Assessing Anticipatory Effects in the Presence of Antidumping Duties: Canadian Softwood Lumber*

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Abstract

Firms subject to AD duties face with uncertainty about ultimate AD duties at the time of export because a US government agency can recalculate the AD duties in ex post administrative reviews based on most recent exporters' pricing. Although AD duties are simple ad valorem tariffs on the surface, the firms' behavior under AD duties would be different from that under standard tariffs because of the presence of the administrative reviews: importers set their volume of imports according to their anticipation on the ultimate AD duties, while exporters set their price anticipating the effects of their pricing on the ultimate AD duties. This paper examines US–Canada softwood lumber disputes to assess these importers' and exporters' anticipation. Focusing on differences in the importers' and exporters' behavior between standard tariffs and AD duties, we find evidence on the effects of importers' and exporters' anticipation: importers' demand was less sensitive to tariff rates for a certain periods of AD duties, while exporters set their prices higher under AD duties. The results indicate the trade-off of AD duties on US market prices: the importers' anticipation induced larger imports and hence decreased US market prices, while the exporters' anticipation increased export prices for the purpose of reducing the ultimate AD duties and hence increased the US market prices.

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1 Introduction

Antidumping (AD) duties are levied when a foreign firm is found to price in their export market below "normal" value for the product, and cause material injury to domestic firms. An AD duty is supposed to be equal to the calculated dumping margin, i.e., the difference between the normal value and the export price of the product, and thus protecting domestic industries against dumping behavior. Although AD duties are simple ad valorem tariffs on the surface, firm behavior under AD duties would be different from that under standard tariffs because of a unique institutional structure in US AD law, known as administrative reviews. After the AD duty is imposed, the US Department of Commerce (USDOC) initiates an administrative review each year upon the request of investigated foreign parties, and recalculates ultimate AD duty using transactions from the 12 months immediately preceding the administrative review request. If a review determines that the margin during the review period differs from the previous margin used as a basis for the importers' cash deposit, a refund (or bill) in the amount of the difference plus interest is rebated (or charged).

Because of this feature of AD duties, exporters and importers face with uncertainty about ultimate AD duties, and thus their behaviors should be subject to their anticipation on the ultimate AD duties. On the one hand, importers set their volume of imports according to their anticipation on the ultimate AD duties; for example, if importers anticipate refund in an ex post administrative review, import demand would be less sensitive to AD duties determined initially. On the other hand, exporters set their prices according to their anticipation on the effects of their pricing on the ultimate AD duties; in particular, they set their prices higher for the purpose of the reduction in the ultimate AD duties which would affect the import demand through the evolution of the importers' anticipation.

This paper studies the anticipatory effects on exporters' and importers' behavior. To assess these anticipatory effects, we examine US–Canada softwood lumber disputes. The softwood lumber dispute between the US and Canada is known as one of the longest trade disputes in history; it dates back to the time of the Great Depression, and has involved

extensive litigation in the US, the NAFTA, and the WTO over subsidization and dumping. As a result, the Canadian softwood lumber industry has been faced with various forms of trade policies in its history. This feature of the softwood lumber are helpful in assessing the effects of AD duties because we can compare the outcome of the trade policy different from AD duties. In this paper, we study two forms of trade policies: standard tariffs under the five-year Softwood Lumber Agreement (SLA) in 1996[1] and antidumping (AD) duties from 2002 to 2006.[2]

Using a panel data with disaggregated lumber products at eight-digit Harmonized Tariff Schedule (HTS) level, we employ a demand estimation technique to reveal the importers' anticipation on an ultimate AD duty. Based on the demand estimation results, we find the evidence of importers' anticipation: importers anticipated significant reduction of the ultimate AD duty rate a few years after the introduction of the AD duties, although importers anticipated little reduction of ultimate AD duty rate soon after the introduction of the AD duties. This paper further shows that the importers were likely to modify their anticipation on the ultimate AD duties adaptively in the sense that they adjust their anticipation according to the revised D duty rate released in the determination of the administrative reviews. With respect to the exporters' anticipation, we implement a pass-through regression in which export prices are dependent variable and assess whether exporters set their prices higher under AD duties compared to the standard tariffs. To identify the pass-through effects, we use the variation in tariff rates accidentally generated in the US–Canada softwood lumber case. Given the same rate of standard tariffs and AD duties, this paper finds that exporters set their prices higher under AD duties than standard tariffs, and thus shows the evidence of the exporters' anticipation.

The anticipatory effects in the presence of AD duties have been studied in AD litera-

[1]To be precise, Canadian exporters were subject to tariff-rate-quota, not just standard tariffs, from 1996. However, because the level of the quota was small compared with the total Canadian exports during SLA, Canadian exporters should set their prices at a marginal cost equal to marginal production cost plus the tariffs; therefore, we regard the tariff-rate-quota as standard tariffs.

[2]Countervailing duties (CVD) were simultaneously imposed from 2002 to 2006. We discuss about the CVD in the following section.

ture. Blonigen and Park (2004) examine the effects of the likelihood of AD settlement on exporters' pricing and show that exporters set their prices higher as the likelihood of future AD settlement increases in an industry they belong. The result supports the presence of the exporters' anticipation, i.e. changes in exporters' pricing in order to reduce ultimate AD duties.[3] Since the administrative reviews affect exporters' pricing behavior, firms' response to an exchange rate movement should be different under AD duties. Blonigen and Haynes (2002) study the case of US-Canada AD case and show the evidence of structural change in exchange rate pass-through coefficient before and after the imposition of AD duties.

On the other hand, although the AD literature has not indicated the effects of importers' anticipation under AD duties explicitly, the strands of literature suggests the importance of importers' anticipation under AD duties. Recently, Kelly (2010) and Blonigen and Haynes (2010) correctly assesses reference prices on the determination on AD margin and indicates that US market prices are subject to ultimate AD duties determined in ex post administrative reviews. Although these studies do not indicate the role of importers' anticipation explicitly, as Blonigen (2006) and Irwin (2009) point out, USDOC has considerable discretion on the determination of AD margin in the administrative reviews and thus importers should be difficult to predict ultimate AD duties correctly. Therefore, the importers' anticipation should affect market outcomes. Moreover, as discussed in Kelly (2010) and Blonigen and Haynes (2010), the importers' anticipation plays an important role in the analyses of tariff pass-through into US market prices, especially when we use the data of export prices (export unit value[4]) that is frequently used in the pass-through literature. In the pass-through analysis, we usually set the measure of US market prices as a dependent variable. When using the data of the export prices, we compute US market prices by adding tariffs to export prices. The construction of dependent variable is valid in the case of a standard tariff[5] because

[3]Other than AD duties, Anderson (1992) investigates the exporters' anticipation regarding voluntary export restraint (VER) policy: the paper shows that under certain conditions, exporters have incentives to do dumping in order to increase their export licenses which may results in so called domino dumping because of a rise in ex ante competition among exporters to obtain more export licenses.

[4]Values of exports/number of exports

[5]We here assume that the importers are in perfectly competition.

the importers can not avoid the tariff payment. However, the importers take account of the future refund of an AD duty in setting the volume of imports, and thus a US market prices is not necessarily an export price plus the AD duty initially set by USDOC. For example, if the importers anticipate future refund, US market prices should be less than export prices plus AD duties. Therefore, without eliminating the effects of importers' anticipation, we cannot assess the impacts of AD duties on the US market prices.

This paper primary contributes to the literature by providing an evidence on the importers' and exporters' anticipation. In particular, this paper reveals the way to eliminate the importers' anticipation and thus makes it possible to analyze the effects of AD duties on US market prices by using export price data. This paper shows that the average impacts of AD duties on the US market prices is similar that of standard tariffs, despite the evidence of the anticipatory effects. This is because the exporters' anticipation increase the US market prices, while the importers' anticipation on future refund decrease the US market prices. Therefore, the effects on the US market prices are offset by these two anticipatory effects. However, when we look at the difference of the policies on period-by-period basis, there is a difference in pass-though between these policies: in the early stages of the AD periods, from May 2002 to March 2004, the pass-through of AD duties was higher than that of standard tariffs, while it is lower in the latter stages, from Apr. 2004 to Mar. 2006.

In addition to the contribution mentioned before, we make the following contributions to the literature on AD duties. First, we assess the impacts of anticipatory effects on welfare. As we mentioned, since the effects of AD duties on the US market prices are similar to that of standard tariffs, there are little difference between the policies for overall AD periods. However, the welfare costs are different from period to period, and in particular, the welfare costs of AD duty was huge, about 177% of the standard tariffs at the early stages, while they are offset by reduction in welfare costs at the latter stages. In the previous study of the welfare cost of AD duty, Gallaway, Blonigen, and Flynn (1999) quantify the US AD and countervailing duty (CVD) order in 1993, and show that US consumer suffered by the

amount of 4 billion US dollars (USD) from AD and CVD without accounting the role of anticipatory effects. The contribution of this paper is to reveal the cost of AD duty taking the role of anticipatory effects into account. Note that, in terms of quantitative assessment of trade policies based on structural econometric models, this paper in line with the previous studies such as Berry, Levinsohn, and Pakes (1999), Goldberg and Verboven (2001), Friberg and Ganslandt (2006), Clerides (2008), and Kitano (2011).

Second, we incorporate the demand estimation techniques in the pass-through regression in order to disentangle the effect of unobserved demand shocks. The importance of unobserved demand shocks is indicated in the literature on demand models, such as Berry, Levinsohn, and Pakes (1995), Bajari and Benkard (2005a) and Goolsbee and Petrin (2004), and that on hedonic analysis, Bajari and Benkard (2005b). In this paper, we develop the reduced form pass-through regression taking account of the effect of unobserved demand shocks similar to Goolsbee and Petrin (2004) that incorporate the unobserved demand shocks (or characteristics) in the estimation of an equilibrium pricing equation.

The organization of the paper is as follows. The next section describes the US-Canada softwood lumber disputes. It also discusses the institutional features of trade remedy policies in the US. The description in Section 2 has a direct bearing on the formulation of empirical strategies and the interpretation of quantitative results in the subsequent analyses of this paper. Section 3 introduces the simple theoretical model of dynamic pricing, and Section 4 introduces an estimation model. Section 5 presents estimation results and based on the results, Section 6 analyzes the effects of the anticipation on the US market prices and welfare. Section 7 concludes, followed by Data Appendix.

