Export Taxes, Industrial Policy and the Value Chain in China After WTO

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Abstract

Countries have long used import tariffs as an instrument to stimulate or protect downstream industries; however, in the GATT/WTO era, tariffs have fallen greatly worldwide. Has the WTO succeeded in limiting the prevalence of this class of industrial policy, or are governments still attempting to move downstream via other policy instruments? For countries with large raw materials endowments, one alternative to imposing import tariffs on downstream industries is to impose export restrictions on upstream sectors. In this paper, I document such policy substitution in the case of an important recent WTO entrant: China. Defining China's export taxes as the tax equivalent of its export VAT rebate policies and export duties, I find that declines in protection of downstream industries due to import tariff cuts associated with China's WTO accession were partly offset by growth in export taxes on raw materials between 1999 and 2011. Rises in export taxes have been coordinated with changes in various other Chinese export policies, including prohibitions of exports via processing trade. I confirm that increases in export taxes are associated with declines in China's exports in affected industries and diversion of sales of raw materials to the domestic market.

[A] WTO deal – one which included surprising concessions on the Chinese side – was successfully brokered at the end of 1999. However, we note that there is a difference between signing a trade treaty and fully implementing its provisions. ... Our interviews of expatriate managers in China strongly indicate that these individuals believe tariff cuts will be at least partially undone by the simultaneous construction of more subtle non-tariff barriers...." – Branstetter and Feenstra (2002)

China's industrial strategy is to leverage and exploit the differences in the international and domestic markets for raw materials and downstream, processed products, using restraints on exports as the linchpin. – US government submission to *China - raw materials* WTO dispute (WTO 2011)

1 Introduction

Governments have long implemented policies designed to influence the industrial structure of the domestic economy, stimulating increased production in some sectors at the expense of lower output in others. One policy lever by which this has commonly been attempted is through variation in import tariffs across industries, affording differential protection from foreign competition to a subset of sectors. The history of import tariffs suggests that governments' industrial preferences tend to skew systematically towards sectors at the downstream end of the 'value chain': indeed, when Corden (1966) claimed that "a widely noted characteristic of the tariff structures of many countries is that nominal rates tend to be low or even zero for raw materials and to rise or 'escalate' with the degree of processing", he added that this fact was "so well known that detailed substantiation is hardly needed". Corden and others have also noted that an escalated tariff schedule of this kind tends to provide effective rates of protection for downstream industries that are much larger than that those suggested by their nominal tariffs.

Differential protection of downstream sectors via tariff escalation has continued to be a characteristic of trade policy in recent years: for example, Cadot et al. (2004), who observed tariff data for 44 countries between 1997 and 1999, found only one (Romania) in which average import tariffs on industrial products did not rise with the stage of processing. However, over the course of the GATT/WTO era, average import tariffs have fallen precipitously, implying that variation in effective protection due to tariffs across the value chain has also narrowed over time.[1] Has the prevalence of industrial policy declined along with tariffs, or are governments today continuing their attempts to 'move up the value chain' via other instruments instead?

[1] Indeed, reduction in the extent of tariff escalation was one of the stated goals of the Uruguay Round of international trade negotiations (GATT 1986).

In this paper, I consider an alternative policy by which some countries might shift their industrial structures towards downstream sectors: export restrictions on raw materials. Export policies associated with the value chain have been far less prominent historically than tariff escalation, but have been achieving some notoriety in recent years. For instance, a ban on the export of 41 unprocessed minerals from Indonesia became effective in January 2014, along with associated regulations setting out the extent to which each mineral must be processed in order to be eligible for export. More famously, China's policy restricting the exports of rare earths elements, a set of industrial raw materials of which Chinese mines provide almost 100% of world supply, has been linked with the fact that rare earths are key inputs for a wide range of high-technology downstream products:

> Resource-rich regions all want to expand into the more-profitable downstream processing sectors instead of just supplying the raw materials, said a government official with Baotou city in the Inner Mongolia Autonomous Region, one of China's major mining centers. – *Wall Street Journal*, August 2010

