This paper provides an analysis of the effects of two trade policies on the softwood lumber industry. I find that the first trade policy, a tariff-enforced voluntary export restraint (VER), does not significantly restrain trade due to the quota allocation methods used by the exporting country. The second trade policy I investigate, an antidumping and countervailing tariff, does restrain trade. I find that for this tariff, the increase in imports from those countries not named in the tariff, called trade diversion, is the key determinant of the effects of the tariff on quantities, prices, and welfare. The significant amount of trade diversion that occurs in the
softwood lumber industry causes this tariff to have a positive effect on overall U.S. welfare, while, without trade diversion I estimate that the tariff could reduce overall U.S. welfare by billions of dollars. My results suggest that the amount of trade diversion in an industry is a crucial determinant of the effects of country-specific trade policies such as antidumping tariffs.

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1. Introduction

As the world economy becomes more integrated, and trade relationships become larger and more complex, it is increasingly important for us to understand the myriad of trade policies used to regulate and restrict trade flows. In this paper I focus on two of the
most popular trade policy instruments, the voluntary export restraint (VER) and antidumping and countervailing (AD/CV) tariffs. Both of these trade policies are used to restrict trade and protect domestic industries from foreign competition.

The voluntary export restraint (VER) generally takes the form of an import quota negotiated between two countries that is enforced by the exporting country. VERs have become popular because their voluntary nature makes them more politically palatable than other trade restrictive policies. I focus on a particular kind of VER, one in which a tariff is used to enforce the quota levels. The key contribution of this paper to our understanding of VERs is that the method used by the exporting country to allocate the export quotas can have a significant effect on the overall ability of the VER to restrict trade. In fact, my analysis shows that the methods used to allocate these quotas can negate any of the trade restrictive effects of the VER. This runs counter to the standard theoretical prediction that a binding VER will restrict trade.

Antidumping and countervailing tariffs, the second type of trade policy that I study, are increasingly becoming one of the world’s largest trade barriers. These specialized tariffs have evaded the tight WTO/GATT controls that have decreased the use of many other tariffs and restrictive trade policies. Antidumping (AD) tariffs are applied on a country-specific basis when a government finds evidence that exporters from one or more countries may be selling their goods in the home country’s domestic market below their average cost. Countervailing (CV) tariffs, which are also country-specific, are applied when there is evidence that a foreign government is giving an exporting industry an unfair advantage, often in the form of subsidies or tax breaks. Antidumping and countervailing tariffs often appear together in the same industry, as in the case I will be studying.
I investigate the effects that these tariffs, acting together in one industry, have on import quantities, prices, and welfare levels in that industry. Thus far there have been two primary lines of research on AD/CV tariffs that are relevant to this paper. The first line of research involves investigating the market and welfare effects in very specific markets, while the second line of research has examined overall trends in antidumping and countervailing effects. This paper seeks to contribute to our understanding of AD/CV tariffs by using market-specific research to gain insight about the theoretical predictions of our models of AD/CV tariffs. In particular, my results highlight the importance of trade diversion, the increase of U.S. imports from those countries to which the AD/CV tariff does not apply, to the price, import quantity, and net welfare effects of an AD/CV tariff. Depending on the size of the trade diversion, I find that the net welfare effects of AD/CV tariffs on the nation that enacts them can vary, from slightly positive to extremely negative.

To analyze the effects of these two trade policy varieties, I focus on one trade relationship, that of the U.S.-Canada softwood lumber trade. The length of my study covers the years 1994 to 2003. The U.S.-Canada softwood lumber trade relationship consists almost entirely of the flow of Canadian lumber to the U.S. The softwood lumber market is one of the largest components of one of the world’s foremost bilateral trade relationships. The Canada-U.S. softwood lumber trade has been the focal point of decades of debate, with billions of dollars hanging in the balance.

The softwood lumber market provides an excellent opportunity to study the effects of both a VER and an AD/CV tariff for several reasons. First, the U.S.-Canada softwood lumber trade is well documented, providing a wealth of data on which to base my analysis. Second, because of the nature of lumber production, there is no possibility of “tariff jumping,” a practice in which firms shift their
production out of countries on which a tariff is applied to avoid paying the duties. Third, this is a large and relatively important trade relationship. Finally, both a VER and an AD/CV tariff were applied to this market within a decade-long time span.

To analyze the softwood lumber market, I utilize a Gravity Equation. The Gravity Equation, though it lacks a clear and solid theoretical foundation, is one of the most successful empirical models in international economics, even though it lacks a clear and solid foundation (Helliwell 1998). This equation allows me to estimate the effects of the VER and the AD/CV tariff on both the quantity of Canadian imports to the U.S. and on U.S. domestic prices. I also modify the equation to measure how trade diversion -- the increase in U.S. imports from countries that do not face the tariff -- alters the size and significance of the price and quantity effects of the AD/CV tariff. Hereafter, I refer to all importing countries other than Canada, none of which face trade barriers with the U.S., as overseas importers. The welfare effects of the AD/CV tariff can be calculated from the changes in U.S. domestic prices and import quantities. In order to understand the importance of the trade diversion effect, I estimate what the welfare effects of the tariff would be without trade diversion and compare this to the welfare effect of the tariff with trade diversion present.

The first policy instrument that I analyze is the Softwood Lumber Agreement (SLA), a tariff-enforced VER that was in effect from April 1, 1996 until its expiration on March 31, 2001. The SLA is similar to a standard VER except that instead of one quota level it includes three quota levels that are enforced by two different tariff sizes. The SLA also includes a “price trigger” mechanism that allows additional imports when U.S. domestic lumber prices reach a certain level. Though the SLA is a modification of the standard
single quota VER, it is still expected to restrict trade, therefore decreasing the quantity of lumber supplied to the U.S. market and driving up U.S. prices.

My analysis finds that even though the SLA appears to be a trade restrictive policy, it actually slightly increased Canadian lumber exports to the U.S. I argue that the reason the SLA does not restrict trade is due to the way that the Canadian government divided the quota between Canadian producers. In the first year of the SLA, Canadian firms received both a base and lower fee quota amount proportional to their previous year’s exports to the U.S. In each following year, this quota was adjusted depending on each firm’s utilization of the previous year’s quota. This system provides a significant incentive for firms to fill their quota each year, and in fact we see that from April 1997 until the end of the SLA in 2001, no less than 99% of Canada’s base quota was filled. The lower fee quota utilization was also very high. I conclude that the quota allocation method played a crucial role in determining the effects of the SLA by giving Canadian firms an incentive to export more than their profit maximizing quantity in order to retain their quota and increase their future profit possibilities.

The second trade policy that I analyze is the AD/CV tariff on Canadian imports to the U.S. that took effect on May 22, 2002, with a combined ad valorem tariff weight averaging 27.5 percent. A traditional two-country tariff analysis, such as the one outlined in Section3, would lead us to expect a fall in the quantity of Canadian imports to the U.S. and an increase in U.S. domestic prices as a result of a tariff. Using the Gravity Equation, I find that when the tariff is applied, Canadian imports to the U.S. fall by 35%, and U.S. prices rise by 12%.
The trade diversion effect is one major factor that sets AD/CV tariffs apart from tariffs that are not country-specific. Because the softwood lumber AD/CV tariff applies only to Canada, it is possible for overseas imports to the U.S., which face no tariff, to partially or entirely offset the decrease in Canadian imports to the U.S. caused by the tariff. I find that increase in imports to the U.S. significantly reduces the price increase in the U.S. domestic market. With trade diversion, U.S. prices increase by 12%, whereas if trade diversion were not present, the price increase would be 27%, almost the full amount of the tariff. The dramatic difference in the tariff’s effect on prices with and without trade diversion highlights the importance of trade diversion. In addition, the fact that trade diversion has a significant effect on U.S. prices means it has a strong impact on the welfare changes resulting from the tariff as well.

Why do overseas imports to the U.S. fail to increase enough to fully offset the decline in Canadian imports to the U.S., keeping U.S. prices constant? In a perfectly competitive world, market theory suggests that overseas imports to the U.S. would increase in direct proportion to the drop in Canadian imports to the U.S. However, my research finds that Canadian imports to the U.S. drop 35% as a result of the tariff, while overseas imports increase only 16%. The reason that overseas exports do not replace Canadian exports on a one-to-one basis is that Canadian exporters are more productive than overseas exporters. Thus the 12% increase in U.S. prices can be interpreted as a measure of the productivity difference between Canadian and overseas exporters. Factors that contribute to the difference in productivity between Canadian and overseas exporters include the large size of the Canadian producers, which allows them to take advantage of economies of scale, and the proximity of Canada to the U.S., which reduces transportation costs. If the
productivity gap between Canadian and overseas producers were not present, we would expect the U.S. domestic price increase to be negligible.

The increase in U.S. domestic prices and the decrease in overall consumption caused by the tariff are certain to impact U.S. welfare. U.S. domestic producer surplus increases because the producer’s products are selling at a higher price. Consumer’s surplus decreases because they are paying higher prices and consuming fewer goods. Government surplus increases because the government is earning income from the tariff duty. The net welfare change for the U.S. depends on the relative size of these changes. My results show that, during the six quarters that the tariff affects the market, it results in either a very small gain in U.S. welfare or no change in welfare versus free trade levels. I also project that, if current trends continue, the welfare effect of the tariff will increase over time, although it will remain relatively small. This result runs counter to the theory of free trade as a first best policy because it shows that free trade-like welfare results can be achieved with a tariff in place. However, when I hold overseas imports constant, I find that the net welfare effect becomes negative and could amount to losses of over $500 million per year. Thus it is the trade diversion effect that is crucial in determining the net welfare outcome of an AD/CV tariff.

In the following several paragraphs I discuss issues relating to the tariff effect that are important for a thorough understanding of the tariff but not the focus of my analysis. First, I discuss several arguments that are commonly used to explain why short-term trade policies such as the AD/CV tariff can lead to positive welfare effects. For instance, tariffs can be used to protect fledgling domestic industries, allowing them to grow and eventually become competitive with foreign firms, leading to a net welfare gain in the long
term. Protected domestic producers can become internationally competitive as a result of the learning by doing effect. Learning by
doing refers to a system in which firms become more competitive in relation to the sum of the quantity the firm has produced in its
history. Thus, the protection can make the industry more competitive in the long run by allowing it to produce more in the short run.
However, the U.S. softwood lumber industry is a mature industry with a growth potential sharply limited by the supply of raw
materials, so this argument in favor of the AD/CV tariff is probably not applicable to the U.S. softwood lumber industry.

Another reason why AD/CV tariffs can be used to increase net welfare is when a domestic market failure is causing the market to
incorrectly measure the costs and benefits of production. In cases where the marginal social benefit of production is not fully
accounted for by the producer surplus measure, it may be desirable to protect the domestic industry with a trade restriction. This
justification for an AD/CV tariff requires that the production or sales of the product by the domestic producer must have some
significant positive externalities.

The two arguments above suggest that in certain circumstances an AD/CV tariff can lead to positive welfare effects. However,
these arguments do not seem to present a compelling case for the softwood lumber AD/CV tariff since it is applied to a mature
industry that has few compelling positive externalities.

