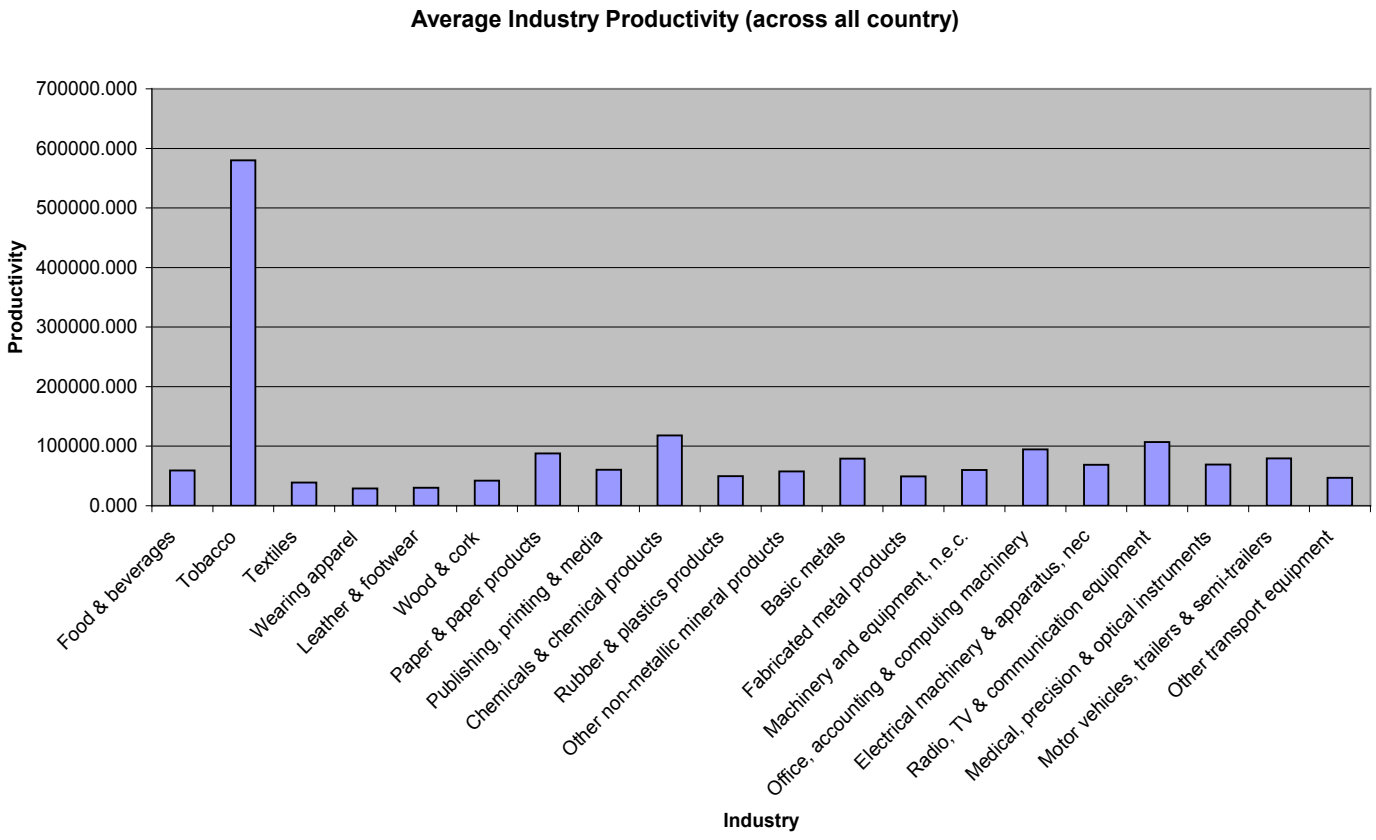


Graph 4

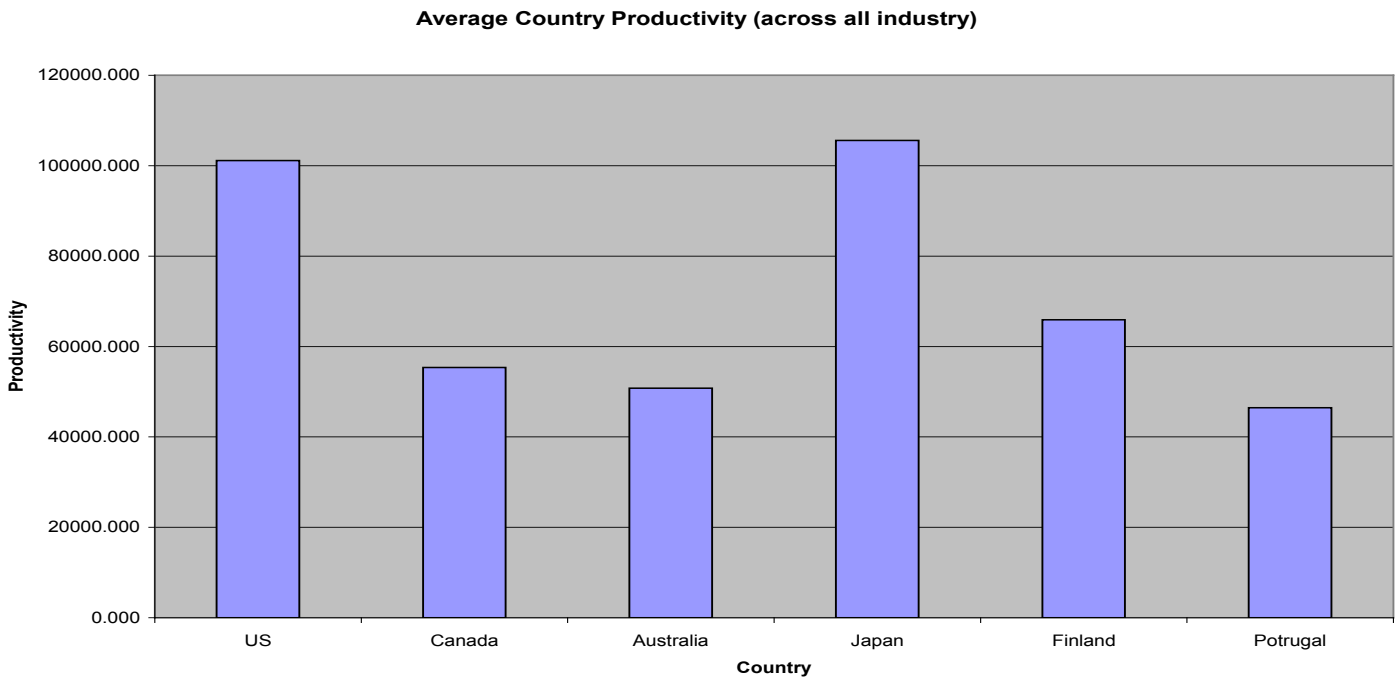


3. ***Real Productivity***: Deflating value added by industrial price indices, and then dividing by total employment in terms of persons employed (headcounts). I calculate nominal productivity first, which equals value added for the particular industry in that year divided by the total employment of the corresponding industry and year. Then, the nominal productivity is deflated by dividing the corresponding *Scaled PPI.* For the US, the Radio and Television, Optical instruments, and Other transport are eliminated due to lack of data for some of the years. Since lack of data will not provide sufficient information for the industry, they are abandoned. The summary statistics of real productivity are shown in Tables 5 and 6. The highest country average real productivity shown in Table 5 is 105,568.417, which appears in Japan. The lowest is for Portugal, at 46,444.231. Tobacco has the highest real productivity across all industries, at 579,863.425. The lowest real productive industry is Wearing apparel, with a real productivity of 29,103.921. Graphs 5 and 6 show the average industry productivity and the average country productivity, respectively.

Graph 5



Graph 6



4. ***Markups***: There are two methods for constructing markups. As the raw data needed to compute markups is collected from two different types of source; the Bank for the Accounts of Companies Harmonised (BACH) database (harmonised means that the data are in a unified standard and are comparable), and the official statistical database of a country; the format of the data from different sources differs. Thus, different approximations are applied in the two cases.

   a) The data for Finland and Portugal are from the BACH database, which contains harmonised annual account statistics. To compute markups across industries i , countries j, and years t , the approximation can be obtained as follows:

$$\mu_{ij,t} = \text{Turnover}_{ij,t} / \text{Total costs}_{ij,t} \qquad (2)$$

Total costs are the sum of the variable costs (e.g., costs of materials and consumables, and staff costs), fixed costs (e.g., depreciation on intangible and tangible assets, and interest paid on financial debts), and other operating charges and taxes, then subtracted from the other operating income. As the data obtained from BACH are presented as a portion of turnover, the numerical value obtained from adding these figures is exactly the reciprocal of μ. In order to get μ, simply use one divided by the numerical value.

b) In the case of the US, Japan, and Australia, the data are obtained from their statistical authorities, in which account statistics are not available. Therefore, an alternative approximation of markups is utilised. The steps are to first, construct a variable using the approximation below, which I name *Semi-Markups:*

Semi-Markups= (Value added – Total compensation paid to employees)/ Value of shipments

