RIETI Discussion Paper Series 10-E-059

Assessing Anticipatory Effects in the Presence of Antidumping Duties: Canadian softwood lumber

KITANO Taiju
National Graduate Institute of Policy Studies

OHASHI Hiroshi
RIETI

RIETI
Research Institute of Economy, Trade & Industry, IAA

The Research Institute of Economy, Trade and Industry
http://www.rieti.go.jp/en/

RIETI Discussion Paper Series 10-E-059
March 2011

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

Taiju Kitano† Hiroshi Ohashi‡

Abstract

US antidumping (AD) policy can generate anticipatory effects on firms subject to AD duties because of a process called "administrative reviews" in which US government agencies determines refund rates based on exporters' most recent pricing behavior. The purpose of this paper is to assess the anticipatory effects from importers' and exporters' side by examining the US–Canada softwood lumber disputes. Using a demand estimation technique, we find evidence of the importers' anticipation: importers were less sensitive to tariff rates under the AD duties compared to standard tariffs, which indicates that the importers increased their volume of imports anticipating the future refund. We further show that the importers adjusted their anticipation adaptively, in the sense that the anticipated refund rate evolved according to the most recent revised rate of an AD duty released in the determination of an administrative review. On the other hand, using a pass-through regression, we find evidence of the exporters' anticipation: the pass-through of the AD duties into export prices (boarder prices) is larger than that of standard tariffs by about 41% after controlling for unobserved demand shocks. The result indicates that the exporters set their prices higher under the AD duties in order to raise the future refund, which in turn increase their future profits through the evolution of the importers' anticipation.

Keywords: antidumping; anticipatory effect; nested logit model; pass-through; softwood lumber
JEL classification: F13; F14; L73

* We are grateful to Kathy Baylis for her inputs on this project. We thank seminar participants at RIETI, University of Tokyo, Yokohama National University, Keio University and Osaka University for helpful comments and suggestions. Financial supports from the JSPS and RIETI are also gratefully acknowledged.
All the remaining errors are our own.
† National Graduate Institute for Policy Studies. 7-22-1 Roppongi, Minato-ku, Tokyo 106-8677, JAPAN. E-mail: t-kitano@grips.ac.jp
‡ Department of Economics, University of Tokyo. 7-6-1 Hongo, Bunkyo-ku, Tokyo 113-0033, JAPAN. Email: ohashi@e.u-tokyo.ac.jp

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. After AD duties are imposed, the US Department of Commerce (USDOC) initiates an administrative review each year upon the request of investigated foreign parties, and recalculates AD duties 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). Although the AD duties seem to be simple ad valorem tariffs on the surface, the refund policy through the administrative review generates anticipatory effects on the firms that lead to a different outcome.

Recent studies, including Blonigen and Haynes (2002) and Blonigen and Park (2004), focused on the role of the anticipatory effects on the exporters' side. These papers indicate that because the administrative review process allows exporters to recover the AD duty payment by increasing their current pricing, the export price should be set higher under AD duties than standard tariffs. While the previous studies mainly focus on the exporters' anticipation, the presence of the refund policy affects an importers' response to the tariffs as well. In general, importers decide the import volume to the extent that the import prices are equal to their marginal costs. Under standard tariffs, marginal cost is simply the export prices multiplied by the tariff, while in the presence of AD duties, the marginal costs depends not only on the export prices and AD duty rate but also the importers' anticipation on the refund rate. For example, if importers anticipate a 10% refund, the volume of imports is based on the export prices multiplied by the tariff rate minus 10% in a competitive market.[1]

[1]As the US government rebates the interest in addition to the refund, importers' discount on the future

The importers' anticipation plays an important role in the analyses of tariff pass-through into importers' market prices, which use export prices plus the tariff rates as dependent variable. However, as pointed out in Kelly (2010) and Blonigen and Haynes (2010), we cannot construct the dependent variable under AD duties in a similar fashion because of the presence of the importers' anticipation. Despite its importance, how the importers' anticipation forms and evolves has not been statistically analyzed. Therefore, this paper analyzes the role of the anticipatory effects not only from the exporters' side but also from the importers' side.