There are also several reasons why an AD/CV tariff may be implemented even though it will not have act to increase welfare. One
of these reasons is the dynamic effects of the tariff that are not captured by my static analysis. If policymakers are more interested in
short term gains, they may support an AD/CV tariff with short-term positive net welfare effects that become negative in the long term
as production and consumption levels adjust to the distorted market incentives. In this case, the short-term gains of the tariff create bad incentives for policymakers.

Another problem caused by the existence of AD/CV tariff laws is unproductive profit seeking. This occurs when the possibility of a large surplus gain by U.S. producers gives them incentives to spend money lobbying for the implementation of a tariff. This lobbying leads to a fall in net welfare regardless of whether a tariff is ultimately applied. Consumers, who face a loss in surplus from the tariff, may decide to lobby against the tariff, creating more unproductive rent seeking losses. The unproductive rent seeking activity created by the possibility of gains from a tariff is a strong argument in favor of free trade as a first best option (Bagwati 2002).

Above I have mentioned a couple of ways that a tariff may have negative welfare effects not captured by my analysis. However, I believe that the most important factors relating to the welfare effects of the tariff are captured by my analysis. I find that the welfare results of an AD/CV tariff are dependent on the amount of trade diversion generated by the tariffs. Thus, it is important to understand factors that may lead to or correspond to a high degree of trade diversion in a market. My analysis points to several factors that may increase the size of trade diversion and reduce the net welfare loss from the tariff. These factors include trade frictions in the market, the homogeneity of productivity levels in the market, and the portion of the market on which the AD/CV tariff is applied. In a market with fewer trade frictions and more homogeneous productivity levels, we are likely to see a larger trade diversion effect, a smaller change in domestic prices, and a more positive welfare outcome. Also, when a larger portion of exporters in the market is named,
there are fewer exporters to increase their shipments, and the trade diversion effect is likely to be smaller. If the size of trade diversion is small, the tariff is likely to cause a significant decline in net welfare for the imposing country.

A final point of note regarding the AD/CV tariff is that it causes welfare losses outside of the U.S., particularly in Canada, and may increase conflict between nations. If tariffs are applied by one country then other countries are likely to respond in order to keep trade “fair”. When many countries decide to apply tariffs the result is a welfare loss in all countries. The GATT and WTO were implemented specifically to limit the proliferation of trade restrictions and to decrease the international welfare losses that widespread tariff use causes.

This paper is organized in the following fashion. In the next section I present some brief background information that includes a review of relevant literature. The third section describes the theory of the trade effects. In the fourth section I present my data and outline the Gravity Equation I use to estimate the trade effects. The fifth section describes and analyzes the effects of the SLA on the softwood lumber market. The sixth section covers the AD/CV tariff’s market effects, while the seventh section investigates how trade diversion affects these results, including a brief discussion of Canadian market effects. The eighth section provides a calculation and analysis of the welfare results. The ninth section provides a brief discussion of the robustness of my findings. I then end with some concluding comments on the implications of my findings.

2. Background
Since 1982, when U.S. lumber producers first began working together to advocate for protection from Canadian lumber imports, there have been four attempts to place a countervailing or antidumping duty on Canadian lumber imports to the U.S. None of the first three attempts, which were initiated in 1982, 1986, and 1991, held up in court after appeal.

During this period, some interesting research was done on the effects of U.S. trade policies on the softwood lumber trade. Abdullatif, Boyd, and Doroodian (1993) use a spatial equilibrium model to study the possible effects of trade liberalization resulting from NAFTA on the softwood lumber trade between the U.S., Canada, and Mexico. By applying a variety of scenarios including trade liberalization and several different levels of protection, they found that trade liberalization would significantly increase lumber shipments but would not have an appreciable effect on welfare. Ames, Dorfman, and Myneni (1994) focus their analysis on the effect of the 1987-1991 “voluntary” Canadian export tax and simultaneous 6.51% U.S. import duty. They find that U.S. consumers suffered losses of 35-45% percent of those endured by Canadian producers, while U.S. producer’s surplus increases.

The fourth tariff, introduced in 1991, was still in effect in early 1994 when my study begins. However, judicial decisions were handed down in late 1993 and early 1994 that made the removal of this tariff and the reimbursement of the fees paid by Canadian exporters all but inevitable, even though the U.S. government stalled reimbursement until 1995. I assume that all importers knew that the tariff duties they were paying were certain to be reimbursed and therefore acted as they would in a free trade situation.
The next evolution of the softwood lumber dispute occurred in 1996 with the implementation of the U.S.-Canada Softwood Lumber Agreement. The SLA was in effect from April 1, 1996 until March 31, 2001. This agreement applied to exports from all of the major softwood lumber producing Canadian provinces: British Columbia, Alberta, Ontario, and Quebec.

The SLA quota split Canadian lumber imports to the U.S. into three levels. The first level, or “base quota”, allowed imports of up to 14.7 billion board feet with no fee. Above that, the “lower fee level” imposed a fee of $50 per thousand board feet for imports over 14.7 but less than 15.35 billion board feet. The “upper fee level” applied a $100 fee per thousand board feet to all imports over 15.35 board feet.

In addition to these three quota fee levels, the SLA also included a “Price Trigger” mechanism that allowed an additional 92 million board feet of fee-free import from Canada to the U.S. for each period during which the average price of softwood lumber for the quarter exceeded $405 per thousand board feet in the period from April 1, 1996 to April 1, 1997, or $410 per thousand board feet after April 1, 1997 (as measured by the Random Length Composite Price Index). The 92 million feet of bonus imports could be spread throughout the four quarters following the “Price Trigger” quarter. This provided an additional mechanism for increasing Canadian imports to the U.S. in response to a rise in price.

Zhang (2001) investigated the welfare impacts of the SLA using an aggregate price model that used supply and demand in the U.S. market to estimate price effects and then examined the implied quantity and welfare effects. Zhang’s model provides an excellent framework for analyzing the SLA. He finds that the SLA causes a relatively small but statistically significant (in three out of four
years) increase in U.S. prices. My findings, discussed in the SLA section, show a similar increase in U.S. prices, although this effect is not significant in my analysis. Zhang also finds that the SLA decreases Canadian imports to the U.S. My results show that the SLA corresponds to a small increase in imports to the U.S. He finds welfare gain by U.S. producers, a small welfare gain by Canadian producers, and a large welfare loss by U.S. consumers.

In this paper, I augment Zhang’s analysis by studying the quota allocation methods used by the Canadian government. He ignores the quota allocation method that my own analysis suggests is crucial to determining the effects of the SLA. By investigating the structure of the quota allocation methods in section 5, I explain why the SLA causes Canadian imports to the U.S. to increase, adding key insight to the analysis of this trade policy with implications for the future design of similar policies.

The next short-term trade policy to be implemented by the U.S. government was the AD/CV tariff that resulted from a petition filed by the U.S. Coalition for Fair Lumber Imports, a lumber industry group, on April 2, 2001. A positive preliminary dumping determination was announced on October 30, 2001, with dumping margin findings ranging from 5.9 to 19.2% (this did not include a CV margin). The final determination was published on May 22, 2002, and duties averaging 27.5% became payable on this day. Due to the fairly recent implementation of this tariff, there has not yet been a significant amount of research on its effect on the softwood lumber market.

There has been some recent research on antidumping that is applicable to the subject of AD/CV tariff effects, particularly on trade diversion. Krupp and Pollard (1996) studied antidumping cases in several chemical imports and found evidence of trade diversion in
these industries. Prusa (1997) generalizes these findings using data on all U.S. AD cases from 1980-1988 that resulted in affirmative dumping determinations. He finds that the value of imports from non-named countries increased approximately 20% in the first year after the duty was applied and increased over 40% after five years.

3. Theory

3.1 Basic Two-Country Model

The theory on which I base my analysis is an expansion of the simple two-country model commonly used in trade policy analysis. First, I explain the two-country model for a single market, which is similar to that presented in Krugman and Obstfeld (2003). For simplicity, my analysis assumes frictionless trade flows and perfect competition. In this model, the U.S. is the home country and Canada is the foreign country. Trade arises if prices for the same product are different in the two markets, in the absence of trade. If the price of the product in the Canadian market is lower than the price of the product in the U.S. market, Canada exports the product while the U.S. imports it. The amount of trade is then determined by Canada’s export supply curve and the U.S.’s import demand curve. The Canadian export supply curve is the difference between the quantity demanded and the quantity supplied in the Canadian domestic market. Likewise, the U.S.’s import demand curve is the difference between demand and supply in the U.S. market. The Canadian and U.S. markets and the export supply and import demand curves derived from them are displayed in Figure 1. The equilibrium world price under free trade, \( P_w \), occurs where the export supply (XS) and import demand (ID) curves cross.
3.2 Theory of Trade Enforced VER Effects

It is possible to use this two-country model to evaluate the effects of a tariff-enforced VER. When a tariff-enforced VER is applied to imports to the U.S. market, and the tariff is binding, it changes the shape of the export supply curve. A VER is binding if the quota amount is set below the level of imports that occur in free trade, and if this quota is enforceable. The resulting XS curve, created by the tariff-enforced VER, is exactly the same as the old XS curve below the quota amount, but at the quota amount it becomes vertical. After it reaches a price $P_t$ such that the price difference between the world price $P_w$ and the new price $P_t$ is equal to the size of the tariff used to enforce the quota, then the XS curve returns to its original slope. A graphical description of the effect of a
A three-country model is necessary to take into account the fact that the trade enforced VER is applied only to Canada: all other countries enjoy free trade with the U.S. For overseas exports to the U.S. to occur, I must assume that without trade, the price that
would occur in the overseas domestic market is lower than the price that would occur in the U.S. market. With this new specification, the XS curve becomes an aggregation of the Canadian XS curve and the overseas XS curve.

Figure 3 displays the effect of a tariff-enforced VER in a model with two importing counties -- Canada and overseas -- in which the VER is applied only to Canada. When the tariff-enforced VER is applied, it changes the shape of the XS curve in the following way. Below the quota level, neither Canadian nor overseas imports are affected by the VER, and the XS curve remains exactly as with free trade. When the quota level is reached, Canadian imports to the U.S. face a trade tariff while overseas imports do not. At the quota level, the export supply curve for Canadian imports becomes vertical, as it did in the two-country model. The export supply curve for overseas imports is still the same as in free trade conditions. Thus the XS curve, which is an aggregation of these two curves, takes on a slope that is steeper than the slope achieved in free trade, but not vertical. The XS slope is dependent on the relative market shares of Canadian and overseas imports to the U.S. Eventually the price reaches a point at which the difference between the price that would have occurred in free trade (Pw) and the actual price (Pt) equals the size of the tariff used to enforce the quota. At this point, which is represented by Pt in Figure 3, the price has increased enough to offset the tariff on U.S. imports from Canada. Because price is high enough to offset the tariff above Pt, the supply curve for Canadian imports to the U.S. resumes its original slope. This causes the XS curve to resume its free trade slope.
The predictions of this model are similar to those of the two-country tariff-enforced VER predictions; U.S. prices increase, import quantities fall, U.S. production increases, and U.S. consumption falls. The difference is that, when there is a second importing country to which the VER is not applied, an equivalently sized VER will have a smaller effect on both prices and import quantities than it would in the two-country model.