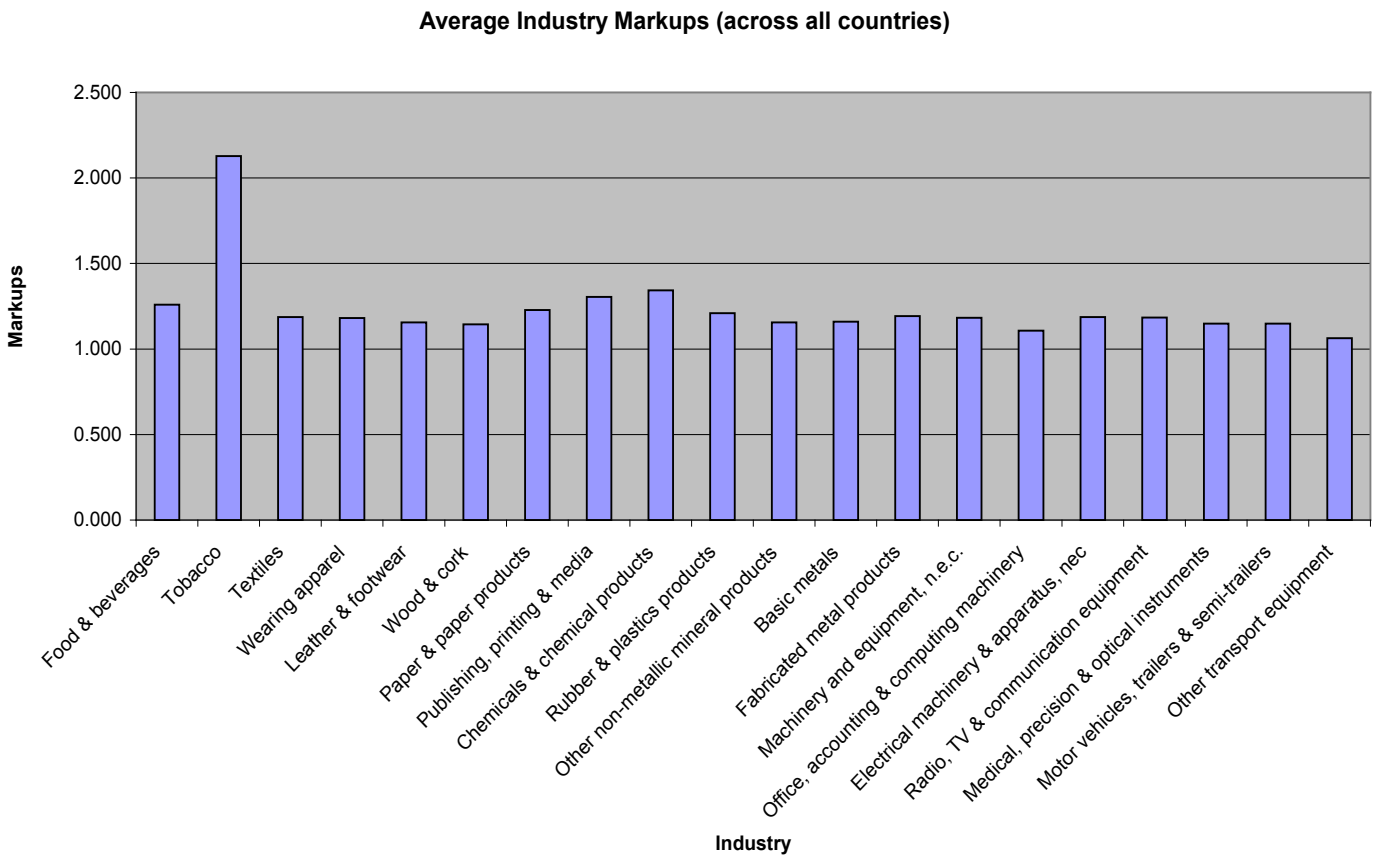
Second, as *Semi-Markups* are equal to one minus total cost divided by turnover (*Semi-Markups* = value added/turnover = (turnover-total costs)/turnover = 1-total costs/turnover), which means that it equals to one minus 1/μ (μ = turnover/total costs). Equivalently, 1/μ is equal to one minus *Semi-Markups*. Finally, μ is computed as one over one minus *Semi-Markups*.

(3)

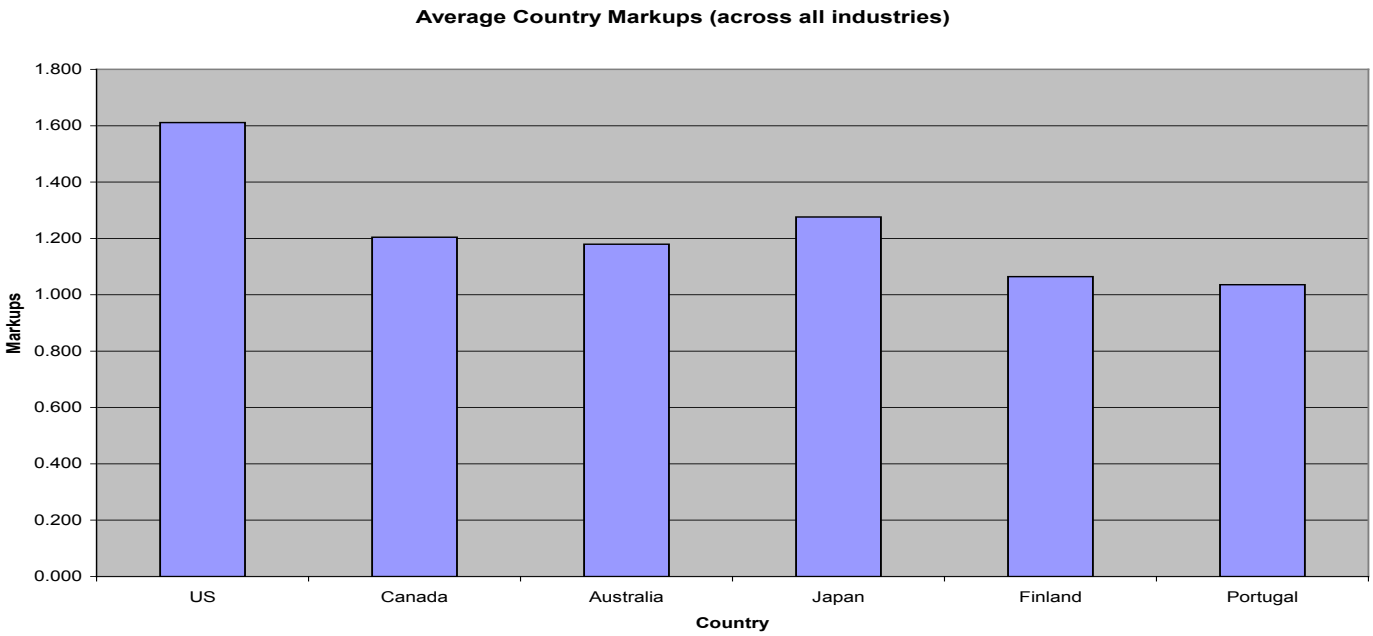
As value added is measured in US dollars, it is necessary to adjust all the value added data for the different countries into one common currency, rather than try to compare them in their local currency, which would make any comparison meaningless. I obtain the exchange rate (local currency/US dollars) and use value added data from the different countries divided by the exchange rate (this depends on whether it is a direct quotation, or an indirect quotation) to convert Japanese Yen, Escudo (before 1999), Markka (before 1999), Euros, Canadian dollars, and Australian dollars into US dollars. Since the value added data is adjusted, real productivity in these countries are also converted into US dollars and, hence, they are comparable. Refer to Tables 7 and 8 for the summary statistics of markups. The

US has the highest average markups of the six countries (1.611) and Portugal has the lowest rate (1.036). The industry that has the highest average markups is *Tobacco* and the industry that has the lowest average markups is *Other transport equipment*, with values of 2.129 and 1.064, respectively. Graphs 7 and 8 show average industry markups and average country markups, respectively.

Graph 7



Graph 8



5. ***Wages***: Labour compensation of employees' data from the STAN database is used. As the data are in local currency, they are then converted into US dollars by dividing the exchange rate (local currency/US dollar).

6. ***Number of Enterprises***: This is the number of firms in each industry for every year, obtained from the official statistics of the countries. For the US, the US Census Bureau only has census data for 1992, 1997, and 2002. Therefore, I assume that the number of firms in the US increased (decreased) at a constant rate, and then calculated the number of firms for the years in between these census dates. One concern when sorting the data is that there are huge gaps between the figures in 1992 and 1997 in five of the industries. The reason of this might be that the measurement standards changed between the two censuses. Thus, those five industries (other non-metallic mineral products, machinery and equipment n.e.c., office, accounting and computing machinery, medical, precision and optical instruments, and motor vehicles) are abandoned. Data for Canada is obtained directly from Statistics Canada, and I aggregate the files for different time periods into one spreadsheet. Australia is the most complicated country in the sample in terms of collecting the number of firms. As two digit industry category level data are not available, but only three digits and above are

available (meaning only detailed categories are listed). Hence, I aggregated the small categories in order to obtain the data for the two digit level industries. Also, the data from the Australian Statistics Bureau are at the level of state, not national, data. Therefore, after summing the industries I add up the data in all of the eight main states to obtain the final number of firms in a particular industry over the year for the whole country. By doing so, I obtain the data for each year from 2003 to 2006 (the exception is that Tobacco industry data is only available for 2006). Japan is similar to the US, only having census data for 1996, 2001, and 2006. Hence, I again assume that the numbers change at a constant rate and I calculate the number of firms for the years in between. The data for Finland and Portugal are obtained from the BACH database, and then sorted to obtain the number of firms for the twenty industries for the years available in the database.

7. ***National GDP (Gross Domestic Products)***: Annual GDP data for each country are obtained from the IMF. The data are in local currency. After dividing this by the exchange rate (local currency/US dollar), the data for the other five countries are converted into US dollars. This is the measure of the size of an economy in this paper.

8. ***National CPI (Consumer Price Index)***: Annual CPI indices for each country are obtained from the IMF.

9. ***Real GDP*****:** National GDP deflated by the national CPI.

10. ***Country Dummy Variable***: There are two sets of country dummy variables. As the paper focuses on international differences and country pairs are utilised, one group of country dummy variables represents the domestic country in the country pairs, and the other group of country dummy variables represents the foreign country in the country pairs.

11. ***Industry Dummy Variable*****:** One dummy variable is created to represent each of the industries.

5. Methodology

5.1 Relative Variables

All of the variables used in the estimations in this paper are relative variables at the industry level. One country is selected as the benchmark and the other countries are compared to the benchmark country in order to obtain the relative variables. First, I use the US as the benchmark. Every variable of all the other five countries is relative to the respective variables used for the US. There are, however, only seventeen US industries in the database, as three industries were missing when calculating the relative variables. Therefore, I also use Canada as the benchmark country to establish an alternative dataset. Although there are eighteen industries in the Canadian dataset (one industry more than for the US), the coverage of some variables is not sufficient for the study purposes. The processes of calculating the relative variables are the same as when using the US as the benchmark country.

5.2 Country Pairs

There are six countries in the primary dataset. Thus, there are five countries in each relative variable dataset, meaning that there are ten distinct bilateral country pairs in both cases.