> We are certainly not focusing on the short-term benefits of raising the rare earth price. Our wish is for Baotou in Inner Mongolia to become the world's 'Rare Earths Valley', the world's rare earths industrial base. – Zhao Shuanglian, Vice Chairman of Inner Mongolia, September 2009 (china.com.cn 2009)

Below, I first present a simple model of unilateral trade policy in the context of a two-stage value chain, given that the goal of policymakers in the home country is to achieve (or maintain) an industrial structure in which the domestic downstream sector is larger than would be the case in a free-trade equilibrium. An import tariff on the downstream industry achieves this goal by protecting it from foreign competition. However, a country with a sufficiently large raw materials endowment may instead choose to impose an export tax on the upstream sector. Such a tax moves domestic factors downstream both by directly discouraging upstream production via reduced export demand, and by creating a wedge between raw materials prices at home and abroad, generating an input cost advantage for the local downstream sector.

I then provide evidence on a particular episode of policy substitution between import tariffs on downstream industries and export taxes on raw materials. To do so, I use a newly assembled panel dataset on Chinese export policies spanning from the late 1990s to the early 2010s, along with a new classification of industries according to their positions in a simple and intuitive two-stage conception of the industrial value chain. The case I consider focuses on one of the most important episodes in world trade of the last twenty years: China's WTO accession. I show that the import tariff cuts required of China as a condition of its entry into WTO decreased the relative protection afforded to downstream industries by its tariff schedule. However, defining China's export taxes as the tax equivalent of its export VAT rebate policies and export duties, I find that this pattern of protection was partly restored via increases in taxes on exports of raw materials. Moreover, rises in export taxes were coordinated with changes in various other export policies, and have been associated with declines in Chinese exports in affected industries as well as diversion of sales of raw materials to the domestic market.

This paper provides evidence on a potentially important instrument of industrial policy about which we currently know very little. At least since Lerner's (1936) classic study of symmetry between export taxes and import tariffs, it has been known that import-side and export-side trade policies can have similar effects on domestic economic outcomes. Yet although there is an enormous empirical literature on tariffs, researchers have not yet observed substitution between import tariffs and export taxes in practice, as far as I know.

Several studies have looked for evidence of substitution between import tariffs and other *import*-side barriers. As early as 1984, Baldwin suggested in the first Handbook of International Economics that rising non-tariff barriers might be substituting for falling tariffs: "[n]ot only have these measures become more visible as tariffs have declined significantly through successive multilateral trade negotiations but they have been used more extensively by governments to attain the protectionist goals formerly achieved with tariffs." Contemporaneously, Ray and Marvel (1984) reported a positive relationship between the non-tariff import barriers of the US, EC, Canada and Japan and their Kennedy Round tariff cuts.

More recently, some scholars have observed a rise in the use of antidumping duties worldwide and tested for a link between this phenomenon and reductions in tariffs. Bown and Tovar (2011) examine policy substitution in India, finding that the explanatory power of the Grossman and Helpman (1994) model of tariff-setting, which appears to be eliminated by India's 1990s tariff liberalization, is restored after accounting for a subsequent rise in the use of antidumping duties. Feinberg and Reynolds (2007), Vandenbussche and Zanardi (2010), Moore and Zanardi (2011) and Bown and Crowley (forthcoming) present mixed evidence for the hypothesis of substitution between tariffs and antidumping duties at the cross-country level.[2]

There is also an ample literature documenting tariff escalation, much of it dating from the 1960s; see, for example, Balassa (1965).[3] However, only a small number of papers have also noted the tendency for export taxes to be higher for raw materials than for processed goods, including Golub and Finger (1979) and Latina, Piermartini and Ruta (2011).