2 Background: US Trade Remedies on Softwood Lumber

Lumber refers to wood products cut on all four sides to some particular length, including wood produced from trees such as pine, spruce, fir, and cedar. Softwood lumber is one of Canada's largest exports to the US, with 21.5 billion board feet of lumber shipped in 2005 alone. Indeed, Canada now supplies over a third of the US consumption of this product. Those exports were worth $8.5 billion, comprising an important element of the largest trading relationship in the world (Random Lengths, 2006). In 2005, imports of softwood lumber from Canada totaled US$7.01 billion, accounting for approximately 3% of trade between the two countries. Canadian producers are normally required to pay a stumpage fee in order to obtain a right to harvest timber on crown lands, whose area covers a large part of forest in Canada. US lumber producers have claimed that this stumpage program function as a subsidy scheme for Canadian producers because it allows them to harvest the lumber at a much lower stumpage fee compared to that in the US. In the long history of softwood lumber disputes, the paper focuses on US-Canada trade disputes in the period from 1996 to 2006. In this section, we first summarize the important events associated with the US-Canada softwood lumber disputes during the periods. See also Figure 1 that summarizes the events during the periods of this study in the US-Canada softwood lumber disputes. We then move to Section 2.2 and provide an overview of US trade remedy investigation procedures.

2.1 US – Canada Softwood Lumber Disputes, 1996 to 2006

We here introduce the chronology of events from 1996 to 2006. Figure 1 summarizes the important events occurred during the time periods. We first explain Softwood Lumber Agreement (SLA) from April 1996 to March 2001, and then explain AD and CVD after the SLA.

2.1.1 Softwood Lumber Agreement (from 1996 to 2001)

The US and Canadian governments reached an agreement, called Softwood Lumber Agreement(SLA), on the restriction of Canadian softwood lumber exports in 1996. The SLA was effective from April 1996 to March 2001, and under the agreement, Canadian producers residing in the four provinces, Alberta, British Columbia, Ontario and Quebec, could export 14.7 billion board feet of softwood lumber without a fee, and an additional 0.65 billion board feet of exports were subject to a fee of 50 USD per thousand board feet. Amounts in excess of 15.35 billion board feet were subject to a fee of 100 USD per thousand board feet.[6]

The fee schedule was modified on several occasions during the SLA periods. Figure 2 shows average tariff rates, measured as the ratio of the tariffs to average export prices of the softwood lumber products. As shown in the figure, the fee levels were updated every year, and increased over the SLA period. In particular, the fee schedule changed significantly in 1999 when the SLA added "super fee" of 146.25 USD per thousand board feet for shipments exceeding 15.46 billion board feet.

Under the agreement, the Canadian government had right to collect the duty rather than the US. Note that the policy is the export taxes rather than the tariffs, but the effects of the fee on firms' behavior is identical to that of standard specific tariffs. Thus, the structure of this trade policy is identical to the tariff-rate-quota. We hereafter refer to the trade policy under the SLA as tariff-rate-quota.

2.1.2 Trade Remedies (from 2002 to 2006)

Investigation Period

Upon the termination of the five-year pact of SLA in 1996, a group of US producers filed petitions of AD and CVD against Canadian exports of softwood lumber. The USDOC and US International Trade Commission (USITC) began investigations in response to these petitions.

[6]One board foot is equal to a 1-inch thick board, 12 inches in width and 1 foot in length.

The USDOC and USITC have distinct roles in legal procedures regarding AD and CVD. The USDOC calculates the respective AD duty and CVD rate and also makes determination on retroactive collection of the AD duty and CVD. On the other hand, the USITC determines whether the corresponding US domestic industries had been materially injured by the import of products under investigation. As shown in the Figure 1, the USDOC and USITC each makes preliminary and final determinations for both AD and CVD investigations. AD and CVD follows the same procedure with slight differences in the duration of investigation taken before the preliminary and final determinations by the USITC and the USDOC.

In May 2001, USITC made the affirmative preliminary determination on both AD and CVD, and hence the legal process continued. The USDOC preliminary determination of CVD was released in August 2001 with a long delay from the schedule. The level of CVD in the preliminary determination was 19.3%, uniformly imposed on all Canadian provinces except for the Atlantic Canada. The preliminary determination of AD case was issued in October 2001. As many firms were involved in exporting softwood lumber to the US, the USDOC only investigated the dumping margins for the six largest companies in Canada, and imposed the weighted average of the investigated firm's margins on the other Canadian firms. The average margin was calculated as 12.6%.

AD and CVD laws rule that the duty can be collected retroactively from up to 90 days before the USITC determination of preliminary determination of positive injury. In the preliminary determination, the USDOC declared that the CVD be retroactive to May 19, which indicates that importers had to prepare the cash deposit to pay the CVD after May 19, and the duty would be actually collected if the final determination was also affirmative and retroactive. Contrary to the CVD determination, AD duty was not retroactive in the preliminary determination. Note that the threat of retroactive payment of the duties should affect importers' and exporters' behavior in the periods of investigation as Blonigen and Haynes (2002) point out. In particular, because of the discrepancy of the retroactive payments between the AD and CVD, they should account for the retroactive payment of the

CVD more seriously after the release of the preliminary determination.

The final AD and CVD determinations finally came out at the same time on May 22 of 2002, with affirmative determinations for both cases. Although the preliminary CVD determination was retroactive, the final determination ordered no retroactive for both AD and CVD duties. Therefore, the cash deposit prepared to pay the CVD during the investigation periods was not collected. The CVD was finalized at 18.79%, applied to the producers in Canadian provinces except for the Maritime Provinces, and the final average AD duty was 8.43%.

AD and CVD Gap Period

The unique aspect of the softwood lumber case is the presence of the AD and CVD gap period. In the softwood lumber case, the USDOC and USITC were obliged to issue the final determination within 180 (120) days after the preliminary determinations of AD (CVD) came out.[7] Otherwise, the US government would not be able to collect duty retroactively during the period from the date of termination to the issuance of final determination. This period is called "Gap" period.

The softwood lumber case began in 2001 and turned out to be fairly complicated; for example, the petitions from US producers and the replies from Canadian producers totaled over 265,000 pages, which made it difficult to issue the final determination within the scheduled timeframe. More importantly, the incident occurred in September the 11th added another factor contributing to the delay. Accordingly, the preliminary CVD determination was expired on December 15, 2001 and the preliminary AD determination expired on May 5 of the next year. Note that in general, the threat of retroactive payments should have influence on the behavior of importers and exporters involving AD and CVD process; however, during the Gap periods, they are free from the threat and hence should behaved as in free trade.

[7]The number of days within which the USDOC and USITC are obliged to issue the final determination depends on whether the AD(CVD) investigation is a complicated case or not. See Appendix B of *Antidumping and Countervailing Duty Handbook* published by ITC (available at `http://www.usitc.gov/trade_remedy/documents/handbook.pdf`), for the statutory timetables for AD and CVD investigations.

Administrative Reviews

Once the AD and CVD were finalized and applied to a product, the importers of Canadian softwood lumber paid US Customs a cash deposit equal to the ad valorem AD and CVD duties times the value of the subject product. This cash deposit did not necessarily represent the final amount of duties to be assessed on softwood lumber imported from Canada because the importers could obtain the refund in subsequent years through the process known as an administrative review.

Under the review, USDOC recalculates AD and CVD duty based on the level of subsidy and the dumping margin recalculated during the periods of trade remedies. The actual liability of importer may change in accordance with the difference between the ultimate duty and the initial duty determined in the investigation. As described in Blonigen and Haynes (2002), before 1984, the determination of the actual liability was assessed by automatic yearly administrative reviews by the USDOC. For the case under study, on the anniversary of the date when the final AD and CVD were issued, the USDOC asked for requests by interested parties for administrative reviews of AD and CVD. Requests came from previously investigated Canadian firms and Canadian government. Upon the receipt of the requests, the USDOC recalculated the AD duty and CVD rate. CVD was assessed presumably based on the amount of the government's subsidy provided through a stumpage fee, and the reassessment of AD duties was based on the information from the 12 months immediately preceding the administrative review request. If a review determined that dumping or subsidy margins differ from the previous margins used as a basis for the importers' cash deposit, a bill (or refund) equal to the amount of the difference plus interest is charged (or rebated). Note that CVD is based on a government subsidy, which is presumably outside the control of exporters' pricing decisions, while the dumping margin is not.

In the softwood lumber disputes under study, the data periods contains four AD periods when the AD duty rate could be revised through the administrative reviews: May 22, 2002 to March 31, 2003; April 1, 2003 to March 31, 2004; April 1, 2004 to March 31, 2005; and

April 1, 2005 to March 31, 2006.

The first period of the AD and CVD administrative review, which calculated the actual dumping margin and the level of subsidy from May 22, 2002 to March 31, 2003, started in June 2003 at the requests of Canadian exporter for AD and the government for CVD. The final determination by the USDOC was released on December 14, 2004 and finalized with a slight amendment in February 2005. The CVD was lowered from 18.8% to 16.4%, while the average AD rate was lowered from 8.4% to 3.8%. As a result, US government refunded the duty based on the difference between the initial and the ultimate duty rate. Similarly, the second administrative review, which calculated the actual dumping margin from April 1, 2003 to March 31, 2004, was finalized in January 2006. The CVD and average AD was further reduced to 8.7% and 2.1%, respectively. The third and fourth administrative reviews started in 2005 and 2006, respectively, and the preliminary determination of the third administrative review was released in May 2006, in which the CVD was increased slightly from 8.7% to 11.2%, and the AD duty was increased slightly from 2.1% to 3.5%. However, they were not finalized because the US and Canadian governments signed a new SLA in September 2006. Under the new SLA, Canadian exporters were refunded all the duty paid during the periods of trade remedies.

2.2 Calculation of Dumping Margin

While the CVD is calculated based on the amount of subsidies provided by the foreign government, an AD duty is basically computed based on firms' pricing decisions between US and an exporter's home market. To be more precise, the USDOC compares sales transactions that occurred in both US and an exporter's home market for the six months prior to the date when the petition is filed to determine both the preliminary and final AD duty. To compare the prices, the USDOC converts the investigated firm's home market price in foreign currency unit into the price in USD, using the bilateral exchange rate of the subject country at the time of the US transactions.