5.3 Aggregate Price Indices

To focus on relative prices it is necessary to exclude the differences in monetary policy across countries. Peersman and Smets (2005) suggested that the differential effects of monetary policy across industries come about by durability, or the existence of financial constraints, rather than openness. Thus, the assumption that monetary influences have relatively homogenous effects across industries is then made. Therefore, national CPI is essential when refining the estimation, in order to control for monetary policy differences.

5.4 Lagged Dependent Variable

The inclusion of a lagged dependent variable avoids the omission of any openness effect that is not in the current period. As it is hard to tell how long openness effects last, it is not possible to accurately determine how many lagged openness measures need to be in

the estimation. The only thing for sure is that the degree of openness in the previous year affects the dependent variables (e.g., prices, productivity, and markups) in the previous year. Also, prices, productivity and markups in the current year depend on the lag of the particular variable. Therefore, instead of using lagged openness, adding the lagged dependent variables into the estimations captures the effects of previous openness on the dependent variables.

5.5 Unit Root Test

To test for unit roots, the Dickey-Fuller test (Dickey and Fuller, 1979) is applied in this study. Since the data utilised is unbalanced panel data, the first-difference form is the most appropriate expression to detect whether the variables have any unit roots:

$$\Delta Yt = \alpha o + \alpha 1 Yt\_1 + vt \qquad (4)$$

Running the regressions on price, productivity, and markups, the t-statistics are obtained, and are reported in Table 1 below. All of the three t-statistics are smaller than the critical value for Dickey-Fuller test at 1 percent level. Hence, do not reject the null hypothesis that the variables contain a unit root (Studenmund, 2006). Price, productivity and Markus are non-stationary in a unit root sense.

Table 5.1: T-statistics of the dependent variables

Variable	t-statistic	Critical Value (1%)
Price	-4.2341	-3.43
Productivity	-11.9688	-3.43
Markups	-6.0499	-3.43

5.6 Endogeneity

As the data set used in this paper is a panel data set, one crucial problem that may be encountered in the estimation is the endogeneity of openness. This means that there will be a positive bias when estimating the effect of openness on prices. In other words, a more open country will have a higher degree of competition, forcing domestic producers to lower the prices of their goods in order to compete with foreign firms. As the prices of domestic goods fall, consumers will buy more domestic goods, rather than imports, which leads to a positive endogeneity bias against the negative relation

between openness and prices. This is, however, an econometric issue that needs to be investigated further in future studies. In the previous studies (Chen, Imbs and Scott, 2004; Chen, Imbs and Scott, 2007), endogeneity of openness did not invalidate the results.

6. Empirical Results

The results of the two data sets (one utilising the US as a benchmark country, and the other using Canada as a benchmark) are both reported for robustness.

6.1 Short run results

Tables 9 to 14 list the effects of openness on prices, productivity, and markups, respectively, and present the short run results under the Ordinary Least Squares methodology. The estimations controlled for country and industry fixed effects are also reported next to the original estimations. Tables 9, 11, and 13 present the results from the US based-dataset, while Tables 10, 12, and 14 present the results from the Canada-based dataset.

6.1.1 Effects of openness on price

Table 9 shows how openness affect prices by using US-based data. The first column includes relative domestic openness, relative foreign openness, the relative number of enterprises in the domestic economy and the relative number of enterprises in the foreign economy as the independent variables. The coefficient of domestic openness is negative and significant. Foreign openness is positive, however, it is not significant. The numbers of domestic and foreign enterprises are both negative, but insignificant. Table 9 Column (3) shows the domestic and foreign relative aggregate prices used to purge differences in monetary policy. All of the variables have the expected signs, but only domestic openness, the domestic CPI, and the foreign CPI are significant. Adding fixed effects into the estimations does not improve the significance of the variables and even changes the signs of some coefficients. Lagged dependent variables are included in Columns (5) and (6), with the original variables in Column (5) remaining the same as in Column (3). The fixed effects do not change the results, which are shown in Column (6). The last two columns in Table 9 test for coefficient equality. The assumption that the domestic and foreign figures have different effects is supported by the result, as the coefficient on the ratio of openness is significant. The estimation without the fixed effects in Column (7) is again better than the estimation in Column (8), which includes the fixed effects. The results in Table 9 are consistent with theory. In other words,

relative price levels fall with domestic openness and rise with foreign openness. Moreover, as the number of firms in a domestic market increases, prices fall, while the an increase in the number of firms in a foreign market leads to an increase in prices. Domestic CPI has a positive impact on prices, and foreign CPI has a negative impact.

Table 10 provides the results obtained by using the Canadian-base dataset. The results are not valuable, however, as only a few of them are significant.

6.1.2 Effects of openness on productivity

Table 11 evaluates how openness affects productivity. Column (1) reports the results of the regression using domestic openness, foreign openness, the domestic number of enterprises, and the foreign number of enterprises as the independent variables. Both domestic and foreign openness are negative, but not significant. When adding country and industry into the estimation, domestic openness is significant. The sign of foreign openness becomes positive, though is still insignificant. The sizes of the coefficients on domestic and foreign openness are larger than in Chen, Imbs and Scott (2007). The lagged dependent variable is included in Columns (3) and (4), and is highly significant in both regressions. Domestic openness is negative and significant, while foreign openness is positive and significant, in both regressions. The results are strengthened when controlling the fixed effects. These results illustrate that as a country becomes relatively more open, its productivity decreases, which is different from the results of Chen, Imbs and Scott (2007). This difference will be discussed further in Section 8.1. The number of enterprises in the domestic market is positive, but insignificant and the foreign number of enterprises is negative and significant, as shown in Column (3). The estimation shown in Column (3) is better than that in Column (4), in terms of not only the signs of the variables, or the significant of the variables, but also in terms of the R-square. As shown in Columns (5) and (6), the assumption that domestic and foreign openness have the same effect on productivity is supported by the low p-value of the coefficient. Although the number of domestic enterprises is insignificant, as shown in Column (5), all variables have the predicted signs.

The results from the Canadian-based dataset, as shown in Table 12, are basically consistent with the US case.

6.1.3 Effects of openness on Markups

The results are reported in Table 13. Domestic openness is negative and significant regardless of fixed effects, as shown in Columns (1) and (2). Foreign openness has the expected sign, but is not significant in either regression. Adding the lagged dependent variable into the estimation, Columns (3) and (4) show that it strengths the magnitude effects of domestic openness and foreign openness on markups, and also shows their significance compared with Columns (1) and (2), respectively. Moreover, tests of coefficient equality, as shown in Columns (5) and (6), both show that domestic and foreign openness have the same significant effects on markups. The number of enterprises in both the domestic and foreign markets are insignificant in all regressions. This table suggests that a relatively more open country has lower aggregate industry markups. An increase in the number of domestic enterprises reduces domestic markups by promoting competition, while increases in the number of foreign enterprises increase domestic markups.

Table 14 shows the results from using the Canadian-based dataset, and it supports the results obtained from the US-based dataset.

6.2 Long Run Results

Tables 15 to 20 list the long run effects of openness on prices, productivity, and markups, with the results obtained from Ordinary Least Squares regressions. The estimations controlling for country and industry fixed effects are also reported in the columns next to the original estimations. Tables 15, 17, and 19 present the results from the dataset that uses the US as the base country, while Tables 16, 18, and 20 present the results from the Canadian-based dataset.

6.2.1 Effects of openness on price

As shown in Table 15, the short run results listed in Column (1) remain consistent with the expectations. Domestic openness negatively affects the price level, while foreign openness has a positive impact. Domestic enterprises' numbers are negative and foreign enterprises' numbers are positive. The domestic CPI has a positive sign and the foreign CPI has a negative sign. Although, the signs of a few variables change when including

fixed effects, as shown in Column (2), the coefficients are not significant. The long run openness seems have opposite effects to the short run effects. The results in Column (1) are hardly significant. In Column (2), which includes the fixed effects, domestic openness is shown to increase prices, while foreign openness lowers them. Domestic CPI has a positive sign and foreign CPI has a negative sign. Moreover, an increase in foreign GDP decreases price, with domestic GDP also having a negative coefficient, but this is not significant.

In the case where the Canadian-based data is used, the results are also unsteady.

6.2.2 Effects of openness on productivity

In Table 17, short run domestic and foreign openness maintain their original signs, which contradicts the results of Chen, Imbs and Scott (2007). Both the domestic and foreign numbers of enterprises have the predicted signs, although they are not significant. In the long run, domestic openness affects productivity negatively. In contrast, foreign openness works positively. They are both significant, as shown in Column (1). In terms of market size, domestic GDP has a negative sign in both Columns (1) and (2), but this is insignificant. Foreign GDP is positive and significant in Column (1), which does not include the fixed effects. The aggregate industry productivity of a higher GDP country is relatively low and the productivity of a lower GDP country is relatively high. This finding is also in opposition to the results of Chen, Imbs, and Scott (2007), and will be discussed further in Section 8.2. Domestic and foreign relative wages both have positive signs and are highly significant when including the fixed effects. This is an interesting result, as they are relative variables, which are assumed to have opposite signs. This finding could be driven by the scarcity of observations, and will be examined in Section 7. Both of the short run and the long run symmetric effects of domestic openness and foreign openness are supported, as the coefficients on the ratio of openness are significant.

The results obtained from the Canadian-based data are shown in Table 18. Foreign wages is positive and significant, as shown in Column (2), which confirms the finding in Table 17. Other results are, however, not significant enough to support the findings from the US-based data.

6.2.3 Effects of openness on markups

The short run effects of openness and the number of enterprises hold in the long run regressions. Domestic and foreign openness in Table 19 have identical signs, as in the short run estimations, and domestic openness is highly significant, as shown in both Columns (1) and (2). Although the signs of enterprise numbers seem unusual, they are insignificant. The long run domestic openness effect is positive and significant, as shown in Column (1). The long run foreign effect is negative and significant, as shown in Column (2). Domestic GDP also works in an interesting direction on markups and is significant regardless of any fixed effects. Foreign GDP is negative, although insignificant, as shown in Column (4). This means that a higher GDP country has higher markups and a lower GDP country has lower markups. This result is also in opposition of the result in Chen, Imbs and Scott (2007), and will be examined further in Section 7. When testing coefficient equality, it is still not possible to reject that domestic and foreign openness have same effects in the short run.

Table 20 is not helpful in supporting the findings in Table 19, but it also shows a significant negative relation between foreign GDP and markups.