This paper examines US–Canada softwood lumber disputes to assess the role of exporters' and importers' anticipatory effects. 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 disputes allows us to compare the differences among trade policies. In this paper, we study two forms of trade policies: standard tariffs under the five-year Softwood Lumber Agreement (SLA) in 1996[2] and antidumping (AD) duties from 2002 to 2006.[3]

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 and a pass-through analysis to reveal the exporters' anticipation. Based on these analyses, we make three contributions to the literature on AD duties. First, we provide a different way to deal with the problem in constructing importers' market prices under AD duties by revealing the importers' anticipation. Previous studies, Gallaway, Blonigen,

refund is taken into account.

[2]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.

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

and Flynn (1999) and Blonigen and Haynes (2010), assume that the importers are perfect foresight, that is, they can correctly predict the refund rate determined in the administrative review at the time of importing; however, the empirical results presented in this paper do not support this presumption and indicate that the importers were likely to modify their anticipation adaptively in the sense that they adjust their anticipation at the time of the release of the administrative reviews based on the revised refund rate.

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.

Finally, we assess the impacts on anticipatory effects on the determination of pass-through into importers' market prices, and then reveal the effect on welfare. This paper shows that AD duties and standard tariffs has similar influences on the import prices on average: the importers' prices increased because of the exporters' anticipation, but the increase was offset by the importers' anticipation. However, it also shows that the pass-though of AD duties is different from period to period: in the early stages of the AD duties, the pass-through of AD duties was higher than that of standard tariffs, while it is lower in the latter stages. The welfare effects are therefore different from period to period, and in particular, the welfare costs of AD duty was huge, about 177% of the standard tariffs, while they are offset by reduction at late stage. 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, assuming that importers can correctly assess the refund rate and exporters

have no anticipatory effect. 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). While previous studies focus on the oligopolistic competition markets, this paper focuses on a market with a large number of firms.

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 reports the effects of the anticipation on the import 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. Although the lumber disputes have long history, the paper focuses on US-Canada trade disputes in the period from 1997 to 2006 when the AD duty and CVD were imposed. In this section, we first summarize the important events associated with the US-Canada softwood lumber disputes. 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

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.[4] The fee levels were updated every year, and increased over the SLA period, as is indicated in Figure 2, which shows the average tariff rates, measured as the ratio of the tariffs to the average export unit value of the softwood lumber. Note that the structure of this trade policy is identical to the tariff-rate-quota, although the Canadian government had right to collect the duty rather than the US. We hereafter refer to the trade policy under the SLA as tariff-rate-quota.

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

Trade Remedies (from 2002 to 2006)

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.

The USDOC and USITC have distinct roles in legal procedures regarding AD and CVD. The USDOC calculates the respective AD and CVD margins, while the USITC determines whether the corresponding US domestic industries had been materially injured by the import of products under investigation. AD and CVD follow the same procedure with slight differences in the duration of investigations taken before preliminary and final determinations.

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 be collected retroactively from up to 90 days before the USITC determination of preliminary determination of positive injury. Hence, firms have an incentive to alter their pricing strategy during the periods of investigation in case of the retroactive imposition of duty.[5] 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. The

[5]Furthermore, firms tend to price higher during the periods of investigation to reduce the likelihood of positive final determination.

difference in preliminary determination was likely to make foreign firms care about the retroactive payment of the CVD seriously, but not that of the AD duty.

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.[6] 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 the "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. The final AD and CVD determinations finally came out at the same time on May 22 of 2002, with affirmative determinations for both cases. As noted above, the preliminary CVD determination was retroactive, but the final determination ordered no retroactive AD and CVD duties, as indicated in Figure 1. The CVD duty was finalized at 18.79%, applied to the producers in Canadian provinces except for the Maritime Provinces, and the final AD duties were 8.43% for the firms not investigated.