The theory for a multi step trade enforced VER like the SLA is very similar to that for a single-step tariff-enforced VER made by the three-country model. With a multiple-step tariff-enforced VER, the XS curve looks like the one in Figure 4. In this case each quota level and its respective tariff are represented by a step. For instance, in the SLA the base quota is up to 14.7 billion board feet, so in Figure 4, 14.7 billion board feet corresponds to $Q_1$. Above 14.7 billion board feet there is a lower fee quota for imports up to
15.35 billion board feet. Q_3 represents 15.35 billion board feet, the beginning of the upper fee quota area. The difference between P_1 and P_2 is the size of the tariff applied to imports in the lower fee area. The difference between P_3 and P_4 is the size of the tariff applied to imports in the upper fee area.

Figure 4: Multi-step Trade-Enforced VER

The overall predictions of the multi-step tariff-enforced VER in the three-country model are the same as those predicted by the single-step tariff-enforced VER in the three-country model. U.S. prices rise, but not as much as in a two-country model. Canadian import quantity falls while overseas import quantity increases. Also, U.S. production will rise and U.S. consumption will fall. These
effects occur only when the intersection of the XS and ID curves is greater than \( Q_1 \); the size of these effects is determined by the sizes of the quota areas, the tariffs used to enforce them, and the ratio of Canadian to overseas imports in the market.

3.3 Theory of AD/CV Tariff Effects

The two-country model in Figure 1 can also provide an excellent foundation from which to analyze the effects of the AD/CV tariff. I start by analyzing the effects of an ad valorem tariff in a two-country model and then expand to a three-country model.

In a two-country model, the imposition of a tariff causes import quantity to fall and U.S. prices to rise. The tariff drives a wedge between the world price, \( P_W \), and post-tariff U.S. prices, \( P_T \). A graphical way to think about the effects of the tariff on the equilibrium price is that the tariff causes the XS curve to shift upward from \( XS_1 \) to \( XS_2 \). The tariff decreases the price that Canadian producers receive for each product, meaning that prices must be higher by the amount of the tariff in order to achieve the same quantity of Canadian imports to the U.S. Interpreting the effect of the tariff on equilibrium prices and import quantities as a shift in the XS curve is useful in the two- and three-country analyses, although this way of visualizing the change can be deceiving when thinking about the price received by Canadian exporters. In Figure 5, the price received by Canadian producers for their products is \( P_w \).
In the U.S. market in Figure 5, we can see that an increase in U.S. prices leads to an increase in production by U.S. producers. The higher price also results in a fall in U.S. consumption.

I now expand to a three-country model, building upon the two-country model by adding a second importer to the U.S., which I term the overseas importer. The three-country model is necessary because the AD/CV tariff I am interested in applies only to Canada. The overseas importers to the U.S. are free of the tariff and other trade restraints.

In the three-country model shown in Figure 6, the XS curve represents an aggregation of the export supply curves from both Canadian and overseas markets. When a tariff is applied to Canadian imports to the U.S., the quantity of Canadian imports falls for any given price, shifting the XS curve upwards as in the two-country model, to XS$_2$. The fall in Canadian imports causes a rise in U.S.
prices, which in turn attracts overseas imports to the U.S. The increase in overseas imports to the U.S. counteracts the fall in Canadian imports to the U.S., decreasing the shift in the XS curve that results from the fall in Canadian imports. The result is that the increase in overseas imports to the U.S. shifts the XS curve from XS$_2$ back to XS$_3$.

How far back towards XS$_1$ does the increase in overseas imports shift the XS curve? If the marginal productivity of all importers were constant, then the increase in overseas imports to the U.S. would exactly offset the decrease in Canadian imports to the U.S., and the tariff would have no effect on the XS curve; it would remain at XS$_1$. With productivity constant across Canadian and overseas producers, it would not matter where the U.S. imports came from. A decrease in U.S. imports from one country would simply cause an increase in U.S. imports from another.

A more realistic model is that the marginal productivity of the original Canadian imports to the U.S. is likely to be larger than the marginal productivity of the overseas imports that replace them. From a theoretical standpoint, this can be explained by assuming that both Canadian and overseas importers experience increasing marginal costs.

Under free trade conditions, Canadian producers send all products to the U.S. with marginal costs lower than the U.S. price. When the tariff is applied to Canadian producers, products with marginal costs greater than the U.S. domestic price, plus the tariff amount, are no longer sent to the U.S. market. Since Canadian producers have increasing marginal costs, the number of products sent to the U.S. with the tariff in place must be smaller than the number of products sent to the U.S. under free trade.
In a free trade situation, overseas importers to the U.S. comprise all overseas imports with marginal costs lower than U.S. prices. When the tariff is applied to Canadian imports, U.S. prices rise. As prices rise, overseas imports to the U.S. increase to include all imports with marginal costs below the new, higher price. Because overseas producers exhibit increasing marginal costs, the new overseas imports attracted by the higher price must have a higher marginal cost than the Canadian imports they replace. So as long as overseas importers exhibit increasing marginal costs, they can never fully replace the fall in Canadian imports resulting from the tariff, and XS$_3$ will always exceed XS$_1$. These effects are displayed in Figure 6.

Figure 6: Three-Country Model of Tariff Effects

In Figure 6, the price increase that occurs without trade diversion is represented by the difference between Pt and Pw. The price increase that occurs with trade diversion is the difference between Pt* and Pw. The price increase caused by the tariff without trade
diversion, which is the same as that found using a two-country model, is larger than the price increase that the tariff causes when trade diversion is present, as in the three-country model. The price received by Canadian producers for their products without trade diversion is Pw. With trade diversion the price they receive is Pc.

The increase in U.S. price resulting from the tariff also raises U.S. production. The size of the production increase depends on the elasticity of supply. So, the four main predicted effects of an AD/CV tariff are: A fall in Canadian imports, an increase in overseas imports, an increase in U.S. prices, and an increase in U.S. production.

4. Gravity Equation and Data Description

4.1 Gravity Equation Description

To study the effects of these trade policies, I use an adaptation of the Gravity Equation. The Gravity Equation, pioneered by Tinbergen (1962) and Pöyhönen (1963), was originally used to explain bilateral trade flows using two countries’ GNP’s and the distance between them. Linnemann (1966) added a population variable to account for scale economies and helped demonstrate the empirical accuracy of the Gravity Equation. His equation explained some 80% of the variance of trade among 80 countries.

Other researchers have attempted to provide a theoretical justification for the Gravity Equation. Anderson (1979) was able to derive the Gravity Equation from expenditure share equations once he assumed that commodities were distinguished by place of production. Helpman (1984) found that it could also be derived when products are differentiated. More recently, Deardorff (1984)
showed that when transport costs are included and modeled in a particular way, the Gravity Equation could fit the Heckscher-Ohlin model. Anderson and Van Wincoop (2003) provide a theoretical grounding for the application of the Gravity Equation to the study of border effects done by McCallum (1995).

4.2 Trade Effects Gravity Equations

I start my analysis with the following traditional form of the Gravity Equation:

\[ \ln x = a_1 + a_2 \ln y_1 + a_3 \ln y_2 + a_4 \dd + a_5 \dd + e \]

Here \((x)\) is the quantity of U.S. imports from Canada, \((y_1)\) is U.S. GDP, \((y_2)\) is Canadian GDP, \(\dd\) is a dummy variable that takes the value one when the SLA is in force, and \(\dd\) is a dummy variable that takes the value one when the AD/CV tariff is affecting the market. To study the effect of the trade policy on U.S. domestic prices, I estimate the following equation:

\[ \ln P = a_1 + a_2 \ln y_1 + a_3 \ln y_2 + a_4 \dd + a_5 \dd + e \]
This equation is identical to (1) except that (P), which represents the U.S. domestic price, is the dependent variable rather than Canadian import quantity. Though not used as often as equation (1), a similar equation to (2) has been used by Helliwell (2002) and others to measure the effect of national borders on prices.

To simplify my analysis, I assume that all of the lumber products are homogeneous even though they come from four different HTS codes. I also ignore the spatial nature of production and consumption, as well as transportation costs. Transportation costs are addressed in Section 9.

One modification of equations (1) and (2) that I have found necessary is replacing the Canadian GDP term with Canadian housing starts. This departure occurs in the following equations:

\[
\ln x = a_1 + a_2 \ln y_1 + a_3 \ln hs + a_4 \bar{a} + a_5 \bar{\bar{a}} + e
\]

\[
\ln P = a_1 + a_2 \ln y_1 + a_3 \ln hs + a_4 \bar{a} + a_5 \bar{\bar{a}} + e
\]

In (3) and (4), all of the variables are the same as those in (1) and (2) except for (hs), which represents Canadian housing starts. This departure from the standard Gravity Equation is necessary because of a boom in Canadian housing extending from the beginning of 2002 through the end of 2003. Figure 7 shows Canadian GDP and Canadian housing starts. This figure shows that a shock causes Canadian housing starts to increase during the period in which the tariff is in place. The increase in Canadian demand is not captured
by the Canadian GDP measure. This results in a less accurate estimation when Canadian GDP is used as an independent variable rather than Canadian housing starts.

The easiest way to tell that the Canadian GDP measure creates a flawed result is to note that, when I control for trade diversion, I find that the estimated effect of the tariff is 29% (see Appendix A), which is larger than the 27.5% AD/CV tariff. Since the tariff is unlikely to have a price effect larger than its own size, the 29% price effect estimated using Canadian GDP as a variable must be inaccurate.
The fact that the increase in housing starts corresponds so closely to the imposition of the AD/CV tariff suggests that the increase may be a result of the tariff. If the tariff did cause the increase in housing starts, then in equations (3) and (4) there is an endogenous explanatory variable, something that would cause my estimations to be inaccurate. If the increase in housing starts were a result of the tariff, I would expect this effect to occur through the mechanism of lumber prices.
The theory is that the tariff causes a drop in Canadian imports to the U.S., which in turn causes Canadian domestic supplies to increase, driving down Canadian domestic lumber prices. The subsequent fall in Canadian lumber prices causes an increase in Canadian housing starts. Therefore, to determine whether the Canadian housing starts term is an endogenous explanatory variable, I check the price linkages through which the change in Canadian exports resulting from the AD/CV tariff would affect the level of housing starts.

The first linkage is between the imposition of the tariff and Canadian lumber prices. I find that the imposition of the tariff actually had a significant effect on Canadian lumber prices. Using an OLS regression, I estimate that the tariff is associated with a decrease in Canadian prices by 6%, at a 90% level of statistical significance. The second linkage is between Canadian lumber prices and Canadian housing starts. I find this linkage to be almost non-existent. When I regress Canadian housing starts on Canadian lumber prices and a time trend, I find that the 95% confidence interval of coefficient representing the percentage increase in housing starts, caused by a one percent increase in Canadian lumber prices, stretches from -41% to 67%, with an estimated coefficient of 13%.

I included a time trend in this regression to account for the fact that both of these variables show strong directional trends. Housing starts show an upward trend, as is expected given the growth of population and the economy. Lumber prices show a downward trend, a change that is not unexpected in a commodity industry.