7. Robustness

The inclusion of numbers of enterprises in the regressions greatly reduces the number of observations. This may raise questions about the reliability of the regressions. To check that the counter-intuitive effects of openness on productivity are not caused by a decrease in the number of observations, the number of enterprises is removed from the regressions.

Tables 21 to 26 report the short run estimations, without including the number of enterprises. Tables 21, 23, and 25 report the estimations from using the US-based data and Tables 22, 24, and 26 report the estimations when using Canada as the benchmark country. In the US-based tables, some of the variables in Table 21 do not have the expected signs (domestic and foreign openness and domestic CPI), but the coefficients are insignificant. All of the variables in Tables 23 and 25 have the expected sign, as in the regressions that includes the number of enterprises, however, some of these are not significant. In the case of the Canadian-based data, before removing the number of enterprises, the results shown in Table 10 are not reliable. In contrast, every variable in Tables 22, 24, and 26 have the expected sign, with some of them being highly significant. The figures in these tables confirm the short run expectations.

Tables 27 to 32 report the long run estimations without the number of enterprises. Tables 27, 29, and 31 present the results from the US-based data, while Tables 28, 30, and 32 present the results from the Canadian-based data. Apparently, the long run results are not as explicit as are the short run results. The effects of domestic and foreign openness on price, productivity, and markups are instable and vary with fixed effects. Although some of the coefficients have the predicted signs, the relations are weak due to the low significances. The long run openness effects are much more doubtful than the short run effects. Foreign GDP is negative and significant, as shown in Column (2) of Table 27. In Column (2) of Table 28, domestic GDP is seen to be significant, but the size of the coefficient is unusually large. Other long run effects are not significant, however, and the R-squares of the regressions are low, which makes the results unimportant. In Table 29, domestic GDP does not seem to be significant in either column and in Table 30 it is only marginally significant in Column (2). Foreign GDP is

positive and highly significant in Table 29, however, it is negative and also significant in Table 30. Obviously, whether foreign GDP has a positive, or a negative, impact on productivity depends on which country is chosen as the benchmark country. The long run impacts of domestic and foreign GDP on productivity are ambiguous. Though the coefficient of foreign GDP in Column (2) of Table 30 is consistent with the result in Chen, Imbs and Scott (2007), the domestic GDP in that regression does not have the expected sign. The results are not robust and it is still not clear whether domestic and foreign GDP will increase, or decrease, productivity in the long run. The effects of GDP on markups are steadier. As shown in Table 31, domestic and foreign GDP both display the expected signs and they are significant when including fixed effects. This means that higher GDP countries have lower markups and lower GDP countries have higher markups. In the Canadian case, as shown in Table 32, domestic GDP is negative, as expected. Foreign GDP does not have the expected sign, however. Nevertheless, the coefficient is not significant.

8. Explanations

8.1 Short Run Real Productivity

Openness works on price and markups in a way that is consistent with expectations from the theory. That is, as an economy opens up to international trade, the number of firms increases, as foreign competitors will enter the domestic market. As a result, firms reduce their markups in order to lower their price. Hence, the aggregate level of markups decreases and aggregated level prices consequently fall. On the other hand, the finding of an openness effect for productivity runs contrary to the theory. One possible reason for this could be the time lag. Assuming a country becomes relatively more open to foreign countries, competition immediately become stronger, with price being very sensitive to this change. At the same time as this lowering of prices, however, firms may not realise why the price level is falling, with it actually being due to the sudden increase in the number of firms in the market. Firms may consider this to be a temporary phenomenon only and not respond by cutting their labour, as they do not think they have redundant labour, even though sales have dropped and markups have decreased. Only after a certain period of time will such firms become aware of the actual market situation. Therefore, aggregate productivity decreases in the short run. In the long run, firms become aware of the increased competition. Therefore, higher productivity firms move to foreign markets, with only the lower productivity firms remaining in the domestic market, which drags down the aggregate industry productivity.

8.2 Real GDP Effects

In the long run, real GDP seems to have challenging effects on price and productivity, even after filtering out the number of enterprises. First, as shown in the tables, domestic GDP works positively on price levels, while foreign GDP works negatively. This result contradicts the original prediction in Chen, Imbs and Scott (2007), that a higher GDP country has a larger number of firms and, therefore, has lower prices. According to the Philips curve, there is a trade off between unemployment and inflation in the short run. When unemployment is high, inflation tends to be low. Despite the fact that this trade off is temporary, it can last for several years. Thus, the Philips curve is crucial for understanding the business cycle (Mankiw, 2004). This is why the Philips curve can be

used in explaining the positive long run relation between GDP and price levels in this study. Based on Okun's law; which illustrates the negative relation between unemployment and real GDP (Mankiw, 2003); it is not hard to discover that GDP should be positively related to inflation. The result obtained in this study is consistent with the theories. It also illustrates that openness is not dominant in reducing productivity in the long run. Second, the effects of GDP on productivity are not constant and seem to be dependent on the sample being tested. The finding as to whether a larger GDP country has higher productivity in the long run is inconclusive using the data set in this paper.

9. Conclusion

This paper presents the evidence that increases in openness; as measured by import shares; reduce price levels, real productivity, and markups in the short run, with the long run effects of openness being weaker. The evidence that openness raises price, and markups lowers productivity, in the long run is not conclusive.

The paper uses difference in differences model and utilises industrial level data to test how openness affects inflation through its impact on productivity and markups. As in Chen, Imbs and Scott (2004) and (2007), openness reduced prices and markups in the short run. However, contrary to their findings, more open industries have lower productivity in the short run. The core of the interpretation for this phenomenon is competition. That is, openness brings competition and, as a result, firms have to lower their prices in order to earn market share, or to survive. One way of doing that is to reduce markups. Another way of reducing price is to save costs by reducing labour. Nonetheless, individual firms are not able to perceive the reason for such a decline in prices in a short period of time. Redundancies will not be implemented in the first instance, until these firms realise the business circumstances of the market. This explains the decrease in productivity in the short run. On the other hand, the long run openness effects seem to be challenging. The role of GDP; the measure of market size; in influencing price, productivity, and markups in the long run is not large. Hence, the finding that, in the long run, greater openness leads to anti-competitive effects is not empirically verifiable. Why openness effects do not last over the long run is a question requiring further observation and research.

Appendix A

Sources of Data

Variables	Country	Source
PPI	US	Data Stream
	Canada, Australia	STAN
	Japan (OPI)	Bank of Japan
	Finland, Portugal	BACH
Import	All Countries	STAN
Production	All Countries	STAN
Value added	All Countries	STAN
Total Employment	All Countries	STAN
Turnover	US	US Census Bureau
	Canada	Statistic Canada
	Australia	Australian Statistic Bureau
	Japan	Japan Ministry of Economy, Trade and Industry
	Finland, Portugal	BACH
Total costs	Finland, Portugal	BACH
Wages	US	US Department of Labour
	Canada	Statistic Canada
	Australia	Australian Statistic Bureau
	Japan	Bank of Japan
	Finland, Portugal	BACH
Number of Enterprises	US	US Census Bureau
	Canada	Statistic Canada
	Australia	Australian Statistic Bureau
	Japan	Bank of Japan
	Finland, Portugal	BACH
GDP	All Countries	IMF
CPI	All Countries	IMF
Exchange Rate	All Countries	IMF

Appendix B

BACH sector groupings used in the paper and correspondence with NACE (revision 1) industries

BACH	NACE	Sector
211	13.0	Metal ores
	27.1	Basic iron & steel
	27.2	Tubes
	27.3	Other first processing of basic iron & steel
	27.4	Basic precious & non-ferrous metals
212	14.0	Mining & quarrying
	26.0	Other non-metallic mineral products
213	24.0	Chemicals & chemical products
221	27.5	Casting of metals
	28.0	Fabricated metal products (except machinery & equipment)
	29.1	Machinery for the production & use of mechanical power
	29.2	Other general purpose machinery
	29.3	Agricultural & forestry machinery
	29.4	Machine-tools
	29.5	Other special purpose machinery
	29.6	Weapons & ammunition
	33.0	Medical, precision & optical instruments
222	30.0	Office machinery & computers
	31.0	Electrical machinery & apparatus
	32.0	Radio, television & communication equipment
	29.7	Domestic appliances
223	34.0	Motor-vehicles, trailers & semi-trailers
	35.0	Other transport equipment
231	15.0	Food products & beverages
	16.0	Tobacco products
232	17.0	Textiles
	18.0	Wearing apparel; dressing & dyeing of fur
	19.0	Tanning & dressing of leather; luggage, handbags
233	20.0	Wood & products of wood & cork, excl. furniture
	21.0	Pulp, paper & paper products
	22.0	Publishing, printing & reproduction of recorded media
234	25.0	Rubber & plastic products
	36.0	Furniture

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Tables

Summery Statistics of Inflation

Table 1

Inflation	Average	Min	Max
US	2.508%	-21.361%	41.288%
Canada	1.441%	-22.791%	32.418%
Australia	2.591%	-34.066%	35.223%
Japan	-1.818%	-40.611%	20.515%
Finland	0.219%	-19.851%	12.786%
Portugal	1.929%	-2.772%	8.985%

Table 2

Inflation	Average	Min	Max
Food and beverages	0.309%	-10.228%	12.102%
Tobacco	4.184%	-21.361%	41.288%
Textiles	1.264%	-5.186%	13.049%
Wearing apparel	1.273%	-3.675%	7.965%
Leather and footwear	2.383%	-9.660%	19.718%
Wood and cork	1.550%	-13.636%	32.418%
Paper	1.926%	-22.791%	30.832%
Publishing and printing	2.602%	-1.926%	11.416%
Chemicals	2.216%	-4.779%	14.448%
Rubber and plastics	1.728%	-6.786%	9.831%
Other non-metallic mineral products	1.991%	-1.948%	8.782%
Basic metals	3.174%	-10.430%	35.223%
Fabricated metal products	3.180%	-0.944%	20.222%
Machinery and equipment, n.e.c.	1.363%	-4.941%	16.747%
Office, accounting and computing machinery	-3.591%	-40.611%	13.672%
Electrical machinery and apparatus, n.e.c	-1.499%	-34.066%	8.715%
Radio, television and communication equipment	-1.651%	-19.851%	25.631%
Medical, precision and optical instruments	-0.451%	-16.667%	16.051%
Motor vehicles	0.930%	-14.613%	17.536%
Other transport equipment	1.766%	-5.922%	12.869%