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

[6]The days within which USDOC and USITC obliged to issue the final determination depend on whether the the AD(CVD) investigation are 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.

CVD duties times the value of the subject product. This cash deposit, however, do not necessarily represent the final amount of duties to be assessed on softwood lumber imported from Canada. The importer 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 actual 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 and CVD. CVD were 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). While CVD is based on a government subsidy, which is presumably outside the control of firms' pricing decisions, the dumping margin is not. The administrative review allowed foreign firms under investigation to evade the duty by altering either or both of their export and own domestic prices.

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. We discuss further details of the AD investigation procedure in the next subsection.

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, Canadian exporters were refunded the difference between the duty paid during the periods of investigation and the duty recalculated in the administrative review. 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. However, 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 exporting government, the USDOC has several ways to compute the dumping margin associated with AD duties. The USDOC typically compares sales transactions that occurred in both exporting and importing markets for the six months prior to the date when the petition is filed to determine both the preliminary and final AD duties. The dumping margin is usually calculated based on the difference between the foreign export price and home market price of the good.

Note that the foreign export price is the price at which the product under investigation

or administrative review is sold, or agreed to be sold, for exportation to the US, or in the US.[7] As Kelly (2010) points out, USDOC refers the price before importing or adding AD duties in recalculating the dumping margin in the administrative reviews.

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. The home market prices are ordinary the actual transaction prices in the foreign market. In the case of softwood lumber, however, the USDOC did not use the actual data on home market price in the calculation of the dumping margin. Instead, they employed the constructed value, which is an estimate of what the price should have been based on the cost of production that was privately obtained by Canadian producers, plus administrative expenses and a profit margin.

The constructed value method is usually employed when the investigated foreign firm does not have sufficient sales of a like product in its own market.[8] However, the softwood lumber case was applied to the constructed value method for opposite reasons: because there was a large number of softwood producers in Canada selling a myriad of different products through hundreds of thousands of individual transactions, the USDOC did not use the price comparison methods and employed the constructed value method to make the proceeding more manageable.[9] Then, the dumping margin for softwood lumber imported from Canada was thus calculated as the difference between the US export price and the USDOC constructed domestic price in Canada.

The administrative reviews were conducted for both AD and CVD in each of the four periods defined before. In the next section, we discuss how the presence of the administrative review process affects the importers' and exporters' behavior.

[7]See Chapter 7 of *2009 Antidumping Manual* released by USITA (available at `http://ia.ita.doc.gov/admanual/index.html`) for more detail on the export price.

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

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

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 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.

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. Therefore, we do not mention about CVD in the following analysis unless necessary.

Before describing the models, we first introduce the prices used in the subsequent analysis in order to avoid confusion. We use three kinds of price in this paper. The first is the *export price* that the exporters set in selling their products to importers, as defined in Section 2.2. The second is the *import price* that the importers pay at the time of importation and is calculated as the export price plus a tariff. The third is the *US market price*, which is the selling price in the US market. As we will discussed in the following section, import prices should be equal to US market prices under the standard tariffs (and perfect competition); however, they can be different in the presence of the anticipatory effects.

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 not only the export prices and the level of the AD duties but also the expected 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. Therefore, we assume that 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 particular, it is much more difficult for importers because the refund rate depends on the exporters pricing not only in a particular market where the importers conduct transactions but also in other markets where they do not conduct transactions.[10] Due to this institutional feature of the calculation of the dumping margin, the firm may not

[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.

obtain the refund if the other firms still imported the product from the same exporter at lower prices even though a firm imports a product from an exporter at much higher prices than before.

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. 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 importers do not modify their expectations based on the current pricing, while the exporters do.

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 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.

3.3 Notes on the Anticipation

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'

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

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. However, the presence of CVD does not change the structure of the model if we consider the tariff rate in our model as the sum of the rates of AD duty and CVD in an empirical analysis. For this reason, our model does not explicitly incorporate the role of CVD in the importers' anticipation; however, note that this paper will reveal the importers' anticipation generated not only from the AD duty but also the CVD.