Indeed, while ample data exists on trade restrictions from the import side, systematic information on export restrictions has rarely been gathered. Solleder

[2]A few theoretical papers have also been concerned specifically with policy substitution: Anderson and Schmitt (2003) model governments' incentives to substitute from import tariffs to non-tariff policies after international tariff-setting agreements, while Yu (2000) proposes a model of substitution between import tariffs and voluntary export restraints.

[3]In their well-known "Protection for Sale" paper, Grossman and Helpman (1994) briefly suggest a political-economy reason for such a tariff structure, an argument expanded by Cadot et al. (2004).

(2013) is a recent exception: she identifies 111 countries imposing export taxes on at least one product and compiles two years of product-level data on export tax rates from twenty of these.[4] Kim (2010) surveys the export restrictions mentioned in WTO Trade Policy Reviews spanning 2003 to 2009, while Fliess and Mard (2012) construct a partial inventory of various countries' export restrictions on raw materials during 2009 and 2010.[5]

The theoretical literature on the symmetry between import tariffs and export taxes, starting with Lerner (1936), focuses on terms-of-trade motivations for trade policy.[6] However, Ethier (2004, 2007) suggests that since international trade agreements have generally not restricted the use of export taxes, the apparent rarity with which they are actually used constitutes a puzzle for the terms-of-trade-based theory of trade agreements proposed by Bagwell and Staiger (1999). My observation that export taxes have emerged in China after its WTO entry, but in line with pre-WTO industrial policy protecting downstream industries, provides a potential clue to this puzzle. My theoretical framework suggests that if trade policy is mainly motivated by the goal of 'moving up the value chain' relative to the free-trade equilibrium, the export taxes that accomplish this goal (i.e. export taxes on raw materials) may be an inferior instrument as compared to import tariffs on downstream sectors. This is both because an export tax on raw materials leads to inefficient changes in the global allocation of factors across the two stages of production, and because the resulting rises on foreign input prices are partly passed through to home consumers via imports of downstream products.

This study also adds to a growing literature on trade policy in China, some of which examines its export-side policies. Defever and Riano (2012) consider the welfare effects of incentives in Chinese policy for firms to export a high proportion of their output. Chandra and Long (2013) calculate the elasticity of Chinese exports to VAT rebate rates, using firm-level data on VAT payments. Khandelwal, Schott and Wei (2013) study the impact of the local institutional reform associated with the removal of externally imposed export quotas on textiles and apparel after the end of the Multifiber Arrangement. Eisenbarth (2014) assesses the evidence that China's post-WTO export policies are based on environmental considerations.

The remainder of the paper is laid out as follows. Section 2 presents the theoretical framework. Section 3 lists the sources of data on Chinese trade policies and discusses the new classification of raw materials and downstream industries defined here. Section 4 presents empirical evidence on the relationship between China's export tax rises and import tariff cuts during the period. Section 5 then draws conclusions.

[4] Although Solleder's dataset of tax rates includes China, it incorporates only China's export duties and not its VAT rebate or other export policies.

[5] Data on export subsidies, especially for agriculture, is somewhat more widely available.

[6] See McKinnon (1966) for a model of Lerner symmetry incorporating intermediate goods.

2 Theoretical framework

In this section, I propose a simple model of unilateral trade policy with two stages of production. My objectives in presenting the model are twofold: to clarify the mechanisms by which an import tariffs on downstream industries and export taxes on raw materials sectors might achieve the same industrial policy goal, and to suggest reasons why an import tariff might be preferred to an export tax by a government free to choose either instrument in order to accomplish this goal.