Summery Statistics of Openness

Table 3

Openness	Average	Min	Max
US	0.319	0.005	5.125
Canada	0.629	0.010	4.082
Australia	1.361	0.031	13.384
Japan	0.134	0.005	1.861
Finland	0.759	0.017	20.648
Portugal	0.814	0.005	18.897

Table 4

Openness	Average	Min	Max
Food and beverages	0.108	0.031	0.311
Tobacco	0.107	0.005	4.588
Textiles	0.547	0.077	1.203
Wearing apparel	0.434	0.005	2.500
Leather and footwear	1.059	0.054	5.125
Wood and cork	0.112	0.013	0.413
Paper	0.168	0.017	1.241
Publishing and printing	0.077	0.007	0.303
Chemicals	0.499	0.049	1.508
Rubber and plastics	0.262	0.018	0.689
Other non-metallic mineral products	0.132	0.009	0.453
Basic metals	0.327	0.044	1.683
Fabricated metal products	0.162	0.010	0.400
Machinery and equipment, n.e.c.	0.517	0.026	1.460
Office, accounting and computing machinery	3.766	0.042	20.648
Electrical machinery and apparatus, n.e.c	0.475	0.023	1.944
Radio, television and communication equipment	1.420	0.020	5.320
Medical, precision and optical instruments	2.678	0.091	13.384
Motor vehicles	0.832	0.005	3.516
Other transport equipment	0.441	0.077	1.390

Summery Statistics of Productivity

Table 5

Productivity	Average	Min	Max
US	101118.602	17960.617	807997.321
Canada	55367.588	19116.052	129893.963
Australia	50761.647	13788.286	138532.480
Japan	105568.417	33284.036	308618.333
Finland	65930.510	18718.750	538668.279
Potrugal	46444.231	10296.057	253398.602

Table 6

Productivity	Average	Min	Max
Food and beverages	59198.337	37796.855	85857.651
Tobacco	579863.425	325079.294	807997.321
Textiles	38801.037	27407.110	57754.072
Wearing apparel	29103.921	17960.617	58070.353
Leather and footwear	30298.267	13788.286	64607.817
Wood and cork	41977.694	10296.057	103160.969
Paper	87696.341	43709.099	182567.179
Publishing and printing	60243.361	29744.101	251941.897
Chemicals	118130.115	57948.514	213517.808
Rubber and plastics	49662.044	20964.921	92490.125
Other non-metallic mineral products	57476.781	29731.756	95713.443
Basic metals	79006.997	29061.328	139689.521
Fabricated metal products	49366.788	26604.381	78282.209
Machinery and equipment, n.e.c.	59924.433	30727.486	116630.487
Office, accounting and computing machinery	94793.431	18967.172	308618.333
Electrical machinery and apparatus, n.e.c	68838.567	46140.637	161928.195
Radio, television and communication equipment	106965.791	26589.119	538668.279
Medical, precision and optical instruments	69192.314	35277.240	178981.557
Motor vehicles	79603.756	26999.336	129893.963
Other transport equipment	47008.297	29094.348	74088.622

Summery Statistics of Markups

Table 7

Markups	Average	Min	Max
US	1.611	1.092	6.324
Canada	1.204	0.987	2.071
Australia	1.179	1.000	1.727
Japan	1.276	1.000	1.711
Finland	1.064	0.959	1.231
Portugal	1.036	0.778	1.383

Table 8

Markups	Average	Min	Max
Food and beverages	1.260	1.019	1.518
Tobacco	2.129	1.025	6.324
Textiles	1.186	0.953	1.402
Wearing apparel	1.181	0.995	1.483
Leather and footwear	1.156	0.999	1.509
Wood and cork	1.144	0.960	1.316
Paper	1.227	0.892	1.641
Publishing and printing	1.304	1.017	1.900
Chemicals	1.343	1.039	1.827
Rubber and plastics	1.210	0.974	1.517
Other non-metallic mineral products	1.156	1.000	1.646
Basic metals	1.159	0.778	1.476
Fabricated metal products	1.192	0.986	1.476
Machinery and equipment, n.e.c.	1.183	0.970	1.457
Office, accounting and computing machinery	1.108	0.918	1.750
Electrical machinery and apparatus, n.e.c	1.186	0.988	1.686
Radio, television and communication equipment	1.185	1.000	2.071
Medical, precision and optical instruments	1.148	1.062	1.308
Motor vehicles	1.149	1.004	1.371
Other transport equipment	1.064	0.866	1.333

Table 9 Short Run Price Effects of Openness (US)

Dependent Variable: Prices

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Number of Observations	115	115	115	115	95	95	95	95
Dppi_1					0.0162	-0.1064	0.0148	-0.1010
					(0.8636)	(0.3100)	(0.8759)	(0.3432)
Dlogod	-0.1518	-0.1585	-0.1409	-0.1845	-0.2093	-0.2406		
	(0.0752)	(0.0780)	(0.0874)	(0.0437)	(0.0212)	(0.0302)		
Dlogof	0.0605	-0.0241	0.0581	-0.0232	0.0987	0.0317		
	(0.1298)	(0.5838)	(0.1358)	(0.5983)	(0.0179)	(0.5177)		
Do							-0.1073	-0.0567
							(0.0095)	(0.2392)
Dloged	-0.0282	-0.0472	-0.0352	-0.0482	-0.0751	-0.0815	-0.0514	-0.0537
	(0.4393)	(0.2141)	(0.3233)	(0.2141)	(0.0585)	(0.0723)	(0.1417)	(0.2140)
Dlogef	-0.005	-0.0397	0.0459	-0.0723	0.0795	-0.0267	0.0573	-0.0612
	(0.9345)	(0.5381)	(0.4419)	(0.3200)	(0.2520)	(0.7887)	(0.3948)	(0.5391)
Dlogcpid			1.2694	1.3424	0.6493	0.2065	0.6929	-0.1746
			(0.0339)	(0.2609)	(0.4192)	(0.8886)	(0.3900)	(0.9045)
Dlogcpif			-1.0399	1.0818	-1.3535	0.1513	-1.3546	-0.0284
			(0.0405)	(0.3365)	(0.0429)	(0.9137)	(0.0435)	(0.9840)
R-square	0.0437	0.2914	0.1257	0.3109	0.1560	0.3020	0.1400	0.2665
Adjusted R-square	0.0089	0.1219	0.0771	0.1272	0.0880	0.0491	0.0814	0.0150

The dependent variable Prices is the relative aggregate industrial price.
p-values are reported in parenthesis under each coefficient. Columns (1), (3), (5), and (7) do not include country and industry fixed effects in the regressions. Columns (2), (4), (6), and (8) run the same regressions as the first four regressions, respectively, but include country and industry fixed effects.

Table 10 Short Run Price Effects of Openness (Canada)

Dependent Variable: Prices

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Number of Observations	172	172	172	172	151	151	151	151
Dppi_1					0.7407	0.6391	0.7365	0.6652
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
Dlogod	-0.0668	0.0970	-0.0532	0.1059	-0.0635	0.0842		
	(0.3903)	(0.2640)	(0.4986)	(0.2262)	(0.4272)	(0.3786)		
Dlogof	0.0494	0.0117	0.0451	0.0184	0.0349	0.0417		
	(0.3014)	(0.8129)	(0.3488)	(0.7112)	(0.4586)	(0.4183)		
Do							-0.0388	-0.0269
							(0.3976)	(0.5940)
Dloged	-0.0409	-0.0422	-0.0573	-0.0442	-0.0749	-0.0668	-0.0790	-0.0508
	(0.4870)	(0.4813)	(0.3395)	(0.4685)	(0.3296)	(0.4269)	(0.2978)	(0.5435)
Dlogef	0.0427	0.0495	0.0621	0.0499	0.0788	0.0740	0.0836	0.0555
	(0.4428)	(0.3746)	(0.2779)	(0.3851)	(0.2793)	(0.3458)	(0.2424)	(0.4744)
Dlogcpid			0.5817	-0.9619	0.3453	-1.6489	0.3421	-1.2726
			(0.2958)	(0.4415)	(0.5371)	(0.1978)	(0.5395)	(0.3099)
Dlogcpif			0.0812	0.0506	0.1509	0.1367	0.1512	0.1362
			(0.2300)	(0.4530)	(0.0402)	(0.0778)	(0.0392)	(0.0799)
R-square	0.0125	0.2253	0.0267	0.2324	0.2858	0.3746	0.2850	0.3650
Adjusted R-square	-.0111	0.0989	-0.0087	0.0948	0.2508	0.2373	0.2553	0.2318

The dependent variable Prices is the relative aggregate industrial price.
p-values are reported in parenthesis under each coefficient. Columns (1), (3), (5) and (7), do not include country and industry fixed effects in the regressions. Columns (2), (4), (6), and (8) run the same regressions as the first four regressions, respectively, but include country and industry fixed effects.

Table 11 Short Run Productivity Effects of Openness (US)

Dependent Variable: Productivity

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Number of Observations	109	109	89	89	89	89
Dp_1			-0.4674	-0.6611	-0.4764	-0.6741
			(0.0000)	(0.0000)	(0.0000)	(0.0000)
Dlogod	-0.8243	-1.0231	-1.4055	-1.8251		
	(0.1115)	(0.0750)	(0.0031)	(0.0001)		
Dlogof	-0.0020	0.4045	0.7496	1.5292		
	(0.9932)	(0.1479)	(0.0006)	(0.0000)		
Do					-0.7961	-1.5737
					(0.0003)	(0.0000)
Dloged	0.2606	0.4466	0.1082	0.2726	0.2536	0.3149
	(0.2354)	(0.0625)	(0.5864)	(0.1041)	(0.1474)	(0.0413)
Dlogef	-0.1678	0.5894	-0.7649	0.1434	-0.9360	0.0614
	(0.6419)	(0.1591)	(0.0465)	(0.6860)	(0.0117)	(0.0852)
R-square	0.0964	0.2716	0.4150	0.7139	0.3996	0.7120
Adjusted R-square	0.0616	0.0852	0.3798	0.6126	0.3710	0.6160

The dependent variable Productivity is the relative aggregate industrial productivity. p-values are reported in parenthesis under each coefficient. Columns (1), (3), and (5) do not include country and industry fixed effects in the regressions. Column (2), (4), and (6) run the same regressions as the first three regressions, respectively, but include country and industry fixed effects.