However, this kind of direct comparison of actual transaction prices in US and home market is not always applicable. In the case of softwood lumber, the USDOC faced with difficulty in using the actual transaction prices in Canada because of a large number of softwood producers in Canada selling a myriad of different products through hundreds of thousands of individual transactions and thus used the different measure of prices.[8] Instead, the USDOC employed constructed value method to obtain a measure in place of the home market prices.[9] Under the constructed value method, US government estimates the cost of production based on information provided by Canadian producers and add administrative expenses and a profit margin to the estimated cost. Note that the dumping margin then does not depend on exporters' pricing in their home market; rather the margin solely depends on the pricing to US market.

3 Anticipatory Effects in the Presence of AD Duties

In this section, we explain how the presence of the administrative review process affects the importers' and exporters' behavior. We analyze a vertical relationship between exporters and importers: exporters set their prices under monopolistic competition and importers purchase the exporters' products given the export prices, and sell them under perfect competition. We believe that this representation of the softwood lumber industry is reasonable because as documented in Leckey (2007), although there are a large number of mills that export the softwood lumber, there is still opportunity for each mill to differentiate its products by the level of quality and by the appearance of the lumber it produces. On the other hand, there is a much larger number of importers and hence they find it difficult to differentiate their products. Under this setting, importers decide the volume of imports after observing exporters' pricing, while exporters set their prices taking account of the importers response to the pricing.

[8]See *Federal Register* Vol.66, No.215, pp.55062.

[9]See Blonigen (2006) and Irwin (2009) for more detail on the calculation of the dumping margin.

We introduce the model in the presence of the AD duties to assess the importers' and exporters' anticipation. In the following model, we do not directly incorporate the presence of CVD because, as we will discuss in Section 3.3, the presence of CVD does not alter the qualitative implications in our model. Hereafter, we do not mention about CVD in the following analysis unless necessary.

3.1 Importers' Anticipation

Importers have to pay tariffs or AD duties set by the government. In the case of standard tariffs, the importers simply add the tariffs to the export prices and hence the vertical market structure reduces to a simple monopolistic competition model with tariffs. On the other hand, as discussed in Kelly (2010) and Blonigen and Haynes (2010), importers can obtain refunds through administrative review in the case of AD duties. Therefore, the volume of imports depends on an ultimate AD duty rate (an initial AD duty rate minus a refund rate) determined in the future administrative review. Then, the US market price in Canadian dollars (CAD) of product j is written as follows:

$$p_{kq} = \bar{p}_{kq}[(1+\tau) - r_q^I], \tag{1}$$

where $\bar{p}_{kq}$ is the export price of product k at time period q, τ is an ad valorem AD duty and r_q^I is an expected rate of refund at time period q. Note that τ and r_q^I are equal to zero under free trade and standard tariffs.

We assume that the importers' anticipation on a refund depends on the past, i.e., $r_q^I = E[r_q|\mathbf{r}_{-q}]$, where r_q is the refund rate determined in the future administrative review, and $\mathbf{r}_{-q}$ is the vector of refund rates released by the USDOC before time q. Under this assumption, the importers do not respond to the current pricing in deciding their volumes of imports. This assumption is based on Blonigen (2006), who indicates the difficulty in predicting the AD margin because of the US government's substantial discretion on the determination of

the AD margin. In addition, the recalculation of dumping margin in administrative reviews depends on the exporters' pricing not only in a particular market where an importer conducts transactions but also in other markets where it do not conduct transactions.[10] Due to this institutional feature of the calculation of the dumping margin, an importer that transacts with an exporter at higher export prices would be unable to obtain the refund because the other firms may import the the same product from the same exporter at lower prices. Therefore, importers are difficult to know what the exporters do currently across the market and thus they are unlikely to form their anticipation at the time of imports.

Note that importers do not have information on pricing to predict the refund rate at the time of importation, while exporters have more information because they know the information on prices for all transactions across the market. Therefore, exporters have advantages in predicting the future refund. In this model, we assume that the exporters' expectations depend on the current pricing not just the released refund rates $\mathbf{r}_{-q}$. In other words, the exporters do modify their anticipation based on the current pricing, while the importers do not.

3.2 Exporters' Anticipation

In the presence of importers' anticipation on the future refund, exporters decide their pricing taking account of the changes in the importers' anticipation according to their pricing. Then, the exporter's profit function in CAD units under AD duty can be written as follows.

$$\pi_k = \bar{p}_{kq} \cdot x_{kq}(e\bar{p}_{kq}[(1+\tau) - r_q^I]) - c(x_{kq}(e\bar{p}_{kq} \cdot [(1+\tau) - r_q^I])) + v^E(\bar{p}_{kq}) \tag{2}$$

where x is the demand for the good k at time q, e is the USD price of CAD, τ is the AD duty rate, and $v^E(\bar{p}_{kq})$ captures the dynamic incentives of exporters. Under the assumption made

[10] In particular, according to the practice known as "zeroing" in the determination of the AD rate, a firm-specific AD rate is the weighted average of these transactions-specific margins, treating transactions with negative dumping as zero dumping margins.

in the previous section, although the importers do not adjust their anticipation on the refund rate based on the current pricing, exporters take account of the revision of the importers' anticipation in the future that affects the future exporters' profits. Therefore, $v^E(\bar{p}_{kq})$ is an increasing function of the current price during the periods of AD duty, or $v^{E'} > 0$.

Note that we assume that pricing in Canada does not affect the calculation of the refund in the administrative review; instead, the refund is solely determined by the pricing in the US market. As is discussed in the previous section, the assumption is reasonable in the case of the AD duty on Canadian softwood lumber[11] because the USDOC computed the margin based on the constructed price method that uses an exporters' estimated cost of production instead of their pricing.

From the profit maximization problem, the price in the importers market is determined as follows:

$$\bar{p}_{kq} = \left(\frac{\eta}{1-\eta}\right)(c' + g(v^{E'})), \tag{3}$$

where

$$g(v^{E'}) \equiv \frac{v^{E'}}{\partial x/\partial p}. \tag{4}$$

η is the elasticity of demand, and c' is marginal cost. $g(\cdot)$ is a function of $v^{E'}$, which is positive in the presence of AD duty, and hence $g(v^{E'}) > 0$ because the derivative of the inverse demand function is negative. This pricing equation indicates that exporters set their prices higher under AD duties than those under standard tariffs because of the presence of the exporters' anticipation.

In the empirical analysis in the following section, we estimate the pass-through of AD duties, the percentage change in export prices resulting from 1% change in the AD duty rate. In particular, we compare the pass-through of AD duties with that of standard tariffs estimated from the SLA periods.

[11] See also the discussion in Blonigen and Park (2004) for the justification of the assumption.

3.3 Notes on the Model

The model introduced ignores some aspects of the US softwood lumber market during the periods of investigation. Before turning to the empirical analysis, we discuss how the gap between the model and practice affects the the analyses of the importers' and exporters' anticipation.

Role of CVD

So far, we have focused only on the role of AD duties in the importers' and exporters' anticipation. However, as is mentioned, the US government implemented not only the AD duties but also the CVD. Therefore, it is worth considering how the coexistence of CVD affects the outcome presented in the previous analyses.

Consider the importers' anticipation first. As explained in the previous section, CVD can also be recovered through administrative review; therefore, CVD also affects the importers' anticipation, similar to the AD. In the empirical analysis below, we simply use the measure of tariff rates that is AD duty rate plus CVD rate, and investigate the anticipation on the sum of the ultimate AD and CVD rate.

On the other hand, CVD does not affect the exporters' anticipation because the refund rate is out of the exporters' control; rather, the refund rate depends on the government policy on the subsidization. The coexistence of CVD and AD does not alter the structure the model: $v^E(\cdot)$ is still present because of the AD duties, even though the τ in the model is sum of AD and CVD duties rather than AD duty only. Therefore, CVD does not affect the qualitative implication of the model.

Comparison of the pass-through of AD duties and tariff-rate-quota under the SLA

This paper compares the pass-through of tariffs under the AD duties and tariff-rate-quotas under the SLA. With respect to this comparison, we have two problems. First, we focus on the trade policy during the periods of SLA that was tariff-rate-quotas rather than standard tariffs. Hence, the pass-through of tariffs under SLA might be different from that

of standard tariffs. The difference, however, does not matter because the quantity of exports during the periods of SLA was always exceeded the limit of quota: if the quantity of export exceeds the limit of quota, the marginal costs should be equal to marginal production cost plus the tariffs. As a result, the pricing equation derived from the tariff-rate-quota and standard tariffs becomes identical.

Second, we focus on the pass-through between the different forms of tariff policies: the Canadian exporters faced with ad valorem tariffs under the AD duties, while they faced with the specific tariffs under SLA. Therefore, the direct comparison between the pass-through of AD duty and standard tariffs may be problematic. As shown in Brander and Spencer (1984) and Helpman and Krugman (1989), the effects on price are usually different between ad valorem and specific tariffs under monopoly. Under ad valorem tariffs, the tariff size depends on the exporter's pricing, while it does not depend on their pricing under specific tariffs. As a result, the pass-through of ad valorem tariffs tends to be lower than that of specific tariffs because exporters have incentives to set their prices lower under ad valorem tariffs in order to reduce the tariff payment, while they do not have such incentives under specific tariffs.

Due to this problem, the difference in the pass-through between an AD duty and standard tariff tends to be lower. However, we can provide the evidence of the exporters' anticipation if we show the pass-through under the AD is larger than that under SLA, despite the underestimation of the difference in pass-through. In other words, we show the effect of the exporters' anticipation on the pass-through at the lower bound.

4 Empirical Specification

This section discusses an estimation approach used for us to examine how trade remedies affected the importers' and exporters' anticipation of the future refund. Using a panel data set that contains products disaggregated at eight-digit HTS level over the period from 1998 to

2005, we first investigate the importers' anticipation by analyzing the US import demand for Canadian softwood lumber and then investigate the exporters' pricing from the pass-through analysis.