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. Therefore, we need not to respecify the model because of the presence of the CVD in terms of the exporters' anticipation.

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. Therefore, 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, we cannot obtain the precise difference of the pass-through between the AD and standard tariffs; however, we can still possible to provide evidence of the exporters' anticipation if we show the pass-through under the AD is larger than that under SLA despite the lower estimate of the pass-through under the AD duties that took the form of ad valorem tariffs. Note that. for this reason, we show the effect of the exporters' anticipation on the pass-through at 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.

On the importers' anticipation analysis, we employ a demand estimation technique focusing on the difference in the price sensitivity between under AD duty and the periods other than the AD, i.e., the SLA, the Investigation, and the Gap periods. If importers anticipate the complete refund in future, the import volume under AD duty should be the same as that

under free trade, all other things being equal. On the other hand, if importers anticipate the incomplete refund, the import volume should be smaller than that under free trade. Therefore, if importers are more sensitive to import prices under AD duty, it can be considered that importers have anticipation on the future refund. Therefore, we can identify the importers' anticipation, r_q^I, by investigating the difference in the price coefficients between under AD duty and the periods other than the AD duties.

For the exporters' anticipation analysis, we employ a pass-through equation. This paper contains two 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. In addition, 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 that is measured by the cubic meter. Then, the purchasing unit becomes 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 the 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 the US market prices. Under the SLA, the US market prices should correspond to the export prices plus the specific tariffs. On the other hand, because we cannot construct US market prices in a similar fashion because of the presence of importers' anticipation on the future refund, we simply include the export prices for the data on the AD duties but allows the coefficient on prices to vary during the AD duties period. Note that as we discussed, the importers' anticipation is identified by the difference in coefficient between AD duties periods and the periods other than AD duties. We include the export prices during the AD duties period, but allows the coefficient on the prices to vary from period to period during the AD duties period. Then, the mean utility δ can be rewritten as:

$$\delta_{jt} = -[\lambda + (d_j \times \mathbf{D}_{tq})\boldsymbol{\lambda}_q] e_t \bar{p}_{jt} + \mathbf{D}_j \boldsymbol{\pi} + \xi_{jt}, \tag{10}$$

where $\boldsymbol{\lambda}_q$ is a vector of coefficients varying from period to period, but the coefficients for the periods other than the AD duty period equal zero. We define the subscript q as representing 10 distinct periods corresponding to SLA1–SLA4, Investigation, Gap, and AD1–AD4 in Figure2. Then, we have four additional coefficients which we define as λ_{AD1}, λ_{AD2}, λ_{AD3}, λ_{AD4}, respectively. Each of them capture the deviation from the price sensitivity during the

periods of standard tariffs. If the price sensitivity is the same for all periods, we compute the expected rate of AD duty, or the importers' anticipation, for period i which can be represented as:

$$\frac{\lambda_{ADi}}{\lambda} = 1 + \tau - r_q^I \tag{11}$$

Using transformation in Berry (1994), we have

$$\ln(s_{jt}) - \ln(s_{0t}) = \delta_{jt} + \sigma \ln(s_{jt/g(j)}) \tag{12}$$

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}. 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 we allow the price coefficient to be varied across periods, we use the rest-of-world price times the period dummy variables for the first to fourth administrative review periods. 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:

$$\ln(\bar{p}_{jt}) = \alpha \ln(e_t) + \mathbf{X}_{jt}\boldsymbol{\beta} + \mathbf{D}_{tq}\boldsymbol{\gamma} + \epsilon_{jt}, \tag{13}$$

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 2003): 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 we defined, q takes the values of 1 through 10 in correspond to the chronological order of these policy events in Figure 1. 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 the US government imposed specific tariffs on softwood lumber imported from Canada. Then, it is difficult to compare the rates of specific tariff and ad valorem tariff. Therefore, we include a set of policy dummy variables, $\mathbf{D}_{tq}$, and calculate pass-through for each period q based on the estimates. The calculation method we apply is discussed in Section 4.