Table 12 Short Run Productivity Effects of Openness (Canada)

Dependent Variable: Productivity

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Number of Observations	152	152	131	131	131	131
Dp_1			-0.2364	-0.2955	-0.2581	-0.3208
			(0.0008)	(0.0002)	(0.0003)	(0.0001)
Dlogod	0.6373	0.6507	0.0216	-0.2264		
	(0.0509)	(0.1070)	(0.9489)	(0.5882)		
Dlogof	0.2564	0.4187	0.6999	0.9612		
	(0.1640)	(0.0490)	(0.0001)	(0.0000)		
Do					-0.6475	-0.9444
					(0.0004)	(0.0000)
Dloged	0.3705	0.1603	0.5264	0.4724	0.6046	0.5771
	(0.1213)	(0.5399)	(0.1022)	(0.1845)	(0.0639)	(0.1066)
Dlogef	-0.3711	-0.2195	-0.5495	-0.5423	-0.6554	-0.6801
	(0.0921)	(0.3577)	(0.0688)	(0.0996)	(0.0313)	(0.0378)
R-square	0.0769	0.1740	0.1900	0.2803	0.1548	0.2532
Adjusted R-square	0.0518	0.0179	0.1576	0.1090	0.1280	0.0841

The dependent variable Productivity is the relative aggregate industrial productivity. p-values are reported in parenthesis under each coefficient. Columns (1), (3), and (5) do not include country and industry fixed effects in the regressions. Columns (2), (4), and (6) run the same regressions as the first three regressions, respectively, but include country and industry fixed effects.

Table 13 Short Run Markups Effects of Openness (US)

Dependent Variable: Markups

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Number of Observations	274	274	191	191	191	191
Dm_1			-0.1372	-0.1957	-0.1485	-0.2082
			(0.0463)	(0.0078)	(0.0305)	(0.0042)
Dlogod	-0.0949	-0.0980	-0.1761	-0.1507		
	(0.0049)	(0.0057)	(0.0011)	(0.0099)		
Dlogof	0.0161	0.0160	0.1146	0.0971		
	(0.4837)	(0.5462)	(0.0071)	(0.0363)		
Do					-0.1286	-0.1117
					(0.0020)	(0.0118)
Dloged	0.0093	-0.0039	0.0221	-0.0171	-0.0271	0.0216
	(0.5657)	(0.8278)	(0.4500)	(0.5762)	(0.3539)	(0.4764)
Dlogef	0.0081	-0.0046	0.0191	0.0152	0.0136	0.0116
	(0.6754)	(0.8283)	(0.5874)	(0.6799)	(0.6986)	(0.7513)
R-square	0.0470	0.0986	0.0994	0.1745	0.0897	0.1692
Adjusted R-square	0.0328	0.0196	0.0750	0.0609	0.0702	0.0604

The dependent variable Markups is the relative aggregate industrial markups.
p-values are reported in parenthesis under each coefficient. Columns (1), (3), and (5) do not include country and industry fixed effects in the regressions. Columns (2), (4), and (6) run the same regressions as the first three regressions, respectively, but include country and industry fixed effects.

Table 14 Short Run Markups Effects of Openness (Canada)

Dependent Variable: Markups

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Number of Observations	364	364	280	280	280	280
Dm_1			-0.0936	-0.1458	-0.0908	-0.1459
			(0.2618)	(0.0788)	(0.2750)	(0.0773)
Dlogod	-0.0496	-0.0809	-0.1010	-0.1261		
	(0.0937)	(0.0133)	(0.0147)	(0.0034)		
Dlogof	0.0486	0.0948	0.0770	0.1277		
	(0.0270)	(0.0001)	(0.0434)	(0.0013)		
Do					-0.0875	-0.1270
					(0.0081)	(0.0002)
Dloged	-0.0484	-0.0344	-0.0195	-0.0171	-0.0253	-0.0168
	(0.0192)	(0.1288)	(0.5733)	(0.6438)	(0.4421)	(0.6423)
Dlogef	0.0163	0.0075	-0.0074	0.0016	-0.0029	0.0014
	(0.3378)	(0.6708)	(0.8024)	(0.9566)	(0.9186)	(0.9617)
R-square	0.0482	0.1636	0.0477	0.2047	0.0467	0.2047
Adjusted R-square	0.0376	0.1044	0.0304	0.1264	0.0328	0.1299

The dependent variable Markups is the relative aggregate industrial markups.
p-values are reported in parenthesis under each coefficient. Columns (1), (3), and (5) do not include country and industry fixed effects in the regressions. Columns (2), (4), and (6) run the same regressions as the first three regressions, respectively, but include country and industry fixed effects.

Table 15 Long Run Price Effects of Openness (US)

Dependent Variable: Prices

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	115	115	115	115
Dlogod	-0.1277 (0.1494)	-0.0870 (0.3030)		
Dlogof	0.0509 (0.1703)	-0.0407 (0.3058)		
Do			-0.0590 (0.1008)	0.0150 (0.6898)
Dloged	-0.0056 (0.8811)	-0.0106 (0.7841)	-0.0040 (0.9009)	0.0076 (0.8392)
Dlogef	0.0284 (0.6546)	-0.0722 (0.2676)	0.0187 (0.7559)	-0.0785 (0.2328)
Dlogcpid	2.3555 (0.2604)	1.6985 (0.3812)	1.1550 (0.1597)	1.7873 (0.3631)
Dlogcpif	-1.3935 (0.0485)	-2.5863 (0.0690)	-1.2959 (0.0605)	-1.5460 (0.2263)
Lnppi_1	-0.3939 (0.0003)	-0.4613 (0.0000)	-0.4101 (0.0001)	-0.5005 (0.0000)
Lnod_1	0.0035 (0.7183)	0.0291 (0.2820)		
Lnof_1	0.0006 (0.9423)	-0.0202 (0.1538)		
Lno_1			0.0006 (0.9366)	0.0233 (0.0450)
Lngdpd_1	0.0301 (0.5297)	-0.3257 (0.2547)		
Lngdpf_1	0.0030 (0.5784)	-0.3375 (0.0436)		
Lngdp_1			-0.0012 (0.8125)	0.1834 (0.1988)
Lncpid_1	0.3165 (0.7222)	2.5506 (0.0863)	0.0470 (0.9322)	0.3191 (0.7467)
Lncpif_1	-0.9547 (0.1705)	-0.3597 (0.6456)	-1.0847 (0.0584)	-0.7646 (0.3168)
R-square	0.2727	0.5090	0.2632	0.4679
Adjusted R-square	0.1790	0.3256	0.1923	0.2946

The dependent variable Prices is the relative aggregate industrial price.
p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run

the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 16 Long Run Price Effects of Openness (Canada)

Dependent Variable: Price

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	172	172	172	172
Dlogod	-0.0647 (0.3513)	-0.0145 (0.8677)		
Dlogof	0.0790 (0.0599)	0.0568 (0.2243)		
Do			-0.0790 (0.0435)	-0.0567 (0.1997)
Dloged	0.0234 ((0.6609)	0.0365 (0.5309)	0.0268 (0.6103)	0.0440 (0.4427)
Dlogef	-0.0117 (0.8198)	-0.0272 (0.6209)	-0.0159 (0.7511)	-0.0382 (0.4778)
Dlogcpid	-0.5618 (0.3847)	-1.2642 (0.5536)	-0.7228 (0.2039)	-1.4298 (0.3568)
Dlogcpif	0.0704 (0.3047)	0.0403 (0.5964)	0.0785 (0.2357)	0.0496 (0.4998)
Lnppi_1	0.4312 (0.0000)	0.4078 (0.0000)	0.4304 (0.0000)	0.4113 (0.0000)
Lnod_1	-0.017 (0.8413)	-0.0149 (0.2139)		
Lnof_1	-0.0023 (0.7272)	-0.0065 (0.7022)		
Lno_1			0.0017 (0.7465)	-0.0070 (0.4597)
Lngdpd_1	-0.0062 (0.2119)	0.0796 (0.7558)		
Lngdpf_1	0.0075 (0.2713)	0.0235 (0.5671)		
Lngdp_1			-0.0066 (0.0954)	-0.0051 (0.8902)
Lncpid_1	0.2820 (0.2724)	-0.0349 (0.9485)	0.2668 (0.2906)	0.1201 (0.7786)
Lncpif_1	-0.0379 (0.5892)	-0.0271 (0.7390)	-0.0242 (0.7119)	-0.0243 (0.7563)
R-square	0.3407	0.4056	0.3392	0.3982
Adjusted R-square	0.2865	0.2634	0.2981	0.2701

The dependent variable Prices is the relative aggregate industrial price.
p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 17 Long Run Productivity Effects of Openness (US)

Dependent Variable: Productivity

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	109	109	109	109
Dlogod	-1.5307 (0.0009)	-1.2005 (0.0019)		
Dlogof	0.4742 (0.0270)	1.6488 (0.0000)		
Do			-0.5226 (0.0132)	-1.2142 (0.0000)
Dloged	0.2143 (0.2650)	0.0750 (0.6386)	0.2873 (0.1021)	0.2039 (0.2124)
Dlogef	-0.0030 (0.9927)	-0.0347 (0.9036)	-0.3536 (0.2606)	0.2775 (0.3336)
Lnp_1	-0.5593 (0.0000)	-0.8831 (0.0000)	-0.5604 (0.0000)	-0.7382 (0.0000)
Lnod_1	-0.2208 (0.0012)	0.2260 (0.1460)		
Lnof_1	0.1644 (0.0744)	0.5225 (0.0000)		
Lno_1			-0.1601 (0.0039)	-0.2098 (0.0170)
Lngdpd_1	-0.1342 (0.2769)	-0.3815 (0.5957)		
Lngdpf_1	0.0887 (0.0062)	-0.5537 (0.4072)		
Lngdp_1			-0.0659 (0.0040)	-0.4694 (0.4697)
Lnwd_1	0.0656 (0.6610)	1.1582 (0.0050)		
Lnwf_1	0.1437 (0.3504)	1.1249 (0.0002)		
Lnw_1			-0.0714 (0.4715)	-0.2577 (0.2739)
R-square	0.4343	0.7337	0.3770	0.6667
Adjusted R-square	0.3702	0.6359	0.3338	0.5663