For the importers' anticipation analysis, we employ a demand estimation technique. If importers have anticipation on the future refund, their price sensitivity under AD duty periods should be smaller; therefore, we can identify the importers' anticipation, r_q^I, by investigating the difference in the price coefficients between under AD duty periods and the periods other than the AD duty periods.

For the exporters' anticipation analysis, we employ a pass-through equation. To be precise, we compare the tariff pass-through into export prices between AD duty and standard tariffs and assess whether or not the tariff pass-through under AD duty is larger. This paper contains three divergences from the existing work on the pass-through of AD duties. First, our data set includes not only the period of administrative reviews, but also the periods prior to the reviews when the standard tariffs were applied. Second, the Gap period from December 2001 to May 2002 provides us with an experimental opportunity, in that no tariffs were certainly imposed during this period. The unique institutional features of the market allows us to directly compare the pass-through of both standard tariffs and AD duties. Second, we incorporate the unobserved demand shocks recovered from the demand estimates in the pass-through regression in order to reveal the supply side behavior more precisely.

4.1 Importers' anticipation: Demand for Canadian Softwood Lumber

We employ a two-stage nested logit model for the demand for the lumber by species categorized by eight-digit HTS. The majority of demand for wood products comes from housing; therefore, we use the number of housing starts multiplied by the average quantity of wood products per house as market size, M. M is measured in terms of cubic meters and

thus we choose the purchasing unit as one cubic meter.

We categorize the lumber products into hardwood and two softwood lumber species, Spruce, Pine, and Fir (SPF) and Cedar, because these species are usually used for different purposes. The SPF species have moderate strength, are worked easily, take paint readily and hold nails well, while the western red cedar, one of the cedar species, is soft, straight-grained, and extremely resistant to decay and insect damage. SPF is mainly used to make dimension lumber for home building and panels, while the cedar species is used extensively in roof coverings, exterior sidings, fences, decks, and other outdoor applications.

At a first stage, each purchasing unit decides whether to choose SPF, Cedar, hardwood lumber, or outside option, and at a second stage, it decides which species to be chosen. Each unit chooses one cubic meter of wood products from the alternatives, $j = 0, 1, \ldots, J$, that gives the highest utility. Indirect utility for purchasing unit i from product j at time t is specified as:

$$u_{ijt} = \delta_{jt} + \zeta_{ig(j)t}(\sigma) + (1-\sigma)\epsilon_{ijt}, \tag{5}$$

where δ_{jt} is the mean utility for product j, $g(j)$ represents the nest in which product j belongs, and $\zeta_{ig(j)t}$ and ϵ_{ijt} are nest- and product-level deviation from the mean utility, respectively. Each unit can choose not to buy any of Canadian softwood lumber: then, each unit chooses the other wood products or American softwood lumber. We express the outside option as product 0 whose mean valuation is normalized to be 0. We assume $\zeta_{igt(s)t} + (1-\sigma)\epsilon_{ijt}$ to follow generalized extreme value; then, the share function for product j can be written as follows.

$$s_{jt} = s_{jt/g(j)} s_{g(j)t}, \tag{6}$$

where

$$s_{jt/g(j)} = \frac{\exp(\delta_{jt}/(1-\sigma))}{\exp(I_{g(j)t}/(1-\sigma))}, s_{g(j)t} = \frac{\exp(I_{g(j)t})}{1 + \sum_{g \in G} \exp(I_{gt})}, \tag{7}$$

where $G = \{SPF, Cedar, Hardwood\}$, the set of nests in the market, and $g(j) \in G$, the nest in which product j belongs. $s_{jt/g(j)}$ and $s_{g(j)t}$ are the share of product j within the nest $g(j)$

and the share of the nest $g(j)$ in the whole market, respectively. I_{gt} is the average utility obtained from the choice of nest g, which can be written as:

$$I_{gt} = \ln\left(\sum_{l \in J_g} \exp(\delta_{lt}/(1-\sigma))\right), \tag{8}$$

Then, the estimation equation can be derived by specifying the mean utility function:

$$\delta_{jt} = -\lambda e_t p_{jt} + \mathbf{D}_j \boldsymbol{\pi} + \xi_{jt}, \tag{9}$$

where $e_t p_{jt}$ is the US market price of product j in CPI-adjusted USD at time t, $\mathbf{D}_j$ is a dummy variable for product j, and ξ_{jt} is the product–time specific unobserved demand shock. λ and $\boldsymbol{\pi}$ are parameters to be estimated. Note that the data available to us is export prices (export unit values) rather than US market prices. Under the SLA, the US market prices should correspond to the export prices plus the specific tariffs because there is no anticipatory effects and all importers had to pay the tariffs. On the other hand, because we cannot construct the US market prices in a similar fashion because of the presence of importers' anticipation on the future refund. To implement the estimation, we specify the US market prices as follows:

$$p_{jt} = \tilde{p}_{jt}\left[1 + \left(\sum_{l=1}^{4} d_{t,ADl} \times \frac{\lambda_{ADl}}{\lambda}\right)\right] \tag{10}$$

where $d_{t,ADl}$ is the dummy variable that takes 1 if t is in an l-th administrative review period and 0 otherwise, and λ_{ADl} is a parameter to be estimated. $\tilde{p}_{jt}$ is specified as

$$\tilde{p}_{jt} = \begin{cases} \bar{p}_{jt} + t_{jt}, & \text{if } t \text{ is in SLA periods,} \\ \bar{p}_{jt}, & \text{otherwise.} \end{cases} \tag{11}$$

where $\bar{p}_{jt}$ is an export price of product j at time t in CAD terms.

As obvious from this specification, importers' anticipation on ultimate AD duty rate for ADl is

$$\frac{\lambda_{ADl}}{\lambda} = 1 + \tau - r^I_{ADl},\ l = 1, 2, 3, 4, \tag{12}$$

From (11), we can rewrite δ_{jt} as follows.

$$\delta_{jt} = -\left[\lambda + \left(\sum_{l=1}^{4} d_{t,ADl} \times \lambda_{ADl}\right)\right] e_t \tilde{p}_{jt} + \mathbf{D}_j \boldsymbol{\pi} + \xi_{jt}. \tag{13}$$

We identify the importers' anticipation based on the difference in price sensitivity between AD duties periods and the periods other than the AD periods. Note also that as is discussed in section 3.3, we assume that importers are unlikely to modify their anticipation based on current exporters' pricing because of limited information for predicting the refund rate. This assumption implies r^I_l to be independent of $\tilde{p}_{jt}$ and thus key to identify the importers' anticipation.

Using transformation in Berry (1994), we have

$$\ln(s_{jt}) - \ln(s_{0t}) = \delta_{jt} + \sigma \ln(s_{jt/g(j)}) \tag{14}$$

where s_{0t} is the share of outside option whose mean utility δ_{0t} is normalized to zero.

Combining (10) and (12), we can estimate the parameters in mean utility and σ from the moment condition on the unobserved demand shock ξ_{jt}. The problem in implementing the estimation is that $\tilde{p}_{jt}$ and $\ln(s_{jt/g(j)})$ are correlated with ξ_{jt}: positive demand shock of a product induces the price of the products higher, and positive demand shock of a product induces the share of the product higher, which in turn induces a share within a nest that the product belongs to higher. Following the literature, such as Hausman (1997) and Nevo (2001), our identification assumption is that the US specific valuation of product j is independent across countries after controlling for the product–specific mean. Under this identification assumption, the prices of product j in other countries is valid instruments. In

this study, we use the rest-of-world price of product j as an instrument for product j. As the price coefficients varies across AD periods, we use the rest-of-world price times the AD period dummy variables as instruments. In addition, we use the cost shifters, exchange rate, wage, log price, and oil price as instruments. Based on the instruments introduced here, we estimate the parameters by GMM.

4.2 Exporters' Anticipation: Pass-through of AD Duties

Using disaggregated product level panel data of US softwood lumber imported from Canada, we perform price regressions, extended from a standard pass-through equation as follows:

$$\ln(\bar{p}_{jt}) = \alpha \ln(e_t) + \mathbf{X}_{jt}\boldsymbol{\beta} + \mathbf{D}_{tq}\boldsymbol{\gamma} + \epsilon_{jt}, \tag{15}$$

for product j and time t. Note that our data contain 29 lumber products in total with the subheading number of 44070000. $\bar{p}_{jt}$ is export price measured in CAD terms. e_t is a US–Canada exchange rate and its coefficient α indicates the pass-through of the exchange rate. If α is found to be -1, Canadian firms fully adjusted their price in response to exchange rates. On the other hand, if α equals 0, Canadian firms do not change their price in response to exchange rates. Between these two extremes, i.e., a value of α between 0 and -1, is called an incomplete pass-through. Goldberg and Knetter(1997) report that the existing studies on exchange-rate pass-through mostly find incomplete pass-through. Note that the existing literature usually uses the importers' market prices, i.e., export prices plus tariffs as dependent variables, and hence the pass-through coefficient usually takes between 0 and 1. A vector of $\mathbf{X}_{jt}$ includes cost and demand shifters, along with product dummy variables at the eight-digit HTS level, quarterly dummy variables, and a constant term. For cost and demand shifters, we incorporate the variables of wages (in CAD); the number of housing units authorized by building permits in the US; world crude oil prices; and average log prices. The summary statistics of these explanatory variables are presented in Table 1, and

data sources are described in the appendix.

Equation (12) also includes a set of policy dummy variables, $\mathbf{D}_{tq}$. As Figure 1 shows, there are four periods prior to the AD and CVD investigations (i.e., the period from April 1997 to March 1998, from April 1998 to March 1999, from April 1999 to March 2000, and April 2000 to March 2001): the AD and CVD investigation period from April 2001 to November 2001; the Gap period from December 2001 to May 2002; and four periods after the issuance of final positive determinations of AD and CVD (i.e., the period from June 2002 to March 2003; from April 2003 to March 2004; April 2004 to March 2005; and from April 2005 to March 2006). As shown in Figure 1, we treat the Gap period as reference; then, $q \in \{SLA1, SLA2, SLA3, SLA4, Investigation, AD1, AD2, AD3, AD4\}$. As we will discussed in the following section, firms involving AD and CVD were likely to behave as in free trade during the Gag periods. Therefore, the coefficients captures the price increase from the price under free trade. The dummy variable, $\mathbf{D}_{tq}$, receives one if time t falls into the policy period q.