It is possible that the policy dummy variables, $\mathbf{D}_{tq}$, may contain industry-wide supply shocks, 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:

$$\ln(\bar{p}_{jt}) = \alpha \ln(e_t) + \mathbf{X}_{jt}\boldsymbol{\beta} + \mathbf{D}_{tq}\boldsymbol{\gamma}_1 + (d_j \times \mathbf{D}_{tq})\boldsymbol{\gamma}_2 + \epsilon_{jt}. \tag{14}$$

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:

$$\ln(\bar{p}_{jt}) = f(\mathbf{z}_{jt}) + \alpha \ln(e_t) + \mathbf{X}_{jt}\boldsymbol{\beta} + \mathbf{D}_{tq}\boldsymbol{\gamma}_1 + (d_j \times \mathbf{D}_{tq})\boldsymbol{\gamma}_2 + \epsilon_{jt}, \tag{15}$$

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, $\sum_{l \in J_{g(j)} \backslash \{j\}} \xi_{lt}$; and the sum of the demand shocks across the nests, $\sum_{g \in G \backslash g(j)} \sum_{l \in J_{g(j)}} \xi_{lt}$.

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 AD duties 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 AD duties. 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. 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 and the presence of Gap periods allows us to have variation in tariff rates for both of the trade policies.[12]

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 AD Gap periods were, unfortunately, less than one month, which is too short to estimate the pass-through. Although the Gap periods give rise to the variation in tariff rates for both of the trade policies, it may be difficult to obtain precise pass-through estimates using such short AD Gap periods.

Because of the limitation imposed by the AD Gap periods, we treat the CVD Gap periods as reference periods. As discussed above, it is problematic to assume the periods of investigation as the period of zero tariff rates because importers face implicit tariffs because of the fear of retroactive determination for AD duties. However, in the case of trade remedies on Canadian softwood lumber, the USDOC's preliminary determination of CVD was positive and retroactive, while that of AD duty was positive but not retroactive. Nonretroactive determination on AD implies that the future payment of AD duty is unlikely to occur. As CVD were never be applied to exporters and were unlikely to be applied AD during the CVD Gap periods, the implicit tariff rates should be close to zero; therefore, it is reasonable to treat the CVD Gap periods as the reference period 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.

[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.

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. Therefore, we infer 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-ii) indicate, the endogeneity problems are successfully corrected by using instruments. However, Hansen's J-statistics in GMM is 23.10 and hence we reject the null hypothesis of $J = 0$; however, we accept the current specification because, as is discussed in Hayashi (2000), the finite sample property of GMM estimation indicates that the J-statistics tends to be overestimated. Partial F-statistics, or an average of the F-statistics for the endogenous variables derived by setting all the coefficients on the instruments to be zero in the regression of the endogenous variable on the instruments and other exogenous variables, is larger than 10. As shown in Staiger and Stock (1997), $F > 10$ indicates the validity of the instruments.

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 pass-through regression. Figure 3 shows the results of the estimated expected rate of AD duty: 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 actual and expected rate of AD duty, i.e., the expected rate of refund, is very small in the first and second periods of the AD duties. Previous studies, Gallaway, Blonigen, and Flynn (1999) and Blonigen and Haynes (2010), assume that importers can correctly assess the future refund or the importers have perfect foresight. Under this assumption, importers set their prices based on the revised rate of AD duty. The line with triangle markers shows the revised rate determined in the administrative review. 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.[13] Obviously, it is likely to have little relation to the estimated importers' anticipation because as shown in Figure 3, the rates under perfect foresight 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 and thereby the perfect foresight assumption is problematic.

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

[13]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.