Consider a world with two symmetric countries, home (H) and foreign (F), which will hereafter be indexed by i. There is a single differentiated final goods sector (which I will call stage 2) with a continuum of varieties, over which representative consumers in each of the two countries have identical constant elasticity of substitution (CES) preferences with elasticity of substitution $\sigma_2 > 1$:

$$U = \left(\int_0^{n_2^H} x(v^H)^{\frac{\sigma_2 - 1}{\sigma_2}} dv^H + \int_0^{n_2^F} x(v^F)^{\frac{\sigma_2 - 1}{\sigma_2}} dv^F \right)^{\frac{\sigma_2}{\sigma_2 - 1}}$$

Each country is endowed with a fixed continuum of local varieties of final goods of equal size n_2.[7] Individual firms do not have monopolistic control over these varieties; instead, perfect competition is assumed to hold for each variety in each country, so that factory-gate prices are equal to marginal costs.[8]

I assume that each country has an endowment L of a single factor (which I will call labour) that is mobile across industries but not countries, and is inelastically supplied to firms. Production of stage 2 goods requires a combination of labour and a continuum of imperfectly substitutable raw materials, with elasticity of substitution across materials inputs of $\sigma_1 > 1$.[9] Raw materials and labour have Cobb-Douglas shares β and $1-\beta$ in the stage 2 production function, which may be written as:

$$q(v_2^i) = z_2 \left(\int_0^{n_1^H} m_2^i(v_1^H)^{\frac{\sigma_1 - 1}{\sigma_1}} dv_1^H + \int_0^{n_1^F} m_2^i(v_1^F)^{\frac{\sigma_1 - 1}{\sigma_1}} dv_1^F \right)^{\frac{\sigma_1}{\sigma_1 - 1}\beta} l(v_2^i)^{1-\beta}$$

Firms specializing in raw materials production (stage 1) are also assumed to be perfectly competitive. Production of raw materials requires only labour: $q(v_1^i) = z_1 l(v^i)$.

[7] This restriction amounts to an Armington (1969)-type assumption of country-specific varieties within a Krugman (1980)-type framework, as in the quantitative trade policy model of Ossa (2013).

[8] The main results here can be shown to hold under the alternative assumption of monopoly; i.e. monopolistic competition across varieties in stage 2 and across raw materials sectors in stage 1. I assume perfect competition here for simplicity and to maximize the transparency of the key mechanisms.

[9] This tractable 'CES aggregate' approach to input-output relationships is similar to the approach taken in recent quantitative trade models such as Caliendo and Parro (2012) and di Giovanni et al. (forthcoming).

Raw materials are assumed to be spread across the two countries symmetrically, in the sense that each country produces a nonintersecting continuum of n_1 distinct raw materials.[10] The two countries are able to trade without cost unless trade taxes are charged by one of the countries; I assume that trade taxes are imposed only by H without retaliation from F. Given the model's symmetry assumptions, under free trade, a share $1-\beta$ of each country's labour force engages in production of stage 2 goods; i.e. $L_2^H = L_2^F = (1-\beta)L$ if there is free trade.

Now say that the government of H sets the policy goal of 'moving up the value chain', which I characterize as a shift of a small proportion of the labour force from stage 1 production into stage 2 relative to the free-trade equilibrium.[11] In particular, I assume that H targets an industrial structure such that $dL_2^H/L = k > 0$. To accomplish this goal, I assume that H chooses between two simple trade policy instruments: a small import tariff on stage 2 or a small export tax on stage 1. I consider the implications of each of these policies in turn.

First say that H imposes an ad valorem import tariff $t_m \equiv \tau_m - 1$ on stage 2 products. Representing the share of varieties in stage k from country i in expenditure on that stage in country j as s_k^{ij}, a direct effect of the tariff is to increase s_2^{HH} at the expense of $s_2^{FH} = 1 - s_2^{HH}$, since:

$$s_2^{HH} = \frac{w^{(1-\beta)(1-\sigma_2)}}{w^{(1-\beta)(1-\sigma_2)} + \tau_m^{1-\sigma_2}}$$

The resulting changes in labour demand affect the relative wage, leading to changes in s_2^{HF}, as well as $s_1^{HH} = s_1^{HF} \equiv s_1^H$:

$$s_1^H = \frac{w^{1-\sigma_1}}{w^{1-\sigma_1}+1}, \quad s_2^{HF} = \frac{w^{(1-\beta)(1-\sigma_2)}}{w^{(1-\beta)(1-\sigma_2)}+1}$$