The last term in the RHS of (12), ϵ_{jt}, is an error term, and the Greek letters, α, $\boldsymbol{\beta}$, and $\boldsymbol{\gamma}$ are parameters to be estimated.

Note that, unlike the standard pass-through regressions (see, for example, Feenstra (1989)), the above regression includes neither tariff rates nor AD duties. This is because the data cover the period of the 1996 SLA under which importers were subject to specific tariffs, while the standard pass-though regression usually analyze ad valorem tariffs. To estimate the pass-through, we focus on the coefficients on $\mathbf{D}_{tq}$ that captures the price increase for each period q compared to the reference period. We then calculate pass-through based on the estimates and the tariffs applied in each periods. Section 5.2 explain the calculation method used in this study.

It is possible that the coefficients on policy dummy variables, $\mathbf{D}_{tq}$, may contain industry-wide supply shocks varies across time periods, which may be unable to be controlled by the

inclusion of the variables, $\mathbf{X}_{jt}$. To cope with this concern, we also apply a DID approach:

$$\ln(\bar{p}_{jt}) = \alpha \ln(e_t) + \mathbf{X}_{jt}\boldsymbol{\beta} + \mathbf{D}_{tq}\boldsymbol{\gamma}_1 + (d_j \times \mathbf{D}_{tq})\boldsymbol{\gamma}_2 + \epsilon_{jt}. \tag{16}$$

The above equation introduces a new dummy variable, d_j, which identifies product j as either in the treatment (when d_j equals one) and control groups (when d_j equals zero). The treatment group is softwood lumber, which incurs tariffs. Note that both specific and ad valorem tariffs were applied to the same categories of softwood lumber.

As a control group, we choose a set of products associated with hardwood lumber. Hardwood lumber possesses product characteristics similar to softwood lumber; this is because the fact that both lumbers are classified under the same subheading number in the HTS. It is known that hardwood lumber is not considered as very substitutable with softwood lumber in terms of usage as housing material, but is subject to similar demand and supply shocks as softwood lumber. Note that d_j is a linear combination of the product dummy variables, already included in $\mathbf{X}_{jt}$. Again, the Greek letters, α, $\boldsymbol{\beta}$, $\boldsymbol{\gamma}_1$, and $\boldsymbol{\gamma}_2$ are the parameters to be estimated.

In investigating the changes in the supply side behavior, we have to remove the effect of demand shock on the price movement. In particular, US softwood lumber market was subject to large demand shifts related to the housing boom induced by so called "sub-prime loan". We here introduce the unobserved demand shocks that control the product specific demand shocks in the price equation. We specify the pricing equation with unobserved demand shocks in the following partial linear form:

$$\ln(\bar{p}_{jt}) = f(\mathbf{z}_{jt}) + \alpha \ln(e_t) + \mathbf{X}_{jt}\boldsymbol{\beta} + \mathbf{D}_{tq}\boldsymbol{\gamma}_1 + (d_j \times \mathbf{D}_{tq})\boldsymbol{\gamma}_2 + \epsilon_{jt}, \tag{17}$$

where $f(\cdot)$ is the function of the vector of unobserved demand shocks $\mathbf{z}_{jt}$. We assume that $\mathbf{z}_{jt}$ has three elements: own demand shock, ξ_{jt}; sum of the other demand shocks within the same nest, $\sum_{l \in J_{g(j)} \setminus \{j\}} \xi_{lt}$; and the sum of the demand shocks across the nests, $\sum_{g \in G \setminus g(j)} \sum_{l \in J_{g(j)}} \xi_{lt}$.

4.3 Identification Issues

We now discuss what variation in data allows us to identify the importers' anticipation and exporters' anticipation. First of all, as is discussed in the previous section, we compare the price sensitivity under AD duty with that under the periods other than the AD periods in order to reveal the importers' anticipation. Obviously, to do this, we need the data not only for the AD duty periods but also for the periods other than the AD periods. As our dataset includes the SLA periods in addition to AD duty periods, we can assess the role of importers' anticipation.

On the other hand, in order to estimate the tariff pass-through, we need the variation in tariff rates for both AD duties and the standard tariffs. Although the estimation of the pass-through of tariffs is difficult because the tariff rates are renewed on rare occasions as discussed in Feenstra (1989), the unique feature of the case of Canadian softwood lumber, the existence of Gap periods, give rise to the variation that allows us to estimate the pass-through.[12] Note that we have the periods of investigation in addition to the SLA, AD and Gap periods; however, because exporters might be required to pay the AD duties retroactively, exporters would be subject to the effects of trade policies even under the Investigation periods. On the other hand, all the Canadian exporters can export their products without the fear of retroactive payment of tariffs during the Gap periods. Therefore, the tariff rate during the Gap periods should be zero.

While the Gap periods help to identify the pass-through, we need adequate length of the Gap periods for estimation. As shown in Figure 1, the the periods when both CVD and AD fell into Gap periods is less than one month, which is too short to estimate the pass-through.

Because of this limitation, we treat the CVD Gap periods as reference periods. As discussed above, it is problematic because importers might face with the threat of retroactive payment of AD duties. However, in the preliminary determination, the USDOC declared

[12] Although there was a little change in tariff rates during the AD duty periods, from 27.2 to 30.3%, it is difficult to estimate the pass-through from such minor variation.

the AD not to be retroactive, while it declared the CVD to be retroactive. Hence, the firms would consider that the retroactive payment of the AD duties was unlikely to occur. As CVD was never be applied during CVD Gap periods, it is reasonable to treat the CVD Gap periods as the reference period, or free trade periods, for the pass-through estimation.

5 Estimation Results

This section applies the estimation models described in the previous section to the data set. The data used in this study are monthly observations from April 1998 to March 2005. The summary statistics pertaining to the important variables used in the estimation appear in Table 1, and the data sources are presented in the appendix.

Price data are unit values of Canadian export of disaggregated softwood lumber products at the eight-digit HTS level with subheadings ranging from 44071010 and 44079990 with a unit of measurement of cubic meters. Note that the duties under the Softwood Lumber Agreement in the period from 1996 to 2001 were directly levied by Canadian Government, while duties associated with AD and CVD were done by US Customs. As we focus on the pass-through into the export prices, we subtract the specific export duties from the unit values under SLA in the analysis of exporters' anticipation. Figure 2 lists the export prices of cedar lumber, one of the species of softwood lumber, and the average tariff rates, measured as the ratio of the tariffs and te average export prices of the cedar lumber. The interesting feature of the figure is that export prices were lower in the SLA period than in the AD period though the tariff rate under SLA and AD and CVD were almost identical. The aggregate evidence suggests that exporters responded differently to the standard tariffs and AD duties.

The data used in the estimation of demand and pass-through is summarized in Table 1.

5.1 Demand Estimates

We first implement the demand estimation of Canadian softwood lumber and hardwood lumber. Table 2 presents the results of the OLS and GMM. Because of the endogeneity, the estimate of σ and the coefficient on price are biased toward one and upward, respectively; indeed, as the estimates in (2-i) and (2-ii) indicate, the endogeneity problems are successfully corrected by using instruments. Note that Hansen's J-statistic in (2-ii) is high and suggests that the identification assumptions are not valid. However, it is unclear whether the small sample size[13] or the problem of the instrumental variables.

In the nested logit model, we categorize the products into three groups, SPF, Cedar and Hardwood lumber. The estimate of σ is 0.587, and the 95% confidence interval of the estimate lies between 0 and 1. The result indicates that the current specification is consistent with the utility maximization problem and that the products within the same nest are close substitutes.

Next we reports the results of the importers' anticipation. Figure 3 shows the results of the importers' anticipation on the ultimate AD duty estimated from the model: a solid line indicates the estimates of equation (11), and the dashed lines indicate their σ-interval. As shown in the figure, the the difference between the initial AD duty rate and importers' anticipation on the ultimate AD duty rate estimated from the demand model, is very small in the first and second periods of the AD duties, but the differences are widen in the third and fourth periods of AD duties. In addition, we include the ultimate AD duty rate determined in the administrative review in Figure 3 to see whether or not the importers adequately assessed the future AD rate. Note that the results of the fourth administrative review is not shown in the figure because the AD and CVD cases were ended before the release of the final determination on the third administrative review.[14] As shown, the importers did

[13]The finite-sample properties of the J-test imply that it rejects too often (Hayashi (2000), Ch. 3)

[14]For the same reason, the final determination of the third administrative review was not released. Therefore, we use the revised rate reported in the preliminary determination of the third administrative review in Figure 3.

not anticipate the ultimate AD rate correctly because the ultimate AD rate are outside of the σ-interval for two out of three periods. The result is consistent with the well-known argument that the USDOC's discretion on the determination of the AD duty rate makes it difficult to predict the rate correctly.

How did the importers form their anticipation? Although importers had limited information on the exporters' pricing and hence had difficulty in predicting the refund rate soon after the imports, they could obtain the information on the refund through the release of the determination of the administrative review. The revised refund rates were not directly related to the current rates of refund, but they should be a helpful clue to adjust for their anticipation. Therefore, we consider the case in which importers adjust their anticipation adaptively, that is, anticipate the refund rate to be equal to the rate released most recently through the determination of the administrative review. Under this assumption, $1 + \tau - r^I$ evolves in accordance with the release of the revised rate. To confirm this hypothesis, we construct the rate under adaptive expectations based on the chronology of the release of the administrative review shown in Figure 4. As shown in Figure 3, the rate under adaptive expectations is almost comparable to the estimates, although the rate in the third period was outside of the σ-interval.[15]

5.2 Pass-through Estimates

We now proceed to the estimation of the AD duty pass-through for Canadian softwood lumber exported to the US. Table 3 presents four results based on methods with product-level fixed effects. Specification (3-i) uses the data of softwood lumber and estimate equation (13), whereas Specification (3-ii) adds the data of hardwood lumber as a control group to perform the pass-through regression based on equation (14). Specification (3-iii) further include

[15]Note that ideally, we should investigate the case of rational expectations, that is, reveal what affects the formation of the anticipation statistically by controlling for the variables in the importers' information set when implementing the demand estimation. However, since we focus on a particular case of the AD duties, we have little variation with which identify the effects of various factors on the importers' anticipation separately.

the unobserved demand shocks based on the estimation results of demand based on the estimation equation (15): we implement the pass-through regression by using a polynomial series estimator for $f(\cdot)$. The empirical results presented here is third order approximation on $f(\cdot)$.[16]

The upper portion of Table 3 reports the estimates of the regression coefficients. Our inferences are based on heteroskedasticity-robust standard errors. All results obtained indicate that the models fit the data moderately well; the adjusted R^2 is approximately 0.7 or higher.