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. The rate under adaptive expectations seems to perform better than that under perfect foresight.[14]

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 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 $f(\cdot)$. However, we found that there is little difference between the third and fourth order approximation.

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 indi-

[14]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.

cate 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 we focus on the difference between specific and ad valorem tariffs that are not directly comparable. 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 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.

$$\begin{aligned} \overline{PT}_{AD} &\equiv \frac{\bar{p}_{AD} - p_0}{\tau p_0}, \\ \overline{PT}_{S} &\equiv \frac{\bar{p}_{SLA} - p_0}{\tau^S} \end{aligned} \tag{16}$$

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:

$$\hat{p_0} = \exp\left[\ln(\bar{p}_q) - \hat{\gamma}_{2q}\right], \tag{17}$$

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 but it is not statistically significant. However, 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:

$$\begin{aligned} PT_{AD} &\equiv \frac{p_{AD} - p_0}{\tau p_0} = \frac{\tau - r^I}{\tau}\frac{\bar{p}_{AD}}{p_0} + \overline{PT}_{AD}, \\ PT_S &\equiv \frac{p_{SLA} - p_0}{\tau^S} = 1 + \overline{PT}_S \end{aligned} \tag{18}$$

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 first column of the table shows the pass-through estimates averaged over the SLA and the AD periods and their difference. As shown, there is no significant difference between these trade policies. This is because several periods after the imposition of the AD duty, the importers adjusted their anticipation and increased the volume of imports taking account of the future refund.[15]

[15]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.

Note that, as shown in the analysis of the importers' anticipation, because the importers did not take account of the future refund at an earlier stage of the AD duties, i.e., the periods of AD1 and AD2, 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 for different periods. The second row of the table shows estimates of the pass-through in the first and second periods of the administrative review. The results show that the pass-through into the US market prices is significantly higher. On the other hand, as shown in the third row of the table, which shows estimates of the pass-through in the third and fourth periods, the pass-through is smaller. Therefore, while the AD duty had similar impacts on US market prices on average, the effects were different from period to period. In particular, because the AD duty increases more at early stages of the trade remedies, the AD measure might be a more restrictive measure if people heavily discount future benefit. 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.

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:

$$\Delta CS = \frac{\ln\left(1+\sum_{g\in G}\exp((1-\sigma)I_{gt}(e_t p_\tau))\right) - \ln\left(1+\sum_{g\in G}\exp((1-\sigma)I_{gt}(e_t p_0))\right)}{\lambda}, \quad (19)$$

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 stages 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 whether importers' and exporters' behavior was altered by 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 us identify the role of market competitiveness in tariff pass-through. This paper first showed that the importers' anticipation 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 late 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