The dependent variable Productivity is the relative aggregate industrial productivity. p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 18 Long Run Productivity Effects of Openness (Canada)

Dependent Variable: Productivity

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of observations	152	152	152	152
Dlogod	0.6174 (0.0481)	0.2172 (0.4948)		
Dlogof	0.7408 (0.0001)	1.0969 (0.0000)		
Do			-0.3894 (0.0398)	-0.9247 (0.0000)
Dloged	0.3091 (0.1634)	0.1083 (0.6108)	0.4038 (0.0888)	0.0777 (0.7209)
Dlogef	-0.2512 (0.2267)	-0.1012 (0.6146)	-0.3988 (0.0703)	-0.1200 (0.5446)
Lnp_1	-0.3622 (0.0000)	-0.6873 (0.0000)	-0.2672 (0.0000)	-0.6300 (0.0000)
Lnod_1	-0.0431 (0.3689)	-0.0305 (0.6961)		
Lnof_1	0.2003 (0.0088)	0.2482 (0.0501)		
Lno_1			-0.0471 (0.2509)	-0.0812 (0.2313)
Lngdpd_1	0.1059 (0.1584)	0.0092 (0.9846)		
Lngdpf_1	-0.0132 (0.7637)	0.0368 (0.8185)		
Lngdp_1			0.0105 (0.8057)	-0.1163 (0.3938)
Lnwd_1	-0.1224 (0.1261)	-0.0109 (0.9255)		
Lnwf_1	0.0933 (0.1710)	0.2267 (0.0577)		
Lnw_1			-0.0156 (0.7516)	-0.0590 (0.4872)
R-square	0.2930	0.5533	0.1586	0.4751
Adjusted R-square	0.2374	0.4379	0.1177	0.3608

The dependent variable Productivity is the relative aggregate industrial productivity. p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 19 Long Run Markups Effects of Openness (US)

Dependent Variable: Markups

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	274	274	274	274
Dlogod	-0.0820 (0.0191)	-0.1182 (0.0012)		
Dlogof	0.0161 (0.4871)	0.0094 (0.7193)		
Do			-0.0296 (0.1857)	-0.0422 (0.0794)
Dloged	0.0191 (0.2588)	0.0024 (0.8902)	0.0201 (0.2064)	0.0126 (0.4630)
Dlogef	0.0114 (0.5628)	-0.0184 (0.3863)	0.0066 (0.7365)	-0.0196 (0.3599)
Lnm_1	-0.0508 (0.0507)	-0.1683 (0.0000)	-0.0332 (0.1875)	-0.1719 (0.0000)
Lnod_1	0.0058 (0.0954)	-0.0068 (0.1556)		
Lnof_1	0.0004 (0.8678)	-0.0089 (0.0382)		
Lno_1			0.0005 (0.8289)	0.0023 (0.4748)
Lngdpd_1	0.0129 (0.0358)	0.1025 (0.0650)		
Lngdpf_1	0.0009 (0.6838)	-0.0219 (0.6913)		
Lngdp_1			0.0006 (0.7226)	0.0470 (0.3283)
R-square	0.0753	0.2011	0.0344	0.1647
Adjusted R-square	0.0437	0.1134	0.0127	0.0842

The dependent variable Markups is the relative aggregate industrial markups.
p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 20 Long Run Markups Effects of Openness (Canada)

Dependent Variable: Markups

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of observations	364	364	364	364
Dlogod	-0.0627 (0.0394)	-0.0749 (0.0251)		
Dlogof	0.0576 (0.0088)	0.0859 (0.0005)		
Do			-0.0550 (0.0084)	-0.0887 (0.0001)
Dloged	-0.0379 (0.0675)	-0.0208 (0.3571)	-0.0434 (0.0354)	-0.0249 (0.2716)
Dlogef	0.0111 (0.5184)	-0.0011 (0.9481)	0.0116 (0.4925)	0.0002 (0.9889)
Lnm_1	-0.0342 (0.2735)	-0.1677 (0.0003)	-0.0437 (0.1587)	-0.1533 (0.0008)
Lnod_1	-0.0051 (0.0497)	-0.0071 (0.1064)		
Lnof_1	0.0012 (0.6470)	-0.0066 (0.0739)		
Lno_1			-0.0040 (0.0379)	0.0008 (0.7495)
Lngdpd_1	-0.0014 (0.6294)	0.0051 (0.8170)		
Lngdpf_1	-0.0061 (0.0397)	0.0004 (0.9495)		
Lngdp_1			0.0020 (0.4213)	-0.0000 (0.9967)
R-square	0.0826	0.2049	0.0629	0.1910
Adjusted R-square	0.0593	0.1358	0.0471	0.1285

The dependent variable Markups is the relative aggregate industrial markups.
p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 21 Short Run Price Effects of Openness without Enterprises Number (US)

Dependent Variable: Prices

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Number of Observations	715	715	640	640	640	640
Dppi_1			0.3825	0.3553	0.3823	0.3555
			(0.0000)	(0.0000)	(0.0000)	(0.0000)
Dlogod	-0.0249	0.0002	0.0024	0.0187		
	(0.2316)	(0.9930)	(0.9097)	(0.4010)		
Dlogof	0.0127	-0.0016	0.0112	0.0024		
	(0.5270)	(0.9397)	(0.5761)	(0.9094)		
Do					-0.0048	0.0074
					(0.7565)	(0.6525)
Dlogcpid	0.6277	0.1097	0.0202	-0.2815	0.0270	-0.2827
	(0.0187)	(0.7565)	(0.9413)	(0.4335)	(0.9214)	(0.4313)
Dlogcpif	-0.7009	-0.5523	-0.3401	-0.2997	-0.3318	-0.2657
	(0.0013)	(0.0905)	(0.1321)	(0.3845)	(0.1410)	(0.4366)
R-square	0.0220	0.0657	0.1516	0.1723	0.1512	0.1715
Adjusted R-square	0.0164	0.0360	0.1449	0.1414	0.1459	0.1420

The dependent variable Prices is the relative aggregate industrial price.
p-values are reported in parenthesis under each coefficient. Columns (1), (3), and (5) do not include country and industry fixed effects in the regressions. Columns (2), (4), and (6) run the same regressions as the first three regressions, respectively, but include country and industry fixed effects.

Table 22 Short Run Price Effects of Openness without Enterprises Number (Canada)

Dependent Variable: Prices

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Number of Observations	689	689	614	614	614	614
Dppi_1			0.0135	-0.0735	0.0114	-0.0739
			(0.7400)	(0.0768)	(0.7417)	(0.0750)
Dlogod	-0.5439	-0.4594	-0.6790	-0.5904		
	(0.0310)	(0.0701)	(0.0227)	(0.0472)		
Dlogof	0.5915	0.4592	0.6656	0.4953		
	(0.0092)	(0.0437)	(0.0097)	(0.0503)		
Do					-0.6648	-0.5326
					(0.0020)	(0.0135)
Dlogcpid	5.3824	12.1614	6.0959	14.9559	6.0627	14.8100
	(0.0755)	(0.0046)	0.0851)	(0.0015)	(0.0836)	(0.0015)
Dlogcpif	-0.2699	-0.1923	-0.5089	-0.7356	-0.5012	-0.7103
	(0.5860)	(0.6979)	(0.4570)	(0.2796)	(0.4584)	(0.2919)
R-square	0.0169	0.0806	0.0198	0.0976	0.0198	0.09745
Adjusted R-square	0.0112	0.0474	0.0117	0.0592	0.0133	0.06068

The dependent variable Prices is the relative aggregate industrial price.
p-values are reported in parenthesis under each coefficient. Columns (1), (3), and (5) do not include country and industry fixed effects in the regressions. Columns (2), (4), and (6) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 23 Short Run Productivity Effects of Openness without Enterprises Number (US)

Dependent Variable: Productivity

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	484	484	484	484
Dp_1	-0.2691 (0.0000)	-0.2902 (0.0000)	-0.2685 (0.0000)	-0.2884 (0.0000)
Dlogod	-0.4658 (0.0000)	-0.5541 (0.0000)		
Dlogof	0.3120 (0.0001)	0.3527 (0.0000)		
Do			-0.3844 (0.0000)	-0.4440 (0.0000)
R-square	0.1446	0.1774	0.1407	0.1711
Adjusted R-square	0.1393	0.1400	0.1371	0.1353

The dependent variable Productivity is the relative aggregate industrial productivity. p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 24 Short Run Productivity Effects of Openness without Enterprises Number (Canada)

Dependent Variable: Productivity

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	466	466	466	466
Dp_1	-0.2430 (0.0000)	-0.2595 (0.0000)	-0.2420 (0.0000)	-0.2584 (0.0000)
Dlogod	-0.3338 (0.0004)	-0.3566 (0.0002)		
Dlogof	0.4356 (0.0000)	0.4515 (0.0000)		
Do			-0.3948 (0.0000)	-0.4133 (0.0000)
R-square	0.1141	0.1336	0.1124	0.1322
Adjusted R-square	0.1084	0.0885	0.1086	0.0891

The dependent variable Productivity is the relative aggregate industrial productivity. p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 25 Short Run Markups Effects of Openness without Enterprises Number (US)

Dependent Variable: Markups

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	619	619	619	619
Dm_1	-0.2026 (0.0000)	-0.2174 (0.0000)	-0.1943 (0.0000)	-0.2076 (0.0000)
Dlogod	-0.0082 (0.5061)	-0.0064 (0.6203)		
Dlogof	0.0370 (0.00123)	0.0408 (0.0077)		
Do			-0.0194 (0.0620)	-0.0200 (0.0679)
R-square Adjusted R-square	0.0414 0.0367	0.0750 0.0424	0.0370 0.0339	0.0691 0.0379

The dependent variable Markups is the relative aggregate industrial markups.
p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 26 Short Run Markups Effects of Openness without Enterprises Number (Canada)