A second direct effect of the tariff is to generate government income, which I will assume is redistributed as a lump sum to H consumers: $G^H = \frac{\tau_m - 1}{\tau_m} s_2^{FH} Y^H$, where $Y^H = wL + G^H$ is total income in H. Setting w^F as the numeraire and writing $w^H \equiv w$, the equilibrium values of the endogenous variables L_2^H, L_2^F and w are determined by the system of equations of rank three equating total

[10] This assumption that the home country is a monopoly producer of a nontrivial set of raw materials essential for downstream production is motivated not only by the situation in the rare earths industry, but also by the leading position of China in a wide range of other raw materials sectors. For example, as documented by the British Geological Survey (2010), China was the world's leading producer in at least 37 categories of minerals and metals in 2008, in 12 of which it produced more than half of total world output.

[11] The 'smallness' assumption is valuable here because it allows for a straightforward analytical characterization of the implications of policy changes for real income via linear approximations around the free-trade equilibrium.

returns to factors in each country-sector with total revenue from sales:

$$
\begin{aligned}
L_1^F &= \beta \left(1 - s_1^H\right) \left(L^F + Y^H - \frac{\tau_m - 1}{\tau_m} \left(1 - s_2^{HH}\right) Y^H\right) \\
wL_1^H &= \beta s_1^H \left(L^F + Y^H - \frac{\tau_m - 1}{\tau_m}(1 - s_2^{HH})Y^H\right) \\
L_2^F &= (1-\beta) \left(\left(1 - s_2^{HF}\right) L^F + \frac{1}{\tau_m} \left(1 - s_2^{HH}\right) Y^H\right) \\
wL_2^H &= (1-\beta) \left(s_2^{HF} Y^F + s_2^{HH} Y^H\right)
\end{aligned}
$$

Differentiating with respect to τ_m at the free-trade equilibrium yields the following solutions for changes in the above three variables:

$$
\begin{aligned}
dw &= \frac{1}{2} \frac{(1-\beta)\sigma_2}{\beta\sigma_1 + (1-\beta)^2(\sigma_2 - 1) + (1-\beta)} d\tau_m > 0 \\
dL_2^H &= \frac{1}{4} \frac{\beta(1-\beta)\sigma_1\sigma_2 L}{\beta\sigma_1 + (1-\beta)^2(\sigma_2 - 1) + (1-\beta)} d\tau_m \\
&= \frac{1}{2}\beta\sigma_1 L dw > 0 \\
dL_2^F &= -dL_2^H < 0
\end{aligned}
$$

where the inequalities assume $d\tau_m > 0$.

Around the free-trade equilibrium, a small import tariff thus indeed moves labour in H into stage 2. Also, because an import tariff taxes the final stage of production, which embodies the output of both stages of the value chain, the total labour employed worldwide at each stage remains the same; in this sense, an import tariff on final goods leads to a pure 'production relocation' effect.[12]

Now instead consider an tax $t_x \equiv \tau_x - 1$ imposed by H on exports of stage 1 goods. Like an import tariff on processed goods, such a tax affects the expenditure shares s_k^{ij} for the stage of production that is taxed, both directly and via changes in relative wages:

$$
s_1^{HH} = \frac{w^{1-\sigma_1}}{w^{1-\sigma_1} + 1}, \quad s_1^{HF} = \frac{(\tau_x w)^{1-\sigma_1}}{(\tau_x w)^{1-\sigma_1} + 1}
$$

However, unlike the tariff studied above, τ_x affects expenditure shares in the untaxed sector not only via changes in the wage, but also by generating a wedge

[12] This is analogous to the production relocation effect in Venables (1987), who similarly investigates the effect of trade policy in a two-sector, two-country framework based on Krugman (1980).