The most important point to note is that the estimation not only fails to show a statistically significant relationship, but also predicts a positive relationship between lumber prices and housing starts. Intuitively, a positive relationship between lumber prices
and housing starts does not make sense. One would expect an increase in lumber prices to cause a decrease in housing starts. Additionally, a positive relationship between housing starts and lumber prices would fail to explain how the fall in Canadian lumber prices resulting from the AD/CV tariff would cause the increase in Canadian housing starts. Thus, it is safe to assume that there is little or no relationship between Canadian lumber prices and housing starts. This conclusion means that there is no risk of an endogenous variable problem when running equations (3) and (4). Furthermore, this conclusion makes instinctive sense, because it is likely that the price of lumber is not a determining factor in a consumer's decision to build a house or other structure. Other factors, such as property values, interest rates, and personal reasons, are likely to be much more important in this decision.

If I am using Canadian housing starts rather than Canadian GDP for my analysis, then why not use U.S. housing starts instead of U.S. GDP as well? There are several reasons why I choose not to do this. The first is that U.S. housing starts do not show any significant shocks during the study period, so housing starts are very similar to GDP. Second, as you can see by comparing the results in Appendix A to those resulting from (3) and (4) listed in the SLA effects section (page 32), when a U.S. housing starts term is used in place of U.S. GDP, the R-squared value of the regression is smaller. This means that, with a U.S. housing starts term, the Gravity Equation explains less of the variance in prices and import quantities than it does with a U.S. GDP term. Finally, I have chosen to keep the U.S. GDP term in order to remain closer to the traditional form of the Gravity Equation.
The length of the two trade policy periods, particularly that of the tariff, also requires some explanation. The SLA came into force on May 29, 1996 and was retired on March 31, 2001. The length of the SLA that is represented by the SLA dummy stretches from the third quarter of 1996 until the first quarter of 2001.

The AD/CV tariff became payable on May 22, 2002, but there is more to consider than just the official start date when setting the length of the AD/CV dummy. This is because antidumping tariffs tend to have an effect on the markets when they are still in the investigation phase, before any actual duty has been applied. Staiger and Wolak (1994) investigate the effects of several different AD investigation events on imports and domestic production during the period 1980-1985. They find that not only do final dumping determinations cause a significant impact on imports and domestic output, but the preliminary dumping determination also has a significant impact on the markets. In fact, roughly half of the overall impact of the dumping determination occurs at the preliminary determination stage. Because the preliminary determination has been shown to have a significant impact on the market, I have chosen to begin the tariff period at the time of the preliminary determination. The DOC’s preliminary finding was published on October 30, 2001, so the AD/CV tariff period stretches from the fourth quarter of 2001 until the end of the data set in 2003.

The theory presented in Section 3 provides a prediction of the signs that I expect each coefficient to have in equations (3) and (4). In (3), \( a_2 \) represents the percentage change in U.S. imports of Canadian products related to a one-percent change in U.S. GDP. The sign of \( a_2 \) in (3) can be either positive or negative, depending on whether changes in GDP are driven by supply or demand forces. If demand forces, such as an increase in the U.S. construction market, cause most of the changes, then the coefficient will be positive. If
supply forces, such as an increase in U.S. domestic production, cause most of the changes in U.S. GDP, then this coefficient should be negative. The second coefficient in (3), \(a_3\), represents the percentage change in U.S. imports from Canada, related to a one-percent change in Canadian housing starts. This coefficient should be negative because an increase in housing starts corresponds to an increase in Canadian lumber demand, which increases Canadian prices and reduces U.S. imports from Canada. The third coefficient in (3), \(a_4\), represents the percentage increase in U.S. imports from Canada related to the SLA being in force. Theory predicts that \(a_4\) should be negative as long as the SLA quota levels are low enough to be binding. The final coefficient in (3), \(a_5\), represents the percentage change in Canadian imports corresponding to the presence of the AD/CV tariff. This coefficient should be negative, since a tariff should restrict trade.

The sign of the coefficients of equation (4) can also be predicted based on the theory outlined in Section 3. The first coefficient, \(a_2\), represents the percentage change in U.S. prices corresponding to a one percent change in U.S. GDP. As in (3), the sign of \(a_2\) in (4) can be either positive or negative depending on whether changes in GDP are driven by supply or demand forces. The second coefficient, \(a_3\), represents the percentage change in U.S. prices corresponding to a one-percent change in Canadian housing starts. This coefficient should be positive because an increase in Canadian housing starts will decrease U.S. import from Canada, increasing U.S. price. The third coefficient in (4), \(a_4\), represents the percentage change in U.S. prices corresponding to the SLA being in place. Because the SLA is a trade restrictive policy, this coefficient should be positive. The last coefficient in (4), \(a_5\), represents the percentage change in U.S. prices corresponding to the AD/CV tariff being in place. This coefficient should also be positive.
4.3 Trade Diversion Gravity Equations

It is important to consider trade diversion effects when studying AD and CV tariffs, since they are country-specific trade policies. To include possible trade diversion effects, I modify equations (3) and (4) to obtain equations (5) and (6) respectively:

\[
\ln x = a_1 + a_2 \ln y_1 + a_3 \ln hs + a_4 \frac{I_w}{I_c} + a_5 \hat{a} + a_6 \bar{a} + e
\]

\[
\ln P = a_1 + a_2 \ln y_1 + a_3 \ln hs + a_4 \frac{I_w}{I_c} + a_5 \hat{a} + a_6 \bar{a} + e
\]

Equations (5) and (6) are the same as (3) and (4) respectively, except for the \( \frac{I_w}{I_c} \) term. This term represents the value of world imports to the U.S. divided by the value of Canadian imports. When I separate out the trade diversion effects as in equations (5) and (6), it changes theoretical predictions for the sizes of the coefficients when compared to (3) and (4). In theoretical terms, controlling for trade diversion levels, as in (5) and (6), is equivalent to shifting to a two-country model from the three-country model underlying (3) and (4).
When comparing (3) and (5), theory predicts that \(a_2\) and \(a_3\) are likely to remain the same in both of these equations. The third coefficient in (5), \(a_4\), was not present in (3). This coefficient represents the percentage change in U.S. imports from Canada, corresponding to a one-unit change in the ratio of overseas to Canadian imports. Coefficient \(a_4\) should be negative because a fall in Canadian imports encourages an increase in overseas imports. The SLA dummy coefficient, \(a_5\), and tariff dummy coefficient \(a_6\), should both be positive, as they were in (3). However, the size of these coefficients should be smaller than those observed in (3). This is because the increase in overseas imports to the U.S., caused when a trade-restrictive policy is applied to Canadian imports to the U.S., increases the competition that Canadian imports face, further reducing Canadian imports. The fall in Canadian imports resulting from the increase in U.S. imports from overseas is included in \(a_4\) and \(a_5\) in (3), but by controlling for trade diversion in (5), I remove these effects, which should reduce \(a_4\) and \(a_5\) if the SLA and AD/CV tariffs are both trade restrictive policies.

In equation (6), both \(a_1\) and \(a_2\) should remain roughly the same as they were in (4). The third coefficient, \(a_3\), represents the percentage change in U.S. prices corresponding to a one unit change in the ratio of world to Canadian import values. The sign of \(a_3\) should be positive because an increase in U.S. prices attracts additional overseas imports at a higher rate than Canadian imports. I know this because I have found that the price elasticity of supply for imports from overseas is roughly twice as large as the price elasticity of supply for imports from Canada (see Page 48). Coefficients \(a_4\) and \(a_5\) have the same interpretation in equation (6) as they did in equation (4). They will also both have a negative sign, as they did in (4). However, they should both be larger and more significant than they were in equation (4). This is because, by separating out the trade diversion effect and holding it constant, I am
finding the effect that the SLA and AD/CV tariff would have in on a two-country model. As I discussed in Section 3, the effects of these trade restrictive policies in a two-country model, where all imports face trade restrictions, will be larger than in a three-country model in which only part of the imports face the trade restrictions.

4.4 Data

In this analysis I use quarterly data from 1994 to 2003 gathered from government and industry sources. The data on the quantity of U.S. lumber imports from Canada and overseas was collected by the U.S. Customs Service and is specific to the eight-digit HTS level. The Customs Service also gathered data on the value of these imports at the same level of disaggregation. This value data was used to calculate the nominal U.S. domestic lumber price for these imports. Using this data, I divide the value of the imports by the quantity of imports to get nominal U.S. lumber prices. I then used the U.S. CPI to adjust prices to real 1996 dollars. U.S. GDP data comes from the Department of Economic Analysis and is in real chained 1996 U.S. dollars. The Canadian housing start data comes from Statistics Canada as did the Canadian lumber price data. U.S. and Canadian production data comes from the Random Lengths Yardstick. International GDP data comes from a variety of government sources.
5. SLA Trade Effects

5.1 Regression Results

How did the SLA affect trade between the U.S. and Canada? To investigate this question, I apply equations (3) and (4) to my data. The coefficients and errors for equations (3) and (4) are displayed in Table 1.

In (3), the negative coefficient for U.S. GDP suggests that GDP levels are more strongly affected by supply than by demand forces; however, the high p-value on this coefficient means that it may be zero or positive as well. The Canadian housing starts coefficient in (3) is negative, as expected, but also has a high p-value. The SLA dummy coefficient for import quantities is positive, the opposite of what theory predicted. This suggests that there may be some reason for the SLA to increase Canadian import quantities not captured by the theory. The tariff dummy coefficient for import quantities is negative and statistically significant. This fits with trade tariff theory.

In equation (4), I regress the natural log of U.S. prices on the same coefficients. U.S. GDP has a large negative coefficient in this regression and also has a somewhat low p-value. Even though the theory predicted that the U.S. GDP term could have a positive or negative sign depending on the interaction of production and demand forces, the large negative value of this coefficient is somewhat surprising. In a normal industry, an increase in GDP should be related to an increase in demand, which puts upward pressure on prices. This should be offset by fact that GDP term is related to an increase in domestic supply, which lowers prices. These two
offsetting effects should result in a small and less significant GDP coefficient. That is why the large and somewhat significant value in (4) is surprising.

The tariff trade diversion effects that I investigate in section 7 shed more light on the U.S. GDP coefficient. It appears that an increase in U.S. GDP is somewhat correlated with an increase in overseas imports, which act to decrease U.S. prices. Thus, when the effect of an increase in overseas imports is separated out, we find that an increase in U.S. GDP actually has a small positive affect on U.S. prices that is not statistically significant. Though there is no clear explanation for why U.S. GDP would be linked to the level of overseas imports, the GDP coefficient obtained when overseas imports are controlled for seems much more reasonable.

The positive coefficient on the Canadian housing starts term in (4) is predicted by the theory. The SLA dummy coefficient in (4) is positive, as predicted, but also has a very low statistical significance. This, together with the small, positive, SLA coefficient in (3), suggests that the SLA may not have a strong effect on the overall lumber market outcomes. The tariff coefficient is positive and somewhat significant, as predicted by the theory.