Dependent Variable: Markups

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	526	526	526	526
Dm_1	-0.1305 (0.0035)	-0.2236 (0.0000)	-0.1320 (0.0031)	-0.2248 (0.0000)
Dlogod	-0.0034 (0.8348)	-0.0168 (0.3167)		
Dlogof	0.0290 (0.1197)	0.0432 (0.0216)		
Do			-0.0142 (0.2944)	-0.0280 (0.0384)
R-square	0.0210	0.1304	0.0185	0.1280
Adjusted R-square	0.0154	0.09052	0.0148	0.0899

The dependent variable Markups is the relative aggregate industrial markups.
p-values are reported in parenthesis under each coefficient. Columns (1) and (3) do not include country and industry fixed effects in the regressions. Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 27 Long Run Price Effects of Openness without Enterprises Number (US)

Dependent Variable: Prices

Independent Variable	(1)	(2)	(3)	(4)
Number of Observations	715	715	715	715
Dlogod	-0.007 (0.7354)	0.0051 (0.8086)		
Dlogof	-0.0102 (0.6158)	-0.0158 (0.4422)		
Do			0.0007 (0.9642)	0.0091 (0.5687)
Dlogcpid	0.2609 (0.5444)	-0.2005 (0.6607)	0.4138 (0.1509)	0.2222 (0.5656)
Dlogcpif	-0.4589 (0.0544)	-0.4966 (0.1374)	-0.4503 (0.0495)	-0.3793 (0.2501)
Lnppi_1	-0.0626 (0.0001)	-0.0698 (0.0000)	-0.0618 (0.0002)	-0.0677 (0.0000)
Lnod_1	0.0083 (0.0121)	0.0175 (0.0032)		
Lnof_1	-0.0057 (0.0709)	0.0054 (0.3359)		
Lno_1			0.0071 (0.0076)	0.0060 (0.1010)
Lngdpd_1	-0.0020 (0.8445)	-0.0237 (0.2794)		
Lngdpf_1	-0.0032 (0.1511)	-0.0125 (0.0005)		
Lngdp_1			0.0027 (0.2016)	0.0094 (0.0049)
Lncpid_1	0.2545 (0.0429)	0.1285 (0.3553)	0.2960 (0.0063)	0.1796 (0.1933)
Lncpif_1	-0.2262 (0.0120)	-0.1947 (0.0518)	-0.2042 (0.0196)	-0.1589 (0.1113)
R-square	0.0815	0.1262	0.0798	0.1140
Adjusted R-square	0.0671	0.0892	0.0694	0.0804

The dependent variable Prices is the relative aggregate industrial price.
p-values are reported in parenthesis under each coefficient. Country and industry fixed effects are not included in Columns (1) and (3). Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 28 Long Run Price Effects of Openness without Enterprises Number (Canada)

Dependent Variable: Prices

Independent Variable	(1)	(2)	(3)	(4)
Number of Observations	689	689	689	689
Dlogod	-0.5339 (0.0233)	-0.5140 (0.0354)		
Dlogof	0.4006 (0.0637)	0.3291 (0.1339)		
Do			-0.4587 (0.0093)	-0.5103 (0.0051)
Dlogcpid	3.7163 (0.2282)	16.6031 (0.0020)	3.3547 (0.2681)	9.6745 (0.0559)
Dlogcpif	-0.2677 (0.5905)	-0.4270 (0.4107)	-0.2276 (0.6442)	-0.1367 (0.7916)
Lnppi_1	-0.1682 (0.0000)	-0.1858 (0.0000)	-0.1682 (0.0000)	-0.1703 (0.0000)
Lnod_1	-0.0227 (0.5600)	0.0009 (0.9872)		
Lnof_1	-0.0033 (0.9226)	-0.0015 (0.9777)		
Lno_1			-0.0071 (0.7948)	-0.0028 (0.9421)
Lngdpd_1	0.0054 (0.8235)	1.9942 (0.0001)		
Lngdpf_1	-0.0107 (0.7925)	0.0151 (0.8754)		
Lngdp_1			0.0062 (0.7686)	0.0369 (0.7008)
Lncpid_1	2.2680 (0.1011)	1.2350 (0.5077)	2.0053 (0.1305)	3.3660 (0.9397)
Lncpif_1	-0.0255 (0.9491)	-0.2856 (0.4972)	-0.0101 (0.9798)	-0.0318 (0.6573)
R-square	0.1826	0.2079	0.1820	0.1875
Adjusted R-square	0.1693	0.1705	0.1724	0.1531

The dependent variable Prices is the relative aggregate industrial price.
p-values are reported in parenthesis under each coefficient. Country and industry fixed effects are not included in Columns (1) and (3). Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 29 Long Run Productivity Effects of Openness without Enterprises Number (US)

Dependent Variable: Productivity

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	548	548	548	548
Dlogod	-0.4780 (0.0000)	-0.5302 (0.0000)		
Dlogof	0.3480 (0.0000)	0.5071 (0.0000)		
Do			-0.4040 (0.0000)	-0.5224 (0.0000)
Lnp_1	-0.3099 (0.0000)	-0.4740 (0.0000)	-0.2971 (0.0000)	-0.4604 (0.0000)
Lnod_1	-0.0177 (0.2900)	0.0140 (0.6197)		
Lnof_1	0.0101 (0.6387)	0.0561 (0.0828)		
Lno_1			-0.0157 (0.3177)	-0.0198 ((0.3180)
Lngdpd_1	0.0102 (0.7807)	0.0009 (0.9902)		
Lngdpf_1	0.0543 (0.0000)	0.0983 (0.0000)		
Lngdp_1			-0.0473 (0.0000)	-0.0966 (0.0000)
Lnwd_1	0.0354 (0.5029)	-0.0460 (0.6120)		
Lnwf_1	-0.0406 (0.2937)	0.1759 (0.0394)		
Lnw_1			0.0590 (0.0484)	-0.1141 (0.0718)
R-square	0.2165	0.3482	0.2069	0.3424
Adjusted R-square	0.2034	0.3144	0.1995	0.3136

The dependent variable Productivity is the relative aggregate industrial productivity. p-values are reported in parenthesis under each coefficient. Country and industry fixed effects are not included in Columns (1) and (3). Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 30 Long Run Productivity Effects of Openness without Enterprises Number (Canada)

Dependent Variable: Productivity

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	531	531	531	
Dlogod	-0.1613 ((0.0835)	-0.1875 (0.0363)		
Dlogof	0.4871 (0.0000)	0.6041 (0.0000)		
Do			-0.3280 (0.0000)	-0.3907 (0.0000)
Lnp_1	-0.2704 (0.0000)	-0.4489 (0.0000)	-0.2593 (0.0000)	-0.4204 (0.0000)
Lnod_1	0.0018 (0.9309)	0.0276 (0.3698)		
Lnof_1	0.0356 (0.1966)	0.1029 (0.0053)		
Lno_1			-0.0006 (0.9731)	-0.0255 (0.2658)
Lngdpd_1	0.0320 (0.3770)	-0.2704 (0.0820)		
Lngdpf_1	0.0090 (0.6540)	-0.0900 (0.0289)		
Lngdp_1			-0.0121 (0.5040)	0.0479 (0.2342)
Lnwd_1	-0.0123 (0.7256)	0.0463 (0.3609)		
Lnwf_1	-0.0142 (0.5789)	0.0582 (0.1378)		
Lnw_1			0.0266 (0.1626)	-0.0053 (0.8631)
R-square	0.1834	0.3206	0.1598	0.2512
Adjusted R-square	0.1693	0.2813	0.1518	0.2839

The dependent variable Productivity is the relative aggregate industrial productivity. p-values are reported in parenthesis under each coefficient. Country and industry fixed effects are not included in Columns (1) and (3). Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 31 Long Run Markups Effects of Openness without Enterprises Number (US)

Dependent Variable: Markups

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	770	770	770	770
Dlogod	-0.0155 (0.1372)	-0.0212 (0.0463)		
Dlogof	0.0190 (0.1262)	0.0212 (0.0903)		
Do			-0.0193 (0.0260)	-0.0180 (0.0413)
Lnm_1	-0.0288 (0.0412)	-0.1362 (0.0000)	-0.0121 (0.3576)	-0.1223 (0.0000)
Lnod_1	0.0017 (0.3533)	-0.0016 (0.5069)		
Lnof_1	0.0012 (0.4012)	-0.0057 (0.0076)		
Lno_1			-0.0013 (0.2952)	0.0024 (0.1190)
Lngdpd_1	0.0081 (0.0026)	-0.0258 (0.0020)		
Lngdpf_1	0.0005 (0.5425)	0.0061 (0.0001)		
Lngdp_1			0.0003 (0.7579)	-0.0544 (0.0005)
R-square	0.0208	0.1007	0.0081	0.0880
Adjusted R-square	0.0118	0.0705	0.0029	0.0612

The dependent variable Markups is the relative aggregate industrial markups.
p-values are reported in parenthesis under each coefficient. Country and industry fixed effects are not included in Columns (1) and (3). Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.

Table 32 Long Run Markups Effects of Openness without Enterprises Number (Canada)

Dependent Variable: Markups

Independent Variable	**(1)**	**(2)**	**(3)**	**(4)**
Number of Observations	664	664	664	664
Dlogod	-0.0135 (0.2979)	-0.0175 (0.1837)		
Dlogof	0.0377 (0.0074)	0.0388 (0.0063)		
Do			-0.0203 (0.0579)	-0.0255 (0.0178)
Lnm_1	-0.0819 (0.0001)	-0.1286 (0.0000)	-0.0807 (0.0001)	-0.1320 (0.0000)
Lnod_1	0.0001 (0.9472)	0.0000 (0.9842)		
Lnof_1	-0.0001 (0.9437)	-0.0042 (0.1030)		
Lno_1			-0.0005 (0.7636)	0.0023 (0.2563)
Lngdpd_1	0.0004 (0.9781)	-0.0306 (0.0720)		
Lngdpf_1	-0.0061 (0.0029)	-0.0053 (0.1892)		
Lngdp_1			0.0022 (0.1834)	0.0063 (0.1155)
R-square	0.0560	0.1239	0.0387	0.1120
Adjusted R-square	0.0459	0.0867	0.0329	0.0786

The dependent variable Markups is the relative aggregate industrial markups.
p-values are reported in parenthesis under each coefficient. Country and industry fixed effects are not included in Columns (1) and (3). Columns (2) and (4) run the same regressions as the first two regressions, respectively, but include country and industry fixed effects.