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

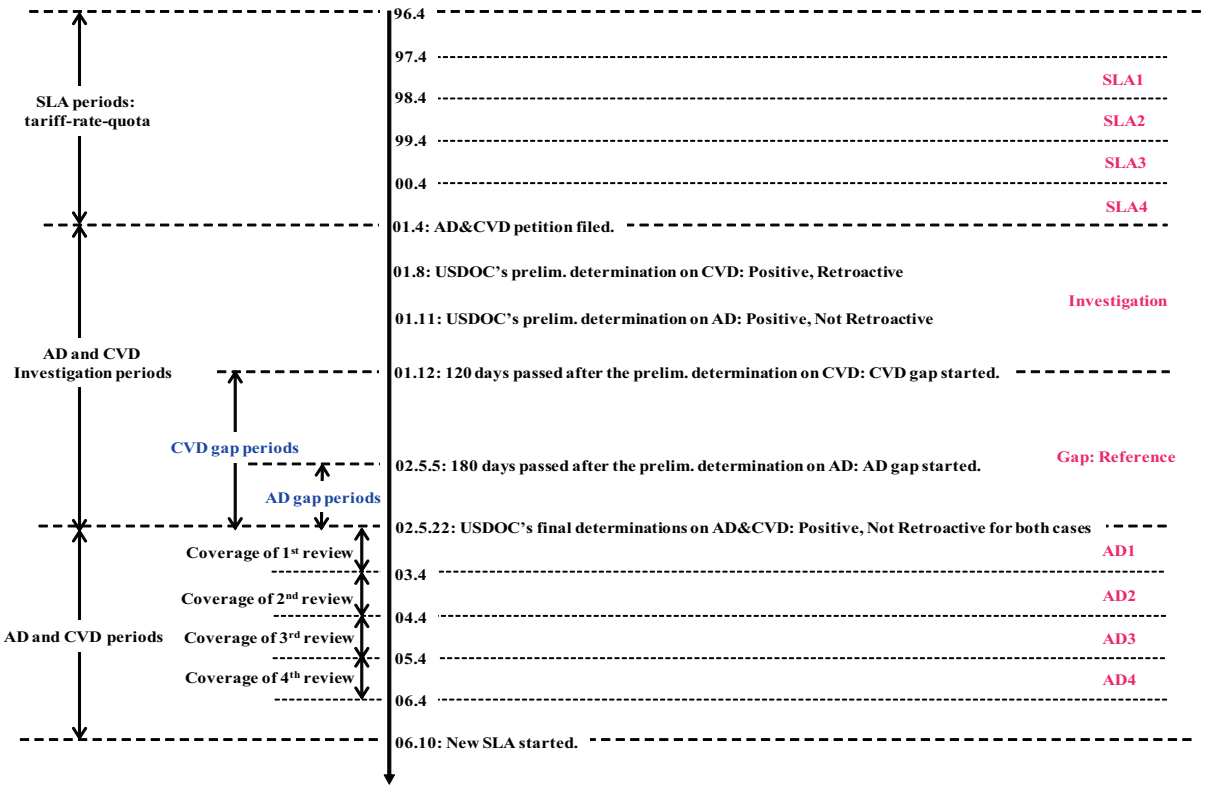

Figure 2: Export price movement

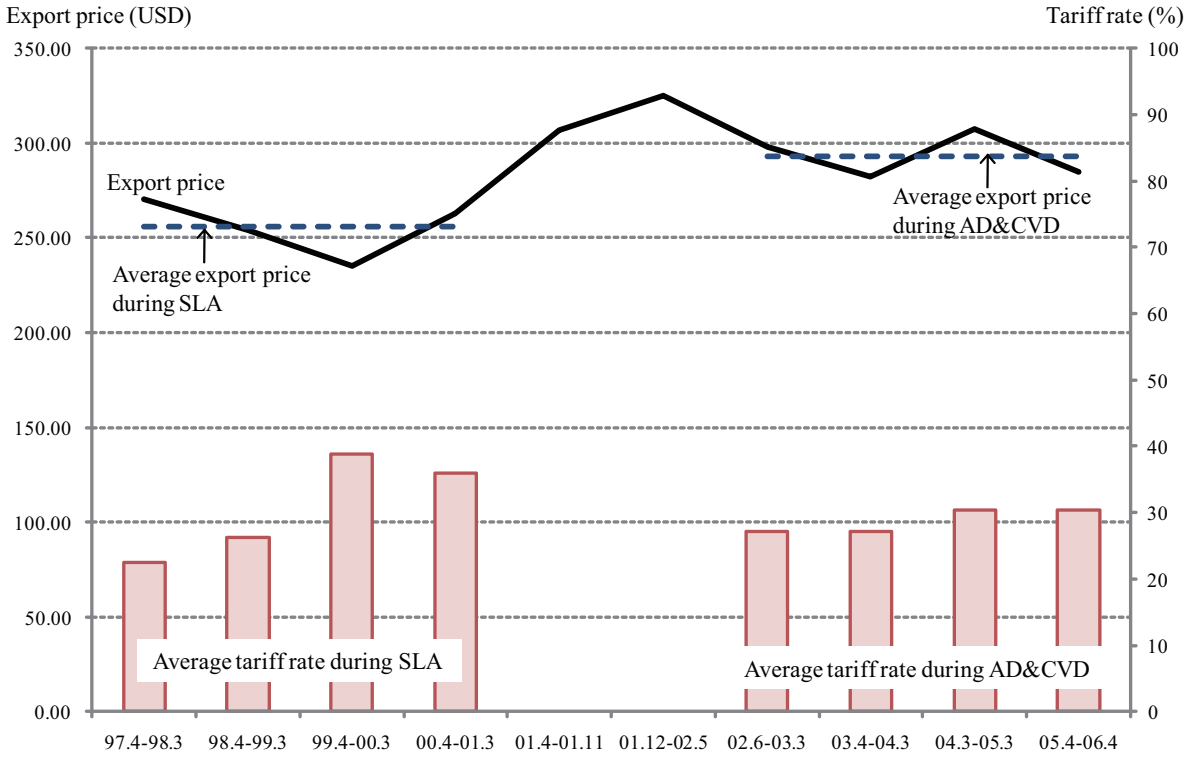