The coefficient of exchange-rate pass-through is estimated to be around 0.34–0.5 in all specifications, indicating the export prices of softwood lumber were not fully responsive to exchange rates. The result of this incomplete exchange-rate pass-through is consistent with the findings in the existing literature, surveyed in, for example, Goldberg and Knetter (1997). The price elasticity with respect to wage is estimated to be negative in specification (3-i) and (3-ii) but takes positive values at 1 % significance level in specification (3-iii), while the elasticities with respect to oil and log prices are found to be neither statistically nor economically significant in all specifications. Note that the partial effects of the unobserved demand shocks are reasonably estimated: the own demand shock is positively correlated with the prices, while the positive demand shocks for competing products are negatively correlated with the price. In particular, within competing products, the demand shocks of products belong to the same group as product j decrease the price of product j at a rate greater than the different groups.

Based on the estimates, we calculate the pass-through of tariffs. Note that we do not directly include the tariff rates in the pass-through regressions, because importers were subject to specific tariffs under SLA rather than ad valorem tariffs. We thus employ the policy dummy variables, $\mathbf{D}_{tq}$, and construct the calculated tariff pass-through using the Gap period when the tariff was nil as the reference period for $\mathbf{D}_{tq}$. Then, we can obtain an export price

[16] We confirmed that there is little difference in the estimates between under the third and fourth order approximation.

under the counterfactual situation for which tariffs had not been imposed at period q. We calculate the average value of pass-through for the regime of specific tariffs (in the period from April 1998 to March 2001 during the study period), and that for the regime of ad valorem tariffs (in the period from June 2002 to March 2006), as follows.

$$\begin{aligned} \overline{PT}_{AD} &\equiv \frac{\bar{p}_{AD} - p_0}{\tau p_0}, \\ \overline{PT}_{S} &\equiv \frac{\bar{p}_{SLA} - p_0}{\tau^S} \end{aligned} \tag{18}$$

where p_0, $\bar{p}_{AD}$, and $\bar{p}_{SLA}$ are the export prices under free trade, AD duty, and specific tariff, respectively. Note that p_0 is unobserved and hence be constructed using the pass-through estimates, i.e., the estimated free trade price for the period q is:

$$\hat{p_0} = \exp\left[\ln(\bar{p}_q) - \hat{\gamma}_{2q}\right], \tag{19}$$

where $\hat{\gamma}_{2q}$ is the estimate of the q-th element of $\boldsymbol{\gamma}_2$.

We calculate the tariff pass-through for each of the nine periods (note that we took the Gap period as a reference). Table 4 summarizes our findings. The block on the left in the table is based on the estimates from Table 4. The first row, calculated from Specification (4-i), indicates that the difference is statistically significant as is expected and is 40% on average in the period of administrative review, relative to that in the period prior to the review. The results indicate the presence of exporters' anticipation in the presence of AD duties.

Note, however, that the pass-through estimates during the SLA in Specification (4-i) should be unreasonable because it takes the value less than –1, which implies that the US market prices and lower under the tariffs than free trade. One of the reason why we obtained such estimates is that the results from specifications (4-i) do not control for, and thus are susceptible to, industry-wide supply shocks. We thus introduce the controls presented in equation (14). As hardwood lumber has characteristics similar to softwood lumber, but its

usage is not considered as substitutable to the usage of softwood lumber, we take hardwood as a control group to estimate the pass-through regression based on equation (14). The results shown in Specification (4-ii) in Table 4 indicates the positive difference though it is not statistically significant. Note that now the pass-through of tariffs under SLA takes the value between 0 and -1: the exporters absorbed the impact of tariff by 66%, and hence the US market prices increased by 34% of the amount of the tariffs.

In addition to the introduction of control groups to control for the industry wide shocks, we introduce the unobserved demand shocks in equation (14), taking the effect of housing bubbles during the periods of the AD and CVD seriously. The results shown in specifications (5-iii) now indicate a positive difference at the 1% significance level, and the pass-through estimates under the SLA lie between 0 and -1.

6 US Market Prices and Welfare Assessment

So far, we found that the importers' anticipation decrease the US market prices, while the exporters' anticipation increase under the AD duties. We now investigate the effects of AD duties on the US market prices and assess whether the AD duties were more restrictive measure in reducing imports. Then, we quantify the anticipatory effects on consumer welfare.

6.1 Impacts on the US market prices

Combining the results of importers' and exporters' anticipation, we here investigate the difference in the pass-through effects on the US market prices between of AD duties and standard tariffs. The pass-through into US market prices is defined as:

$$\begin{aligned} PT_{AD} &\equiv \frac{p_{AD} - p_0}{\tau p_0} = \frac{\tau - r^I}{\tau} \frac{\bar{p}_{AD}}{p_0} + \overline{PT}_{AD}, \\ PT_S &\equiv \frac{p_{SLA} - p_0}{\tau^S} = 1 + \overline{PT}_S \end{aligned} \tag{20}$$

where p_{AD} and p_{SLA} are the US market prices under AD and SLA, respectively.

Table 5 shows the results of the pass-through into the US market prices. The pass-through estimates averaged over the SLA and the AD periods and their difference is shown in (5-i). The results indicate that there is no significant difference in pass-through between these trade policies, despite the presence of importers' and exporters' anticipation.[17] The results is due to the trade-off of the effects of importers' and exporters' anticipation on US market prices: importers' anticipation decreased the US market prices, while exporters' anticipation increased the US market prices.

Note that, as shown in the analysis of the importers' anticipation, the importers anticipated little refund at an earlier periods of the AD duties (AD1 and AD2 periods), the AD duties should increase more than the standard tariffs under the SLA. To see the difference in effects from period to period, we estimate the pass-through separating the AD periods into two periods. The results in (5-ii) shows estimates of the pass-through in the AD1 and AD2 periods, the pass-through into the US market prices is significantly higher under the AD duties. On the other hand, as shown in (5-iii) of the table, the pass-through estimates of the pass-through in the AD3 and AD4 periods is much smaller under the AD duties. Therefore, while the AD duty had similar impacts on US market prices on average, the effects were different from period to period. In particular, the effects of AD duties on US market prices at the beggining of the introduction of AD duties is large and thus welfare costs at the beginning of the introduction of AD duties should be also quite high. In the following section, we assess the effects on consumer welfare, including how much the additional increase in US market prices in the early stages of the trade remedies harmed consumer welfare.

[17]Note that as we discussed, because of the measurement problem of the pass-through, the pass-through of ad valorem tariffs tends to be smaller than that of specific tariffs. Therefore, to take this feature into account, there should be larger differences between AD duties and standard tariffs.

6.2 Effects on consumer welfare

Based on the demand system introduced in the previous section, we compute the changes in consumer welfare resulting from the anticipatory effects as follows:

$$\Delta CS = \frac{\ln\left(1+\sum_{g\in G}\exp((1-\sigma)I_{gt}(e_t p_\tau))\right) - \ln\left(1+\sum_{g\in G}\exp((1-\sigma)I_{gt}(e_t p_0))\right)}{\lambda}, \quad (21)$$

where p_τ is the price for which we consider two cases: the price in the presence of anticipatory effects, i.e., the price under AD duties; and the price without anticipatory effects, i.e., the price under standard tariffs. For both cases, the tariff rates are set to be the actual rate of AD duties. The latter price is calculated by setting the pass-through of AD duty to be the same as that of standard tariffs. In deriving the counterfactual prices, we employ the pass-through estimates in Table 5. The simulation results are summarized in table 6. As shown in this table, because of the dynamic incentives, the welfare cost of AD duty is increased by 4.86% higher compared to that of standard tariff in total. However, the additional welfare costs resulting from the anticipatory effects are huge, about 77% of standard tariffs at early periods of the AD duties.

7 Conclusion

The softwood lumber dispute between the US and Canada has been one of the longest running trade disputes in history, producing extensive litigation in the US, the NAFTA, and the WTO spanning questions of subsidization, dumping, and injury. For the moment at least, the dispute appears to have been settled by the entry into another round of the US–Canada SLA, under which Canada has agreed to impose a tiered system of export taxes, quantitative controls, and export licenses on its softwood lumber exports. This paper assessed the role of importers' and exporters' anticipation in the presence of administrative reviews, the institutional features surrounding the AD administration, with an application to

US-Canada softwood lumber disputes in the period from 1997 to 2006. This paper used the panel data of US disaggregated softwood lumber with the coverage beyond the period of AD administrative reviews, and performed the demand estimation and pass-through regressions. The unique features of the softwood lumber market helped to us identify the role of market competitiveness in tariff pass-through.

This paper first showed that the importers' anticipation on ultimate AD duty rates determined in administrative reviews evolved according to the release of most recent release of the refund rate determined on the administrative review. It also showed that exporters set their prices higher in the presence of the AD duties, which is consistent with the dynamic incentives to increase the refund rate. While the overall impact on US market prices is not significant, the paper reveals that at early stages of the AD period, the anticipatory effects increased the pass-through into US market prices more than the standard tariffs. The additional welfare costs of AD duties resulting from the anticipatory effects are amount to 77% of standard tariffs at an early stage of the AD periods. Although the welfare costs were offset by the reduction in the welfare costs at latter stages of the AD periods, it is worth accounting for these welfare costs and the difference in the path of the price impacts of AD duties in implementing the AD duties.