between the raw materials price indices faced by firms in the two countries:[13]

$$s_2^H = \frac{\left(\left(\frac{P_1^H}{P_1^F}\right)^\beta w^{1-\beta}\right)^{1-\sigma_2}}{\left(\left(\frac{P_1^H}{P_1^F}\right)^\beta w^{1-\beta}\right)^{1-\sigma_2} + 1}, \quad \text{where } \frac{P_1^H}{P_1^F} = \left(\frac{w^{1-\sigma_1}+1}{(\tau_x w)^{1-\sigma_1}+1}\right)^{\frac{1}{1-\sigma_1}}$$

Solving for dw, dL_2^H and dL_2^F in an analogous way to above yields:

$$\begin{aligned}
dw &= -\frac{1}{2}\frac{\beta\sigma_1 - \beta(1-\beta)(\sigma_2-1)}{\beta\sigma_1 + (1-\beta)^2(\sigma_2-1) + (1-\beta)} d\tau_x \\
dL_2^H &= \left(\frac{1}{4}\frac{\beta(1-\beta)\sigma_1\sigma_2 L}{\beta\sigma_1 + (1-\beta)^2(\sigma_2-1) + (1-\beta)} + \frac{1}{4}\beta(1-\beta)L\right) d\tau_x \\
&= \frac{1}{2}\beta\sigma_1 L dw + (\sigma_1 + (1-\beta))\, d\tau_x > 0 \\
dL_2^F &= -dL_2^H + \frac{1}{2}\beta(1-\beta)L d\tau_x < 0
\end{aligned}$$

where the inequalities again assume $d\tau_x > 0$.

Like a downstream import tariff, an upstream export tax thus also moves factors in H into stage 2 production relative to the free-trade equilibrium. Indeed, comparing the above result for dL_2^H to that for an import tariff shows that an export tax shifts more H labour into stage 2 production than a tariff of the same magnitude; this is due to the additional effect of the input price wedge. A second difference from the case of an import tariff is that now $dL_2^H + dL_2^F \neq 0$; i.e. trade policy now distorts the global allocation of labour across stages, because of substitution away from higher-cost raw materials in stage 2 production in F.

What if the government of H is also interested in the real income implications of the two policies, for a given shift of labour into stage 2? The proportional effect of τ_m on real income in H is determined by the gain in nominal income via wage growth and government revenue, offset by the rise in the consumer price index in H, P_2^H, due to tariffs on F goods and higher nominal labour costs for firms in H:

$$\frac{dY^H}{Y^H} - \frac{dP_2^H}{P_2^H} = \left(dw + \frac{1}{2}d\tau_m\right) - \left(\frac{1}{2}d\tau_m + \frac{1}{2}dw\right) = \frac{1}{2}dw$$

Thus, for the tariff that achieves $dL_2^H = kL$, the associated gain in real income in H is $\frac{1}{2}dw = k/(\beta\sigma_1) > 0$.

Meanwhile, the implications of an export tax achieving $dL_2^H = kL$ on real

[13] For an illustration of the emergence of such a price wedge contemporaneously with rises in Chinese export taxes, see Price and Nance (2010) for the case of coke.

income in H are as follows:

$$\begin{aligned}\frac{dY^H}{Y^H}-\frac{dP_2^H}{P_2^H} &= \left(dw+\frac{1}{2}\beta d\tau_x\right)-\left(\frac{1}{2}dw+\frac{1}{4}\beta d\tau_x\right)\\ &= \frac{k}{\beta\sigma_1}\underbrace{+\left(\frac{1}{2}\beta-\frac{1}{4}\right)d\tau_x}_{revenue}\underbrace{-\frac{1}{4}\left(\frac{1-\beta}{\sigma_1}\right)d\tau_x}_{distortion}\quad\underbrace{-\frac{1}{4}\beta d\tau_x}_{pass-through}\\ &= \frac{k}{\beta\sigma_1}-\frac{1}{4}(1-\beta)\left(\frac{\sigma_1+1}{\sigma_1}\right)d\tau_x\end{aligned}$$

Given that $d\tau_x > 0$, this is an unambiguously smaller gain in real income than in the case of a downstream import tariff, which yields a proportional improvement in welfare of $k/\beta\sigma_1$. The difference between the two gains is due to three separate effects, highlighted in the equations above.