Figure 3: Importers' anticipation

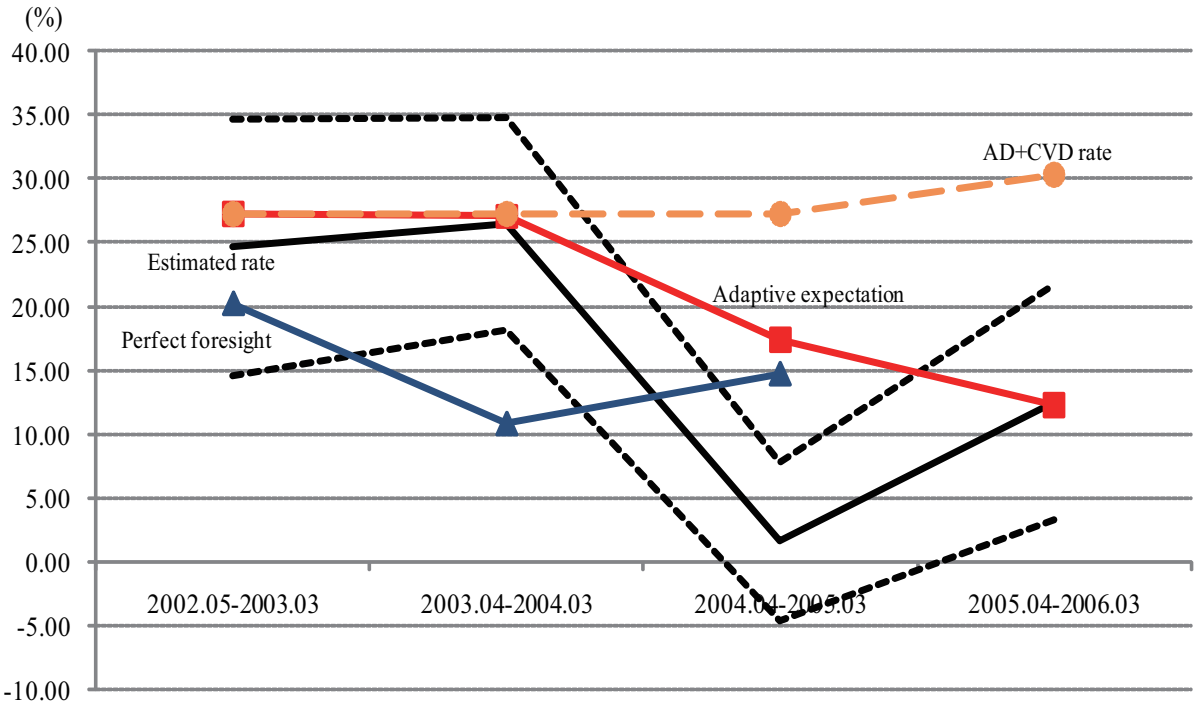

Figure 4: Revised rates released by the USDOC's administrative review