<table>
<thead>
<tr>
<th>Table 1- Regressions for (3) and (4)</th>
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<tbody>
<tr>
<td><strong>Quantity Regressions- Equation Three</strong></td>
</tr>
<tr>
<td>R Square .65</td>
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<td>Observations 39</td>
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<tr>
<td><strong>Independent Variable</strong></td>
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</tr>
<tr>
<td>In Canadian Housing Starts</td>
</tr>
<tr>
<td>SLA Dummy</td>
</tr>
</tbody>
</table>
### 5.2 Discussion of SLA Effects

Of the dummy coefficients in equations (3) and (4), the only coefficient that defies the theoretical prediction is the SLA coefficient in equation (3). Though the SLA appears to be a trade restrictive policy, my results show that the SLA actually *increases* Canadian imports to the U.S. Even more interesting is that, while imports increase as a result of the SLA, prices also increase. The only explanation for these results is that there is some effect not captured by the theory.

By studying the SLA closely, I have come to the conclusion that the quota allocation method used by the Canadian government is the central cause of the unexpected increase in imports during the SLA period. The SLA stipulates that both the base quota and the lower fee quota for a given year must be allocated by the Canadian government prior to the beginning of the year. The Canadian government decided to allocate quotas to producers using the following system: Allocations for the first year were split among the

<table>
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<th>Independent Variable</th>
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<th>S.E.</th>
<th>P-value</th>
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<td>.15</td>
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<tr>
<td>In Canadian Housing Starts</td>
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<td>.24</td>
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<td>SLA Dummy</td>
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<td>.07</td>
<td>.60</td>
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<tr>
<td>Tariff Dummy</td>
<td>.12</td>
<td>.12</td>
<td>.31</td>
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<tr>
<th>R Square</th>
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<th>S.E.</th>
<th>0.14</th>
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<tr>
<td>Observations</td>
<td>39</td>
<td>Durbin Watson</td>
<td>1.32</td>
</tr>
</tbody>
</table>

Price Regressions - Equation Four
four provinces based on their exports to the U.S. from 1994 to 1996, and they were then split among producers based on their historical exports to the U.S. For all following years, allocations were based on each producer’s quota utilization in the previous year. A small quota amount was also withheld for new entrants and those undertaking major expansion (Canadian Department of Foreign Affairs and International Trade, 2003).

The fact that quota allocations for each year are based on the preceding year’s quota utilization provides a significant incentive for firms to use their entire base quota. Exporting without a fee allows firms to earn significantly higher profits than exporting under either the lower or upper fee. By filling the current year’s export quota, firms ensured that they would have the opportunity to benefit from an equal or larger base quota in the future. In fact, in the years from April 1, 1997 until the end of the SLA in 2001 (no data was available for 1996), no less than 99% of Canada’s base quota yearly allocation was used (Canadian Department of Foreign Affairs and International Trade, 2003). Incentives also existed for firms to fill most or all of their lower fee quota for the same reason that they want to fill their base quota. The incentives for firms to export more than their profit maximizing quantity helps explain why the SLA tariff does not significantly affect trade levels, even though it appears to be a trade restricting policy.

I do not attempt to calculate welfare effects resulting from the SLA trade policy since I do not find either the quantity or price effects to be large or statistically significant. The small increase in U.S. prices that equation (4) predicts should cause a modest decrease in consumer surplus and a small increase in producer surplus. Also, the increase in Canadian imports predicted by equation
(3), combined with the increase in prices, would lead to an increase in Canadian producer surplus. These welfare predictions correspond closely to the welfare predictions of Zhang (2001).

6. Tariff Trade Effects

The AD/CV tariff is a combination of two different tariffs: an antidumping tariff and a countervailing tariff. AD tariffs are unique in that they are not only country-specific but are also firm specific. It is common for an AD tariff to be calculated for one or more large producers and then for an “all others” rate to be applied to all other producers. The “all others” rate is often just the average of the rates applied to the major producers. In the softwood lumber case, different AD tariff rates were calculated for the six largest Canadian exporters. These ranged from 2.18% to 12.44%. The all others rate was 8.43%. Added to this was an 18.79% CV tariff that applied to all imports. By taking into account the production levels of the six named firms during the tariff period, I calculate an average tariff duty of 27.6 percent.

The quantity and price results of this tariff are indicated by the tariff dummy coefficient displayed in Table 1. According to these results, the tariff causes a 35% decrease in the quantity of Canadian imports flowing across the U.S. border and a 12% increase in U.S. domestic prices. The effect of the tariff on the quantity of Canadian imports to the U.S. is highly statistically significant, while the price effect is only marginally significant. This difference makes sense because all of the Canadian imports are acted on by the tariff,
while the tariff acts on U.S. domestic prices through imports that comprise only part of U.S. lumber imports and an even smaller part of the total U.S. softwood lumber market.

The AD/CV tariff appears to be causing a large change in both U.S. prices and Canadian import quantities, with implications on both sides of the border. It is important to understand why the size of the change in U.S. prices is not in line with the size of the tariff. One reason that prices do not increase by the full tariff amount could be the increase in U.S. production caused by the upward pressure on U.S. prices. Increases in U.S. domestic supply would offset the fall in import supply caused by the tariff and reduce the size of the price increase caused by the tariff. However, several researchers, notably Robinson (1974), Adams and Haynes (1980), and Boyd and Krutilla (1987), have found that regional lumber production has very little or no price elasticity. This can also be seen in Figure 8, in which production levels show no response to the price increase caused by the tariff in late 2001 and early 2002. Note that the production data in Figure 8 includes all U.S. lumber production, not just softwoods.
If U.S. production is not increasing to dampen the price effect of the tariff, then there must be some other factor. Trade diversion is another possibility because an increase in overseas trade in response to the increase in U.S. domestic prices could dampen the price effect of the tariff.

7. Trade Diversion Effects

To study trade diversion effects, I utilize (4) and (5), which include a term corresponding to the share of imports coming from overseas versus Canadian imports. The sharp increase in the ratio of overseas to Canadian imports can be seen in Figure 9. There is a
small spike that occurs near the end of 2001 that corresponds to the preliminary determination, and a larger spike in 2002 that corresponds to the final determination.

The results from running equations (5) and (6) are displayed in Table 2. Theory tells us that the coefficient for U.S. GDP in (5) could be either positive or negative, depending on whether the change in GDP was more representative of an increase in lumber supply or lumber demand. In (5), the coefficient for U.S. GDP is positive, which differs from that found in (3), but it also has a very high p-value in both (3) and (5), so this difference is not surprising. The coefficient for Canadian housing starts is negative, just as predicted, and nearly the same as estimated in (3). The third coefficient in (5), the ratio of overseas import value to Canadian import

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value, is the term that is not included in (3). Theory predicts that this coefficient should be negative, which is the result estimated by (5) as well. This is not surprising since an increase in overseas imports represents an increase in competition for the Canadian imports. The SLA dummy in (5) is positive and of a similar size to that estimated in (3). This suggests that trade diversion was not a significant force during the SLA period. Since it appears that the SLA had little trade restrictive effect, it is not surprising that the size and direction of the effects of the SLA on the market are not seriously affected when I control for trade diversion.

<table>
<thead>
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<th>Table 2: Regressions for (5) and (6)</th>
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<tr>
<td><strong>Quantity Regressions- Equation Five</strong></td>
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<tr>
<td>R Square</td>
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<td>Observations</td>
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<tr>
<td>Independent Variable</td>
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<tr>
<td>In U.S. GDP</td>
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<td>In Canadian Housing Starts</td>
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<tr>
<td>In Overseas/Can. Import Val.</td>
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<tr>
<td>SLA Dummy</td>
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<tr>
<td>Tariff Dummy</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Price Regressions- Equation Six</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>R Square</td>
</tr>
<tr>
<td>Observations</td>
</tr>
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<td>Independent Variable</td>
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<td>In U.S. GDP</td>
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<tr>
<td>In Canadian Housing Starts</td>
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<td>In Overseas/Can. Import Val.</td>
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<tr>
<td>SLA Dummy</td>
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<tr>
<td>Tariff Dummy</td>
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</tbody>
</table>
Theory predicts that a trade restrictive policy such as the AD/CV tariff will cause an increase in overseas imports (trade diversion), and that this in turn will reduce the price effects of the tariff. It also appears that the increase in overseas imports further decreases Canadian import quantities by increasing the competition they face in the U.S. market. This effect will be even more significant if the increase in overseas exports to the U.S. allows overseas producers to take advantage of economies of scale in transportation and marketing that they were not able to benefit from before. The difference in the estimated tariff coefficients in (5) and (3) suggests that the increase in overseas exports to the U.S. is causing a further reduction in Canadian exports to the U.S. Equation (5) predicts that the tariff causes a 24% fall in Canadian imports, while equation (3) predicts a 35% fall in Canadian imports from the tariff. When trade diversion is held constant, it appears that the effect of the tariff on Canadian imports is not as significant as when trade diversion is not controlled for.

In equation (6), the price regression, the coefficient for U.S. GDP is small and positive, a dramatic change from the large negative coefficient estimated for U.S. GDP in (4). This indicates that an increase in U.S. GDP was associated with an increase in overseas imports, which lowered prices in the U.S. market. When we separate out this effect, we see that U.S. GDP appears to cause an increase in U.S. prices. Though my theory predicted that the U.S. GDP coefficient could be positive or negative, it makes sense that it should be small, as I discussed previously.

The third coefficient in (6) represents the effect of the ratio of overseas to Canadian import values on U.S. prices. This coefficient is negative and fairly statistically significant, suggesting that overseas imports act to decrease U.S. prices. This is an important point
because, as the tariff coefficient shows, the amount of trade diversion in an industry is the key determinant of the effect a trade restrictive policy will have when applied on a country-specific basis. The SLA coefficient in (6) is even smaller than it was in (4), and also less significant. As is the case in (4), it appears that the SLA does not significantly affect U.S. prices.

The most important result from equation (6) -- and the key insight about the importance of trade diversion on the effect of trade restrictive policies -- comes from the tariff coefficient. In (4), I estimated that the tariff causes a 12% increase in U.S. price, with a p-value of .31. When a term representing the amount of trade diversion is included in (6), I estimate that the 27.6% AD/CV tariff causes a 27% increase in U.S. prices. Without trade diversion, the effect of the tariff is expected to be more than twice as large as the effect that actually occurs. Therefore, the level of trade diversion is a key determinant of the overall effects of the tariff. A comparison of the SLA and tariff coefficients from equations (4) and (6) is presented in Table 3.

<table>
<thead>
<tr>
<th>Table 3: Trade Diversion Price Comparison</th>
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</thead>
<tbody>
<tr>
<td>Price Results from (4)</td>
</tr>
<tr>
<td>Coef</td>
</tr>
<tr>
<td>SLA dummy</td>
</tr>
<tr>
<td>TAR dummy</td>
</tr>
</tbody>
</table>

It is not surprising that, while the tariff dummy coefficients change dramatically when trade diversion effects are controlled for, the SLA coefficients are similar. The fact that the SLA had minimal trade restrictive effects, and only a small price effect, means that
it would not attract a large increase in overseas imports; thus, the trade diversion effect is insignificant. It is only when the trade policy is significantly restrictive, such as the AD/CV tariff, that trade diversion becomes important.