The first effect, of ambiguous sign, results from the fact that government revenue from the two instruments depends on the share of value added in the free-trade economy accruing from the raw materials stage. If the two stages are of equal importance to gross domestic product under free trade – i.e. if $\beta = \frac{1}{2}$ – then the revenue implications of a tax on either sector are identical.

The second effect, which is negative, derives from the aforementioned distortion to the world allocation of labour across stages induced by an export tax on raw materials but not an import tariff on processed goods. This effect decreases in σ_1 because this distortion is smaller if the raw materials from F are more substitutable for those in H, since stage 2 firms in F can more readily replace higher-cost raw materials from H with local raw materials rather than hiring more labour.

The final effect, also unambiguously negative, is due to the fact that part of the price increase resulting from the export tax is paid for by consumers in H via imports of processed goods from F. To better understand this pass-through effect, imagine instead an analogous model of two final goods with equal Cobb-Douglas consumption shares and identical production functions requiring only labour. In such a model, the effects for sectoral distribution and real income of an import tariff on one sector and an export tax on the other are identical. This is in part because the implications of each of the policy instruments for government revenue and production choices are the same. But it is also because of the key insight of Lerner's (1936) symmetry result: that an import tariff, which raises both relative nominal wages and local prices, and an export tax, which depresses relative nominal wages and causes price increases abroad, result in the same shift in a country's terms of trade. In the two-stage model here, this symmetry does not hold because the price increases resulting from an export tax instead accrue partly in H itself.

Thus, between the two instruments of industrial policy considered in this simple two-country symmetric context, this secondary criterion of maximization of real income conditional on industrial structure implies an unambiguous choice: an import tariff on the downstream industry. Governments' use of import tariffs rather than export taxes in order to shift the economy downstream is thus the outcome that one would expect from this model, *ceteris paribus*.

3 Data sources

3.1 Chinese trade policies

I have created a new dataset of Chinese trade policy by compiling detailed information on a set of several export policy instruments used by China. My measure of Chinese export taxes uses data on two instruments that may readily be combined into a single export tax equivalent – value-added tax (VAT) rebates for exporters and export duties – from 1997 to 2011. I have also collected data on all other measures identified as 'policies affecting exports' in the WTO's Trade Policy Reviews of China (see WTO 2006, 2008, 2010, 2012), including information on export licensing requirements, export quotas, state trading requirements and export prohibitions from 2002 to 2011, and data on products prohibited from being exported via processing trade for 2005 to 2011.[14]

In China, the calculation of the value-added tax bill of exporting firms depends on the VAT rebate rates for which their exported products are eligible. As noted by Feldstein and Krugman (1990), in a system where countries charge VAT on imports (as do China and other countries with value-added taxes), the nondistortionary policy is for countries to also fully rebate VAT on exports, so that the effective VAT rates charged on domestically produced and imported goods are equalized within each country. However, the official VAT rebate rates for Chinese exporters, which are set at the product level, are often lower than the rate of VAT charged (which is either 13% or 17% for most goods). Using the principle that a product afforded a full VAT rebate has an export tax rate of zero, a difference between a product's VAT and rebate rates thus constitutes a tax on exports (Feldstein and Krugman 1990, WTO 2008).

I therefore source information on VAT rebate policies, VAT rates and rebate rates at the product level from policy updates that are periodically disseminated to firms in electronic format from official sources. The set of these updates starting from 2002 is available at www.taxrefund.com.cn (a privately run web site), from which I source the data used in this paper. I extrapolate the 2002 product-level data back to 1997 using summaries of pre-2002 changes in rebate policies from Deloitte Touche Tomatsu (2005).