A Data

The data used on the LHS of equations (1) and (2) were monthly value and quantity of Canadian exports to US for selected lumber related products in the period from April 1997 to March 2005. *Canadian International Merchandize Trade* provides the eight-digit HTS codes with subheading numbers ranging from 44071010 to 44079990. The treatment group, which is subject to tariffs, is softwood lumber (HTS 44071010 - 44071090), while the control group is defined as hardwood lumber (HTS 44072400 - 44079990). The timeline of events associated with AD and CVD along with their duties is obtained from *Federal*

Register. Monthly exchange rates between Canada and US are taken from *International Financial Statistics*. The variable of the number of housing units authorized by building permit is used as a proxy for US softwood lumber demand. The data are from US Census Bureau. Three variables were employed to capture marginal cost of exporting Canadian softwood lumber to the Untied States. Data on average monthly wage for all manufacturing are taken from Statistics Canada, and those on world crude oil prices are from the US Energy Information Administration (EIA). These two variables are associated with marginal cost of producing and delivering softwood lumber. The last cost variable is average log prices, taken from the Ministry of Forests and Range in the Province of British Columbia. This variable reflects the opportunity cost of producing softwood lumber in Canada, instead of shipping logs and manufacturing lumber in the United States.

References

Anderson, James E. 1992. "Domino dumping, I: competitive exporters." *American Economic Review* 82 (1):65–83.

———. 1993. "Domino dumping II: anti-dumping." *Journal of International Economics* 35:133–150.

Bajari, Patrick and C. Larniel Benkard. 2005a. "Demand estimation with heterogenous consumers and unobserved product characteristics: a hedonic approach." *Journal of Political Economy* 113 (6):1239–1276.

———. 2005b. "Hedonic price indexes with unobserved product characteristics, and aplication to personal computers." *Journal of Business and Economic Statistics* 23 (1):61–75.

Berry, Steven. 1994. "Estimating discrete-choice models of product differentiation." *Rand Journal of Economics* 25 (2):242–262.

Berry, Steven, James Levinsohn, and Ariel Pakes. 1995. "Automobile prices in market equilibrium." *Econometrica* 63 (4):841–890.

———. 1999. "Voluntary export restraints on automobiles: evaluating the trade policy." *American Economic Review* 89 (3):400–430.

Blonigen, Bruce A. 2006. "Evolving discretionary practices of U.S. antidumping activity." *Canadian Journal of Economics* 39 (3):874–900.

Blonigen, Bruce A. and Stephen E. Haynes. 2002. "Antidumping investigations and the pass-through of antidumping duties." *American Economic Review* 92 (4):1044–1061.

———. 2010. "Antidumping investigations and the pass-through of antidumping duties: Reply." *American Economic Review* 100 (3):1283–1284.

Blonigen, Bruce A. and Jee-Hyeong Park. 2004. "Dynamic pricing in the presence of antidumping policy: theory and evidence." *American Economic Review* 94 (1):134–154.

Brander, James A. and Barbara J. Spencer. 1984. "Trade welfare: tariff and cartels." *Journal of International Economics* 16:227–242.

Clerides, Sofronis. 2008. "Gains from trade in used goods: Evidence from automobiles." *Journal of International Economics* 76:322–336.

Feenstra, Robert C. 1989. "Symmetric pass-through of tariffs and exchange rates under imperfect competition: an empirical test." *Journal of International Economics* 27:25–45.

Friberg, Richard and Mattias Ganslandt. 2006. "An empirical assessment of the welfare effects of reciprocal dumping." *Journal of International Economics* 70:1–24.

Gallaway, Michael P., Bruce A. Blonigen, and Joseph E. Flynn. 1999. "Welfare costs of the U.S. antidumping and countervailing duty laws." *Journal of International Economics* 49:211–244.

Goldberg, Pinelopi Koujianou and Michael M. Knetter. 1997. "Goods prices and exchange rate: what have we learned?" *Journal of Economic Literature* 35 (3):1243–1272.

Goldberg, Pinelopi Koujianou and Frank Verboven. 2001. "The evolution of price dispersion in the European car market." *Review of Economic Studies* 68:811–848.

Goolsbee, Austan and Amil Petrin. 2004. "The consumer gains from direct broadcast satellites and the competition with cable TV." *Econometrica* 72:351–381.

Hausman, Jerry. 1997. "Valuation of new goods under perfect and imperfect competition." In *The Economics of New Goods*, edited by Timothy F. Bresnahan and Robert J. Gordon. Chicago: National Bureau of Economic Research, 209.

Hayashi, Fumio. 2000. *Econometrics*. Princeton University Press.

Helpman, Elhanan and Paul Krugman. 1989. *Trade Policy and Market Structure.* MIT Press.

Irwin, Douglas A. 2009. *Free Trade Under Fire.* Princeton University Press.

Kelly, Brian D. 2010. "Antidumping investigations and the pass-through of antidumping duties: Comment." *American Economic Review* 100 (3):1280–1282.

Kitano, Taiju. 2011. "Did temporary protection induce technology adoption? A study of the US motorcycle industry." Mimeo.

Leckey, Dave. 2007. *Buying & Selling SOFTWOOD LUMBER & PANELS.* Random Lengths.

Nevo, Aviv. 2001. "Measuring market power in the ready-to-eat cereal industry." *Econometrica* 69 (2):307–342.

Staiger, Douglas and James H. Stock. 1997. "Instrumental variable regression with weak instruments." *Econometrica* 65 (3):557–586.

Table 1: Summary Statistics

Time	Log prices	Housing starts	Wage	Oil prices	Exchange rate
97.4-98.3	4.672	11.711	2.750	3.091	0.338
98.4-99.3	4.552	11.809	2.782	2.796	0.409
99.4-00.3	4.601	11.805	2.803	3.389	0.386
00.4-01.3	4.626	11.766	2.830	3.661	0.408
01.4-01.11	4.673	11.839	2.821	3.507	0.440
01.12-02.5	4.655	11.791	2.936	3.424	0.459
02.6-03.3	4.747	11.854	2.886	3.687	0.436
03.4-04.3	4.487	11.959	3.007	3.579	0.301
04.3-05.3	4.438	12.035	2.950	3.852	0.245
05.4-06.4	4.362	12.084	3.029	4.115	0.177
Average	4.581	11.865	2.879	3.510	0.360

Note: All the variables are in logarithm.

Table 2: Demand Estimates

	(2-i) OLS			(2-ii) GMM		
	Est.	S.E.		Est.	S.E.	
Coef. on Price						
λ	-0.0002	0.0001	***	-0.0051	0.0012	***
λ_{AD1}	0.0001	0.0001		-0.0013	0.0005	**
λ_{AD2}	0.0008	0.0001	***	-0.0014	0.0004	***
λ_{AD3}	0.0011	0.0001	***	-0.0001	0.0003	
λ_{AD4}	0.0013	0.0001	***	-0.0006	0.0005	
σ	0.9799	0.0065	***	0.7326	0.1014	***
Const.	-3.5239	0.0284	***	-3.1094	0.3245	***
Quarter dummy	Yes			Yes		
Product dummy	Yes			Yes		
R^2 / J-stat. (dof)	0.99			23.46(3)		
Partial F-stat.	-			33.4		
No. of obs.	2472			2472		

Note: ***, ** and * denote significance at 1, 5 and 10%, respectively.

Table 3: Results of pass-through regression: export prices

	(3-i)SL			(3-ii)SL&HL			(3-iii)SL&HL with $\boldsymbol{\xi}$		
	Est.	S.E.		Est.	S.E.		Est.	S.E.	
LN(Exchange Rate)	0.343	0.236		0.499	0.199	**	0.446	0.136	***
LN(Wage)	-0.099	0.131		-0.009	0.098		0.166	0.046	***
LN(Housing Start)	0.064	0.064		0.050	0.052		0.066	0.051	
LN(Log Price)	0.121	0.089		0.102	0.074		-0.047	0.030	
LN(Oil Price)	-0.005	0.058		0.015	0.047		-0.016	0.010	
SLA1	-0.234	0.047	***	-0.064	0.052		-0.072	0.030	**
SLA2	-0.294	0.050	***	-0.100	0.054	*	-0.059	0.019	***
SLA3	-0.331	0.035	***	-0.108	0.038	***	-0.088	0.022	***
SLA4	-0.445	0.035	***	-0.144	0.044	***	0.024	0.016	
Investigation	-0.016	0.035		-0.007	0.039		-0.052	0.020	**
AD1	-0.185	0.037	***	-0.085	0.039	**	-0.044	0.026	*
AD2	-0.260	0.046	***	-0.046	0.047		0.005	0.031	
AD3	-0.124	0.058	**	-0.025	0.054		0.026	0.040	
AD4	-0.194	0.075	***	0.002	0.067		0.189	0.024	***
SL*SLA1	-	-		-0.136	0.047	***	-0.231	0.027	***
SL*SLA2	-	-		-0.168	0.051	***	-0.177	0.027	***
SL*SLA3	-	-		-0.206	0.046	***	-0.220	0.023	***
SL*SLA4	-	-		-0.297	0.053	***	-0.302	0.028	***
SL*Investigation	-	-		0.000	0.051		0.002	0.023	
SL*AD1	-	-		-0.096	0.049	*	-0.079	0.026	***
SL*AD2	-	-		-0.196	0.045	***	-0.174	0.024	***
SL*AD3	-	-		-0.079	0.046	*	-0.077	0.022	***
SL*AD4	-	-		-0.178	0.048	***	-0.148	0.025	***
Constant	4.278	0.890	**	4.134	0.696	***	4.535	0.262	***
Partial effects of:									
ξ_{jt}	-	-		-	-		0.454	0.027	***
$\sum_{l \in J_{g(j)} \setminus \{j\}} \xi_{lt}$	-	-		-	-		-0.025	0.003	***
$\sum_{g \in G \setminus g(j)} \sum_{l \in J_{g(j)}} \xi_{lt}$	-	-		-	-		-0.004	0.001	***
Quarter dummy variables	Yes			Yes			Yes		
Product dummy variables	Yes			Yes			Yes		
R^2	0.697			0.804			0.922		
No. of obs.	1826			2472			2472		

Note: ***, ** and * denote significance at 1, 5 and 10%, respectively.
Specification (3-iii) applies a third order polynomial expansion in an approximation of $f(\cdot)$.