It is clear that trade diversion decreases the effect of the tariff significantly, but why doesn’t it eliminate the effect of the tariff altogether? As I discussed in Section 3, if Canadian and overseas producers exhibit increasing marginal costs, then the overseas imports that increase as a result of the tariff will be less productive than the Canadian imports they replace. Thus, they will never fully replace the Canadian imports. In this case, the price change resulting from the tariff, estimated to be 12% by (4), can be interpreted as a measure of the difference in productivity between the new overseas imports to the U.S. and the Canadian imports they replace.

Why is it that Canadian producers are that much more productive than overseas producers? Technology may be a small factor in this difference, but most of the difference is likely to come from a difference in transportation costs. Softwood lumber is a fairly costly item to transport, and many of the other sources of U.S. imports, such as New Zealand, Brazil, Russia, and Sweden, are much more distant than Canada.

8. Tariff Welfare Effects

8.1 Welfare Calculation Model

The most important characteristic of a trade policy is its effect on welfare. Measuring the size of this welfare effect has proven to be difficult in many cases, and researchers must often rely on elasticity estimates that can have an enormous effect on outcomes.
Fortunately, my estimation of the welfare effects of this tariff is aided by my focus on one well-defined market and the static nature of my analysis. This allows me to avoid using an elasticity estimate in the following welfare analysis.

My analysis of the trade effects of the tariff shows that the tariff brings about a significant increase in U.S. prices, a decrease in Canadian imports, and an increase in overseas imports. I use the estimates of the sizes of these effects to calculate the effect that the tariff has on net U.S. welfare, as well as on consumer and government surplus. I also measure the welfare effects that I would expect to happen if there had not been any trade diversion. A comparison of the welfare estimates with and without trade diversion provides a strong argument for the key role I believe trade diversion plays in determining the effects of a country-specific trade policy.

The welfare model I will use is a more complex version of the model outlined in Krugman and Obstfeld (2003). A graphical representation of this geometric tariff model is presented in Figure 11. In this model, the gains and losses from the tariff are represented by the areas of regions A, B, C, D, E, and F.

In this model, I assume that the supply and demand curves are linear in order to simplify my calculations. If these curves were not actually linear, regions A, B, and

![Figure 10: Welfare Regions](image-url)
D would be affected. However, this effect is likely to be small unless the curves are extremely non-linear. The tariff effects I am studying are small relative to the size of the total market, so a linear form is an adequate approximation of the supply and demand curves.

In Figure 1, \( P_W \) represents the world price, \( P_T \) represents the U.S. price resulting from the tariff, and \( P_T^* \) represents the price accepted by Canadian producers for products they export to the U.S. The difference between \( P_T \) and \( P_T^* \) is the size of the ad valorem tariff, \( t \).

On the quantity axis, \( S_1 \) represents domestic supply in free trade, and \( S_2 \) represents domestic supply with the tariff. \( S_{FT} \) represents total imports plus domestic supply under free trade. \( S_C \) represents Canadian imports plus U.S. domestic supply under the tariff, and \( S_T \) represents the sum of overseas imports, Canadian imports, and U.S. domestic supply with the tariff in place.

I am forced to analyze the welfare effects of this tariff without including U.S. production. The reason I avoid using U.S. production data in my welfare analysis is that I have not been able to obtain production data for the specific softwood lumber product codes in which I am interested. I am able to avoid using U.S. production in my welfare analysis because the U.S. producer surplus gain that results from the tariff is offset by an equivalent consumer loss, and thus has no effect on net welfare. This transfer of surplus from consumers to producers is represented by region A in Figure 11. However, by not calculating region A, I will not be able to find either the total consumer surplus loss or the producer surplus gain, only net welfare changes. Given that roughly 65% of the U.S.
lumber market is supplied by domestic production, it is clear that the consumer surplus loss and offsetting producer surplus gain, represented by region A, will be larger than the consumer surplus loss from regions B, C, D, and E combined.

8.2 Welfare Calculation Input Values

It is possible to calculate the areas of all regions except region A using the data that I have gathered. Below, I first describe where the values used to calculate the areas come from and then describe the exact procedure used to calculate each area. I calculate two different estimates for the area of each region. The first estimate I call the Predicted Surplus Change (PSC). The PSC is calculated using values estimated by my regressions for the free trade and tariff price and quantity levels. The second estimate I call the Calculated Actual Surplus Change (CASC). The CASC is calculated using values estimated by my regressions for free trade prices and quantities, and the actual prices and quantities observed in the market during the tariff period, for the tariff prices and quantities. The PSC represents the welfare results that my model predicts, while the CASC represents my best estimate of the actual welfare results. The methodological difference between these two measures should become clearer as I describe the procedure for obtaining the free trade and tariff price and quantity levels as well as the procedure for using these to calculate the areas of the regions.

Both the PSC and CASC play an important role in helping us understand the welfare effects of the AD/CV tariff. The advantage of the PSC is that it provides a strong sense of the welfare change trend caused by the tariff, while ignoring the many small exogenous
shocks occurring in the market that make the CASC more variable. The CACS’s advantage is that it allows us to check the predictions of the PSC against the prices and quantities that actually occur in the market.

To calculate the area of regions B, C, D, E, and F, I first need to estimate the free trade and tariff price levels. The world price level, \( P_W \), is estimated by running equation (4) with the tariff dummy variable held at zero. The tariff price level, \( P_T \), is a variable that is actually observed in the market, so it has both a PSC and a CASC value. To find the PSC value of \( P_T \), I run (4) but allow the tariff dummy variable to take a value of one for the quarters in which the tariff is affecting the market. To find the CASC value of \( P_T \), I use the price that I observed in the market during the tariff period. The price that Canadian exporters receive for their products after the tariff duty is deducted, \( P_T^* \), is found using the value of \( P_T \). Therefore \( P_T^* \) also has both a PSC and CASC value. To find the PSC value of \( P_T^* \), I subtract the tariff size (t) from the PSC value of \( P_T \). To find the CASC value of \( P_T^* \), I subtract the tariff level from the CASC value of \( P_T \).

Next I need quantity levels in the U.S. market. In addition to the results from (3) and (4), I need to estimate the change in overseas imports resulting from the tariff in order to calculate the effect of the tariff on total import quantity. My analysis of the trade diversion effects shows how important the level of overseas imports is to the market outcomes of a tariff, so trade diversion will certainly effect the welfare outcome of the tariff as well. To measure the change in overseas imports that result from the tariff, I estimate the following equation.
\begin{equation}
\ln \hat{e} = a + a_1 \ln y_1 + a_2 y_2 + a_3 \hat{a} + u
\end{equation}

In (7), the dependent variable, \( \hat{e} \), is overseas import quantity. The first independent variable, \( y_1 \), is U.S. GDP, and thus the coefficient \( a_1 \) represents the percentage change in overseas import quantity resulting from a one-percent change in U.S. GDP.

The second independent variable, \( y_2 \), is an indexed aggregation of the GDP of the seven major softwood lumber exporters to the U.S. These exporters are Austria, Brazil, Chile, Germany, Mexico, New Zealand, and Sweden. I have chosen to include only the seven largest softwood lumber exporters to the U.S. because their exports comprised over 85% of U.S. softwood lumber imports from countries other than Canada in 2001, and they held similarly large market shares in all other recent years. In order to aggregate the GDP data for these countries, I indexed them to the base year 1996, added them, and then set the base year as 1996 again. Using indexed GDP values is important because it allows me to avoid using exchange rates to convert all of the GDP levels to a common currency. It is desirable to avoid using exchange rates because they can have a high level of volatility that is not representative of the activity of the real sector. The coefficient \( a_2 \) represents the percentage change in overseas import quantity from a one-percent increase in the aggregate GDP’s of these countries.

The final variable, \( \hat{a} \), is a dummy variable representing the AD/CV tariff. Its coefficient, \( a_4 \), represents the percentage change in overseas import quantities resulting from the imposition of the tariff.

\begin{center}
\textbf{Table 4: Overseas Import Quantity Estimates from (7)}
\end{center}
The results estimated from (7) are displayed in Table 4. In (7), the coefficient for the tariff dummy variable signifies that the tariff has a relatively large positive effect on overseas imports. This result verifies that the tariff increases overseas imports, causing the trade diversion effect.

Now that I have estimated the change in overseas imports resulting from the tariff, I am able to find the quantity values for my welfare calculation. The free trade level of total imports, represented by \((S_{FT}-S_1)\) in Figure 11, is the sum of Canadian import quantity and overseas import quantity in free trade. Canadian import quantity in free trade is found by running (3) with the tariff dummy held at zero. The overseas import quantity in free trade is found by running (7) with the tariff dummy held at zero. The tariff level of total imports, represented by \((S_T-S_2)\), is the sum of Canadian import quantity and overseas import quantity when the tariff is in place. Because the quantity of imports with the tariff in place is actually observable in the market, I find both PSC and CASC values for this quantity. The PSC value for Canadian imports is found by running (3), with the tariff dummy variable taking a value of one when the tariff is affecting the market. The PSC value of overseas imports is found by running (7) with a similar dummy variable. The PSC level of total imports to the U.S. with the tariff is the sum of the PSC level of Canadian imports and the PSC level...
of overseas imports. The CASC values for Canadian and overseas import quantities with the tariff in place are those values actually observed in the market; the CASC value of total imports with the tariff in place is the sum the Canadian and overseas values.

The final quantity measure that I need for the welfare calculation is the Canadian import quantity with the tariff in place. This is represented by \((S_C - S_T)\) in Figure 11. I find this quantity by running (3), with the tariff dummy taking a value of one when the tariff is affecting the market.

8.3 Welfare Calculation Methodology

Using the input values described above, I am able to calculate the area of all of the regions in Figure 11 except region A. Table 5 lists the formulas used to calculate the area of each region, as well as a description of the surplus changes that each region represents.

I calculate the area of region C by multiplying the change in U.S. prices resulting from the tariff, \((P_T - P_W)\), by the quantity of Canadian import to the U.S. with the tariff in place. This region represents a consumer surplus loss and a government surplus gain. Consumers lose because they are paying a higher price for the Canadian imports, and the government gains because it is collecting a tariff duty on all Canadian imports. This region has no affect on the overall change in U.S. welfare.
The area of region D is calculated by multiplying the change in U.S. prices resulting from the tariff, \( (P_T - P_W) \), by the quantity of overseas imports to the U.S. with the tariff in place. This region represents a consumer loss because consumers are paying a higher price for the overseas imports. There is no government surplus gain in this region because the tariff duties do not apply to imports from countries other than Canada. This region will negatively affect the net welfare outcome.

The areas of regions B and E are calculated together. They represent the change in import levels between the free trade and tariff regimes multiplied by the change in prices between the free trade and tariff regimes. I calculate the area of these regions together because I am not able to tell how much of the difference in quantity between the tariff and free trade regimes is represented by the distance between \( S_1 \) and \( S_2 \), versus how much of the difference in import quantities is represented by the distance between \( S_0 \) and \( S_{FT} \). In other words, I do not know the slopes of either the supply or demand curve. However, this does not matter because, with the linear

<table>
<thead>
<tr>
<th>Region</th>
<th>Formula</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Not Calculated</td>
<td>Consumer Surplus Loss, Producer Surplus Gain</td>
</tr>
<tr>
<td>C</td>
<td>((P_T - P_W)(S_C - S_2))</td>
<td>Consumer Surplus Loss, Government Surplus Gain</td>
</tr>
<tr>
<td>D</td>
<td>((P_T - P_W)(S_T - S_C))</td>
<td>Consumer Surplus Loss</td>
</tr>
<tr>
<td>B+E</td>
<td>((P_T - P_W)((S_{FT} - S_1) - (S_T - S_2)))</td>
<td>Consumer Surplus Loss</td>
</tr>
<tr>
<td>F</td>
<td>((S_C - S_2)(P_T - P_W) - (S_C - S_2)(P_T - P_W))</td>
<td>Government Surplus Gain</td>
</tr>
</tbody>
</table>
welfare model I am using, I am able to calculate the area of B+E without ever knowing the areas of B or E individually. In addition to this, both of these regions represent the same welfare effect, a loss in consumer surplus. Therefore, to calculate the area of region B+E, I multiply the change in import quantity resulting from the tariff, \((S_{FT} - S_1) - (S_{FT} - S_2)\), by the change in price resulting from the tariff \((P_T - P_W)\). These regions represent a consumer surplus loss from a decrease in the quantity of lumber consumed and will negatively affect the net welfare outcome.

I calculate the area of region F by finding the total government revenue from the tariff duty, \((S_C - S_2) \times (P_T - P_*)\), and subtracting that portion of this revenue already calculated in region C, \((S_C - S_2) \times (P_T - P_W)\). Though this is not the most elegant way to make this calculation, in practice it is fairly simple. This region represents a government surplus gain from the tariff duty revenues. It will positively affect the net welfare outcome.

The net welfare outcome for the U.S. is found by subtracting the consumer losses represented by regions D, B, and E, from the government surplus gain represented by region F.

8.4 Welfare Results

My results for the welfare calculation are displayed in Table 6. As expected, the government surplus change resulting from the tariff is positive from collecting tariff duties, and the consumer surplus change is negative as a result of increased prices and decreased consumption. Note that the consumer surplus loss displayed in Table 6 is only part of the total consumer surplus loss. There is a large
consumer surplus loss represented by Region A that is not included in this figure. The actual consumer surplus loss is likely to be at least twice as large as the figure reported in Table 6. Also note that I do not include the large producer surplus gain represented by region A.

Table 6: Welfare Results Without Controlling for Trade Diversion

<table>
<thead>
<tr>
<th></th>
<th>Net Welfare</th>
<th>Consumer Surplus</th>
<th>Government Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Projected</td>
<td>Calculated</td>
<td>Projected</td>
</tr>
<tr>
<td></td>
<td>Change</td>
<td>Actual Change</td>
<td>Change</td>
</tr>
<tr>
<td>Pre-Tariff Total</td>
<td>-424,297</td>
<td>-350,641</td>
<td>-516,209</td>
</tr>
<tr>
<td>(2001 IV-2002 II)</td>
<td></td>
<td></td>
<td>-472,703</td>
</tr>
<tr>
<td>Post-Tariff Total</td>
<td>473,507</td>
<td>298,708</td>
<td>-890,378</td>
</tr>
<tr>
<td>(2002 IV-2003 III)</td>
<td></td>
<td></td>
<td>-938,239</td>
</tr>
<tr>
<td>Total</td>
<td><strong>49,210</strong></td>
<td><strong>-51,933</strong></td>
<td>1,406,587</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,410,942</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,455,797</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,359,009</td>
</tr>
</tbody>
</table>

Another point to note about the data in Table 6 is that welfare results are displayed for pre- and post-tariff time periods. I calculate welfare values for both pre- and post-tariff time periods because, as I discussed before, the tariff has an effect on the market prior to the tariff duty becoming payable. The fact that the tariff affects the market before duties are actually in place explains why we see consumer surplus losses in the last quarter of 2001 and the first quarter of 2002, while the government receives no revenues. In the second quarter of 2002, near the end of May, the duties come into force, so the government only receives revenues for one third of the
imports of this quarter. This probably slightly overestimates the government revenues for this month because there are likely to be more imports before the duties are applied than after; however, this effect is not likely to be significant in the overall calculation.

These calculations give us some insight into the kind of welfare effects we can expect from an AD/CV tariff. It is particularly interesting that the projected net welfare effect of the tariff is slightly positive, while the calculated actual welfare effect is negative. However, these results are relatively close together given the billion dollar sizes of the surplus shifts causing them. This suggests that the PSC does a reasonably good job projecting the welfare effects of the tariff.

The key fact to come from the results in Table 6 is that, because total surplus change that occurs following the imposition of the duty is positive for both measures, the net welfare gain for the U.S. will grow as the length of the tariff increases with all other factors remaining unchanged. The prediction that the antidumping tariff could have a positive net welfare effect contradicts the traditional view that free trade is the first best option in trade policy. As the findings below show, the possibility of positive net welfare resulting from an antidumping or countervailing tariff depends largely on the level of trade diversion.

8.5 Welfare Results Controlling for Trade Diversion

To compare how trade diversion affects welfare levels, I have calculated a second set of welfare results that do not include trade diversion. To do this I use the price and Canadian import quantity estimates from (5) and (6), in place of the estimates from (3) and
(4) used in the last section. I also use the overseas import levels estimated by (7) when no tariff is present. Otherwise, the methods used for these calculations are exactly the same as those used before.

The welfare results that would occur without trade diversion are displayed in Table 7. These results differ significantly from those calculated with trade diversion included. Without trade diversion, the net welfare results are always negative, because the shift in domestic prices is much larger than it was without trade diversion.

<table>
<thead>
<tr>
<th>Table 7: Welfare Results Controlling for Trade Diversion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Welfare</strong></td>
</tr>
<tr>
<td>Projected Change</td>
</tr>
<tr>
<td>Pre-Tariff Total (2001 IV-2002 II)</td>
</tr>
<tr>
<td>Post-Tariff Total (2002 IV-2003 III)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>
When I control for trade diversion, the PSC and CASC calculations both show that, without trade diversion, net welfare could decrease over one billion dollars in only six quarters. In addition, over time, the losses resulting from a tariff with no trade diversion present could continue to increase at a high rate. These welfare results reinforce the conclusion that trade diversion is a key determinant of the size and welfare effects of a tariff.

Consumers are big losers whether trade diversion occurs or not. Without including the consumer surplus loss from region A, the first model still estimates a consumer welfare loss of over one billion dollars using either the PSC or CASC methods. Without trade diversion, the consumer surplus loss could have exceeded two and a half billion dollars. The consumer surplus loss from region A is likely to be even larger than these values since imports account for only about 34% of total U.S. lumber consumption (American Consumers for Affordable Homes 2004).

The government, on the other hand, has gained significant revenues. My predictions for government revenues place them at around 1.3 billion dollars for the six quarters in question. This figure seems large but is corroborated by recent news reports. American Consumers for Affordable Homes (ACAH, 2004) reported on Jan. 20, 2004 that the U.S. government had collected approximately $2 billion in import duties. Canada’s CBC news reported on December 8, 2003 that the U.S. had collected around $1.6 Billion dollars of import duties from Canadian firms. Both of these figures are similar to my findings.

8.6 Implications
Now that we have seen that antidumping tariffs can have a positive net welfare effect, why not use them more frequently? There are many factors that make the decision to use an antidumping tariff more complex than the simple welfare analysis that I have done.

The key factor affecting the welfare implications of future antidumping tariffs is whether and to what extent trade diversion is likely to occur. In the softwood lumber case, overseas imports increased significantly in response to the fall in Canadian imports; that outcome may not happen in all industries. I will discuss factors that may increase the probability of trade diversion occurring, and the size of this diversion briefly, and leave a complete analysis for future research.

One reason that the softwood lumber market may have had a propensity for a large trade diversion effect is that the overseas import market was relatively underdeveloped. One indicator of this is the difference in the price elasticity of exports to the U.S. between Canadian and overseas exporters. I find that a one-percent change in U.S. prices corresponds to a 20% change in Canadian exports to the U.S. The same one-percent U.S. price increase corresponds to a 47% increase in overseas imports to the U.S. The fact that the price elasticity of overseas exports to the U.S. is twice that of Canadian exports to the U.S. suggests that price increases allow overseas imports to take advantage of economies of scale in production and shipment that Canadian importers are already taking full advantage of. This is one factor that may allow the trade diversion effect to be larger. In industries with a mature U.S. export market, in which all or most countries are taking advantage of economies of scale, trade diversion may not be as large. The high price elasticity of overseas imports also tells us that these importers have the ability to increase their imports to the U.S. rapidly. This may
not be true in all cases. One lesson to take from this analysis is that trade diversion may be more likely if the price elasticity of imports from those countries not named in the tariff is high and/or significantly larger than that of the named countries.

The number of countries facing the tariff and their share of imports is also likely to influence the size of the trade diversion effect. This could occur through several means. First, if most or all of the importers are named, then the others may not have the capacity to increase their imports significantly or rapidly. In the case of softwood lumber, the tariff was applied only to Canada, though it comprised a large share of imports. This left many other countries, some of which had the ability to increase their imports quickly, free of tariff barriers. Second, if many countries are named, or if non-named countries have import levels of a similar size to some named countries, it may cause concern amongst non-named countries that an increase in their imports may cause them to become the target of a future antidumping case. Studies done by Ethier and Fischer (1987), Fisher (1992), and Reitzes (1993) use duopoly games to study the way firms may alter their behavior to avoid an antidumping determination in an oligopolistic market. They find that, given the right market conditions, foreign exporters may lower their exports to raise prices and decrease the probability that they will be found guilty of dumping. In this respect, the softwood lumber case was an ideal situation to encourage trade diversion. Only Canada was named in the antidumping tariff, and the fact that no other importing country was even close to Canada in import volume meant that it was relatively unlikely that they would become the target of another antidumping investigation.

Transportation costs are another factor that should be taken into account when trade diversion calculations are made. Higher transport costs may reduce trade diversion by decreasing the relative productivity of more distant producers. My analysis shows that,
when the tariff is applied, trade diversion eliminates all but 12 percent of the increase in U.S. prices. The 12% increase in U.S. prices that remained following the increase in foreign imports can be interpreted as a measure of the difference in productivity between Canadian and overseas producers. Much of this productivity difference is probably due to transportation costs, which are known to be relatively high in the softwood lumber industry. One reason transportation costs are likely to cause a significant part of the productivity gap between Canadian and overseas producers is that many of the other factors of production, such as technology, are transferable between countries. Also, wage levels are lower in other importing countries, such as Brazil, than they are in Canada. If transportation costs were lower in this industry, it is likely that trade diversion would have been larger, eliminating more of the tariff’s effect on U.S. prices.

It is apparent that the softwood lumber industry has several characteristics that encourage a high level of trade diversion, as well as a few that make it less likely. If these trade diversion increasing factors are not present in other industries, there may be more damaging results when a tariff is introduced.