Table 4: Pass-through Estimates: export prices

		SLA	AD	Difference	
(4-i)SL	Est.	-1.153	-0.759	0.395	**
	S.E.	0.147	0.177	0.159	
(4-ii)SL&HL	Est.	-0.657	-0.535	0.122	
	S.E.	0.155	0.145	0.085	
(4-iii)SL&HL with $\boldsymbol{\xi}$	Est.	-0.800	-0.462	0.338	***
	S.E.	0.082	0.071	0.050	

Table 5: Pass-through estimates: US market prices

		SLA	AD	Difference	
(5-i) All AD periods	Est.	0.200	0.206	0.006	
	S.E.	0.082	0.092	0.065	
(5-ii) AD1 & AD2	Est.	0.200	0.358	0.158	**
	S.E.	0.082	0.087	0.078	
(5-iii) AD3 & AD4	Est.	0.200	0.064	-0.136	
	S.E.	0.082	0.093	0.080	

Table 6: Average consumer welfare effects of AD duties and standard tariffs

	AD duty(USD)	Standard tariff(USD)	Difference	Rate of Change (%)
(7-i) AD1 & AD2	522843484	295065782	227777702	77.24
(7-ii) AD3 & AD4	95949210	295065782	-199116572	-67.49
Total	618792694	590131564	28661130	4.86

Note: (6-i) and (6-ii) of this table computed by using the pass-through, (5-ii) and (5-iii) reported in table 5, respectively.

Figure 1: Timeline of the events

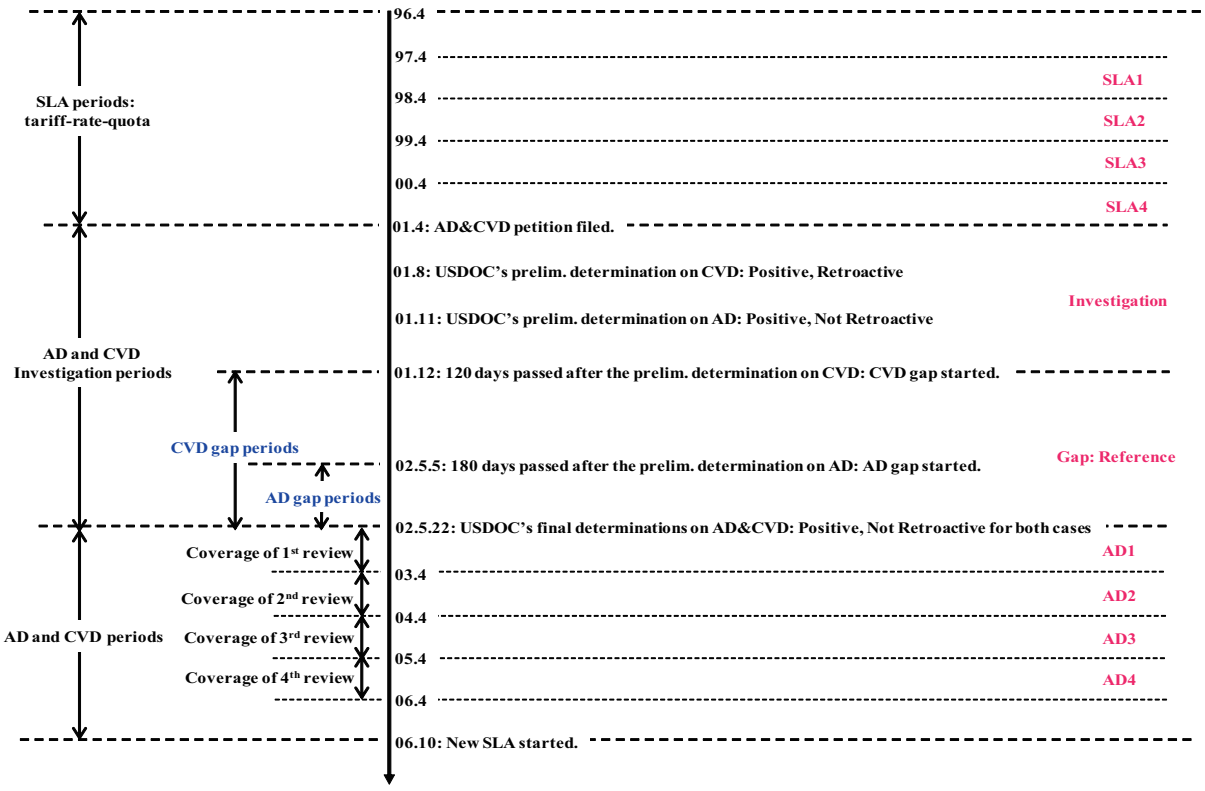

Figure 2: Export price movement

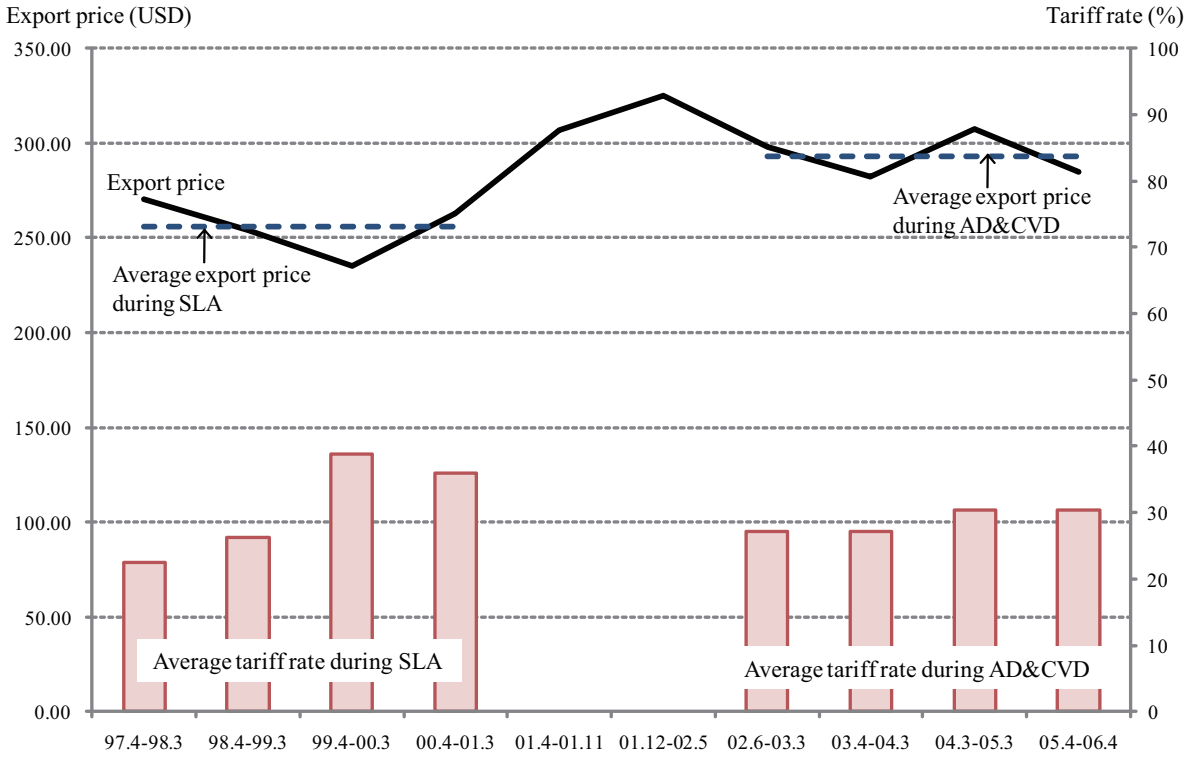

Figure 3: Importers' anticipation

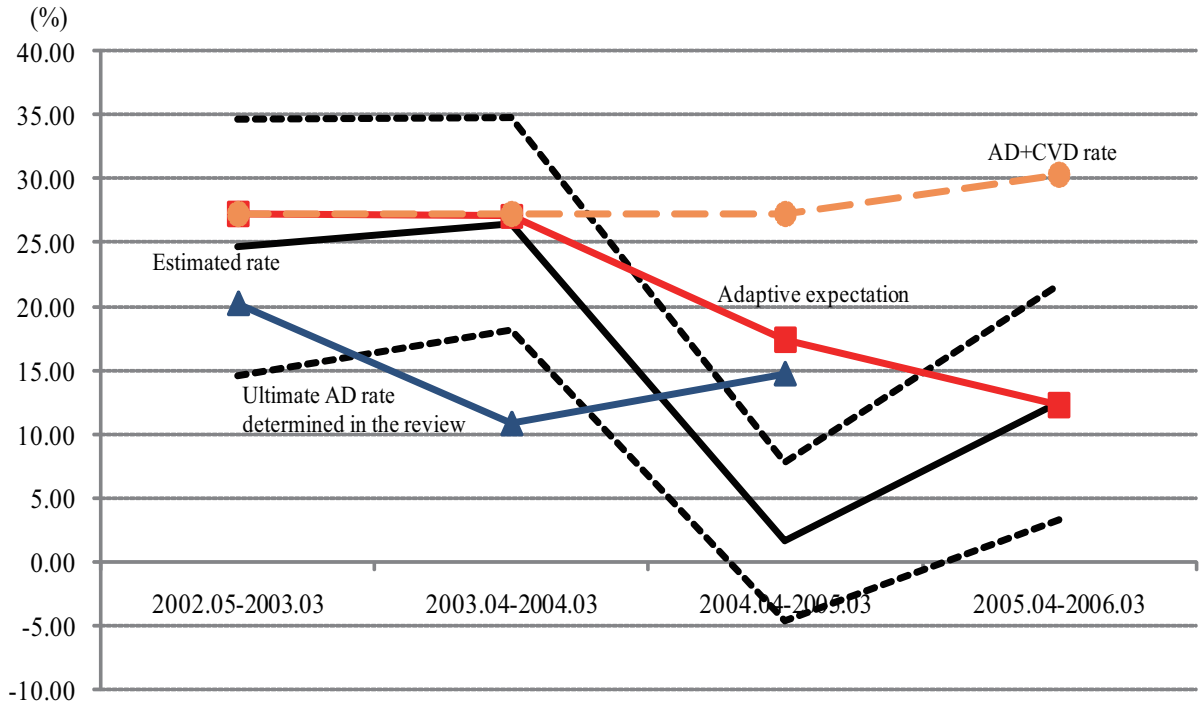

Figure 4: Revised rates released by the USDOC's administrative review