9. Robustness Tests

To check the robustness of the results above I rerun the Gravity Equation with a variety of different specifications. In the first set of regressions, displayed in Appendix A, I run an equation in which I substitute Canadian GDP in for housing starts, and then an equation in which I substitute U.S. housing starts in for U.S. GDP. The equation that includes both GDP terms estimates a slightly
larger tariff effect, while that with only housing start terms estimates a lower tariff effect. Both of them find trade diversion to be significant and the SLA to have minimal trade effects. My results from (3), (4), (5), and (6) fit in between these results, and all of these results show similar trends.

In Appendix B I run a set of regressions in which I use U.S. and Canadian lumber production levels (overall lumber production, not just softwood) instead of GDP or housing starts. These regressions estimate the tariff and trade diversion effects to be slightly larger than my basic results for prices and slightly smaller for quantities. They also estimate the SLA effects to be small and statistically insignificant. Overall, the production regression results are similar to my basic results. Furthermore, they suggest that my basic results may actually be conservative estimates.

I also run equations (3) through (6) with exchange rates included, which can be seen in Appendix C. The inclusion of exchange rates does not alter the estimated effects, nor does it significantly increase the R-squared of the equations.

In Appendix D I show the results that occur when I run equations (3) through (6) with transportation costs included. Though transportation costs are interesting, I decided not to include them in equations (3) through (6) initially, for two reasons. First, as Appendix D shows, they do not seem to add anything to the estimation results, other than slightly increasing the R-squared term. Second, I am wary of including transport costs in my basic regression because the data does not seem to be completely accurate, even though it was obtained from the U.S. Customs Service. Overall, all of these robustness tests verify my original results.
10. Conclusions

This paper has shown the market effects of two different kinds of country-specific trade policies, and how these effects are influenced by a multitude of factors. The SLA appears to result in a small increase in U.S. prices but, due to the way quotas are allocated, it increases Canadian imports. In this paper I argue that the incentives put in place by the quota allocation method can have an important effect on market outcomes and thus welfare results. When nations draft future trade policies like the SLA, they will do well to pay attention to the incentives created by the quota allocation structure.

The AD/CV tariff caused an increase in U.S. prices and a large decrease in Canadian lumber shipments to the U.S. In addition, we see that there is a large increase in overseas lumber shipments to the U.S. Analysis suggests that the size of this trade diversion effect is the crucial determinant of the overall market effects of the tariff. With the trade diversion present, we see a 12% increase in U.S. prices, whereas when we remove the trade diversion effect, we project the increase in U.S. prices to be 27%, almost the full tariff level. A difference between the effect of the tariff on prices with and without trade diversion means that different levels of trade diversion can lead to very different welfare implications. With trade diversion, net U.S. welfare is nearly the same as with free trade, whereas when I control for trade diversion, I project that net welfare losses could be in the billions of dollars.

These results highlight the importance of trade diversion when considering the welfare effects of a trade policy. This paper also discusses reasons why this trade diversion effect might be so pronounced in the softwood lumber market. The considerable difference between the Canadian and overseas import price elasticities is one factor that should be noted. This, together with the relative sizes of
these two trade flows, signals that the overseas exports are an underdeveloped trade relationship and have not yet been able to take full advantage of economies of scale. Thus, when the tariff was put in place, overseas exports grew significantly. If this had not been the case, this tariff could have been much more costly.

There are also factors that could limit trade diversion in an industry and lead to worse net welfare outcomes. High transport costs and other factors that may cause producers in countries not named in the tariff to have higher marginal costs than those named in the tariff will limit the amount of trade diversion. I argue that, in the softwood lumber industry, the 12% increase in U.S. prices resulting from the tariff can be interpreted as a measure of the difference between the marginal cost of Canadian versus overseas producers. Much of this difference is likely to come from the high transportation costs in the softwood lumber industry. Another factor that may limit trade diversion levels is the number of countries named in the tariff. If most or all major exporters of a product are named in an AD tariff, then trade diversion is likely to be lower.

My results suggest that certain AD and CV tariffs may, under the right conditions, increase domestic welfare. Yet there is more to consider when determining whether a tariff is desirable. For instance, the static analysis that I have undertaken will miss important dynamic effects. One of the dynamic effects commonly sighted as the reason for an AD or CV tariff is that by giving domestic producers short-term protection, they can be made more competitive in the long term. That the U.S. producers have gained substantially in the short run is clear, but it is not as clear that the tariff has made them more competitive in the long run. U.S. lumber
production does not appear to increase as a result of the tariff, an outcome I would expect to occur if the industry were becoming more competitive.

Another possibility is that, rather than desiring the protection of the AD/CV tariff until they become competitive, U.S. producers were more interested in taking advantage of the short term gains afforded by the tariff. The significant size of the gains from protection in an industry such as softwood lumber creates strong incentives for producers to spend money lobbying to get a tariff put in place. Because of these gains, the existence of the tariff is certain to create unproductive rent seeking activities by the producers in the form of lobbying, advertising, etc. Bagwati (2002) cites these efforts, which he calls Directly Unproductive Profit Seeking (DUPS), as a strong argument in favor of free trade as a first best policy.

The large redistribution of surplus caused by an AC/CV tariff is another reason to be cautious with the use of tariffs. I find that consumers suffer massive surplus loss, while producers and the government gain. This large redistribution is not efficient nor is it necessarily socially desirable. In addition, the large gains felt by the government and producers may lead to misuse of tariffs. The large short-term gains from a tariff may create incentives that lead to long-term losses. For instance, protection reduces competition, which, in a mature industry, may decrease the long-term competitiveness of the domestic industry. Thus, the short-term gains possible with some tariffs create incentives that may lead to long-term losses that far outweigh the short-term gains.

A final reason for caution in tariff use is the possibility of enormous net welfare losses in cases where trade diversion levels are low. I show that net U.S. welfare losses in the softwood lumber industry could be over $1 billion in a span of only 6 quarters.
The results that I show in this paper suggest that a couple of policy changes could improve the current trade policy system. Under the SLA, my results suggest that when drafting VER agreements, the quota allocation method used by the foreign government can play an important role in the results of the VER. In particular, if the quotas are allocated freely and based upon previous quota utilization, then the trade restrictive effects of the VER will decrease.

For AD/CV tariffs, one policy change that could be beneficial is to increase the time it takes to undertake a tariff investigation, particularly the time between the preliminary and final determination. This increases the initial negative welfare effects of the tariff during the period between the preliminary and final determination. Why increase the initial negative welfare effects of the tariff? The reason is that a larger initial welfare loss will make it less likely for policymakers to enact a tariff in order to secure the short-term benefits that my results show some AD/CV tariffs can produce. Instead, policymakers will be more wary in their application of AD/CV tariffs, implementing only those that can lead to long-term welfare gains.

A second policy step that could minimize the negative welfare effects of a tariff is undertaking a simple welfare analysis, similar to the one I have undertaken in this paper, prior to the implementation of the tariff. Currently, the welfare effects of a tariff are not taken into account by the agencies that enact AD and CV tariffs. Adding a welfare effects estimate will allow them to make more informed decisions about tariffs.

Third, the negative effects of tariffs can be decreased by making the investigation and determination process as simple and straightforward as possible. This would decrease the incentives for firms to spend resources on unproductive rent seeking activity.
Finally, my results suggest that caution and restraint should be used in any decision regarding an AD/CV tariff. Though I have shown that the tariff can result in outcomes similar to free trade for the country applying them, there is also the possibility of the tariff resulting in large welfare losses. In addition, the redistribution of surplus that always results from a tariff is enormous.

11. References


### Appendix A- Regressions with Canadian GDP or US Housing Starts

#### Prices

<table>
<thead>
<tr>
<th>Regression of Ln Price on:</th>
<th>With Trade Diversion</th>
<th>Without Trade Diversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a_1 + a_2 \text{ Ln GDPus} + a_3 \text{ Ln GDPcan} + a_4 \text{ SLAdum} + a_5 \text{TARdum} + e)</td>
<td>0.2</td>
<td>0.2</td>
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<tr>
<td>(a_1 + a_2 \text{ Ln HSus} + a_3 \text{ Ln HScan} + a_4 \text{ SLAdum} + a_5 \text{TARdum} + e)</td>
<td>0.08</td>
<td>0.05</td>
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#### Quantities

<table>
<thead>
<tr>
<th>Regression of Ln Canadian Import Quantity on:</th>
<th>With Trade Diversion</th>
<th>Without Trade Diversion</th>
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</thead>
<tbody>
<tr>
<td>(a_1 + a_2 \text{ Ln GDPus} + a_3 \text{ Ln GDPcan} + a_4 \text{ SLAdum} + a_5 \text{TARdum} + e)</td>
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<td>-0.37</td>
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<td>(a_1 + a_2 \text{ Ln HSus} + a_3 \text{ Ln HScan} + a_4 \text{ SLAdum} + a_5 \text{TARdum} + e)</td>
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## Appendix B- Production Regressions

### Prices

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<tr>
<th>Regression of Ln Price on:</th>
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<th>TAR P-value</th>
<th>SLA P-value</th>
<th>With Trade Diversion</th>
<th>R Square</th>
<th>TAR P-value</th>
<th>SLA P-value</th>
<th>Without Trade Diversion</th>
<th>R Square</th>
<th>TAR P-value</th>
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<td>( a_1 + a_2 \ln \text{PRODus} + a_3 \ln \text{PRODcan} + a_4 \text{SLAdum} + a_5 \text{TARdum} + e )</td>
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<td>0.007</td>
<td>0.91</td>
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<td>( a_1 + a_2 \ln \text{PRODus} + a_3 \ln \text{PRODcan} + a_4 \ln \text{ER} + a_5 \text{SLAdum} + a_6 \text{TARdum} + e )</td>
<td>0.15</td>
<td>0.21</td>
<td>0.06</td>
<td>0.02</td>
<td>0.75</td>
<td>0.19</td>
<td>0.34</td>
<td>0.01</td>
<td>0.84</td>
<td>0.34</td>
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### Quantities

<table>
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<th>SLA P-value</th>
<th>With Trade Diversion</th>
<th>R Square</th>
<th>TAR P-value</th>
<th>SLA P-value</th>
<th>Without Trade Diversion</th>
<th>R Square</th>
<th>TAR P-value</th>
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### Appendix C - Exchange Rate Regressions

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<tr>
<td></td>
<td>R Square</td>
<td>TAR</td>
</tr>
<tr>
<td>a1+a2 Ln GDPus + a3 Ln GDPcan + a4 Ln ER + a5 SLAdum + a6 TARdum + e</td>
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#### Quantities

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### Appendix D- Transportation Cost Regressions

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<th>R Square</th>
<th>TAR P-value</th>
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#### Quantities

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<th>SLA P-value</th>
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<th>SLA P-value</th>
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<tr>
<td>$a_1 + a_2 \ln GDP_{us} + a_3 \ln HScan + a_4 \ln Tran + a_5 SLA_{dum} + a_6 TAR_{dum} + e$</td>
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<td>-0.36</td>
<td>0.005</td>
<td>0.07</td>
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