In addition to charging export taxes via incomplete rebates of VAT to exporters, China also directly imposes duties on some exported products; the lists of goods subject to export duties and the corresponding rates are published by China annually together with its schedule of import tariffs. Using the data on export duties and VAT export rebate policies, along with information on how both value-added taxes and export duties are charged to exporting firms,

[14]Some policies that are identified in the WTO reviews but that do not vary primarily at the sector level, such as tax concessions to foreign-invested enterprises, are not considered here.

I calculate a single total rate of export tax for each product and year.[15]

For some products, China requires that firms acquire a license before the good may be eligible for export, imposes quotas on the amount of the good that can be exported in a particular period, and/or allows only designated state-owned firms to export the good. The set of products subject to any of these three measures is announced annually in a single official notice. However, there are no regular notices of products subject to export prohibitions or prohibitions of exports via processing trade, the lists of which updated only on an ad hoc basis. I thus assemble data on these two measures based on these ad hoc official notices. For import tariffs, I use annual product-level information for 1997 to 2011 from the UNCTAD TRAINS database, and data on China's bound tariffs from WTO's Tariff Analysis Online facility. I annualize all trade policy measures by defining the policies prevailing on January 1 of each year as the data for that year.

I use this annual product-level data to create a panel of trade policies at the four-digit industry level, where industries are defined according to the Chinese industrial classification.[16] Since some policies are set at the eight-digit product level while others are set at finer levels of disaggregation, I first define all policies at the eight-digit level, and then take simple averages across the eight-digit products associated with each industry.[17] This results in either an average industry-level tax or tariff or an industry-level coverage ratio (for qualitative policies such as export licensing requirements).[18]

I collect data only for unilateral policy measures, and thus ignore a key change to Chinese export policy during the period of interest based on international agreement: the removal of textiles and apparel quotas associated with the end of the Multifiber Arrangement in the mid-2000s. To ensure that the results below do not also depend on this major multilateral episode, I simply drop all industries in the textiles supply chain (textiles, textile products, apparel and synthetic fibers) from the empirical analysis in Section 4. Including these industries has little effect on the estimates of interest below.

[15] A full explanation of this calculation may be found in Appendix 1. Data on export duties is missing for 1998; for this year, I use a linear interpolation of 1997 and 1999 product-level duty rates.

[16] I use this level of aggregation both because this paper is a study of industrial policy, and because actual Chinese nonagricultural tariffs and taxes vary mainly at the industry level: regressions of 1999 tariffs and 2011 export tax equivalents at the eight-digit product level on a full set of four-digit industry dummies yield an adjusted R^2 of 0.63 and 0.72 respectively.

[17] For export taxes, this involves calculating the tax equivalent of observed policies at the most disaggregate level for which information is available, and then taking a simple average of taxes across products within each eight-digit category. However, I code an eight-digit category as subject to a qualitative measure such as a licensing requirement if any of its constituent products are subject to such a measure.

[18] For quotas, I use information only on whether or not a product is subject to a quota, rather than data on the size of quotas, and so my industry-level quota variable is a coverage ratio.

3.2 Raw materials industries

In line with the theoretical framework above, I code Chinese nonagricultural industries as upstream or downstream according to a simple two-stage value chain, using a new classification of products into raw materials and processed goods. Defining such a variable amounts to determining a dividing line somewhere in the industrial value chain turning products of the extractive industries (e.g. logs, ores or crude oil) into goods for final consumption (e.g. envelopes, machines, or plastic toys). While it might initially seem natural to draw this line immediately after the extractive stage, some manufacturing industries are also producers of goods considered to be raw materials (e.g. paper pulp, pig iron, or polymers).

I choose a particular perspective on the concept of 'raw materials' in order to define them here: that they are goods that are not yet describable as either 'articles' or 'parts'. Conveniently, a classification of products according to this perspective is already implicitly embedded in the Harmonized System (HS) classification of traded goods. The headings of many major categories of the HS system (e.g. "Plastics and articles thereof", "Wood and articles of wood"; "Textiles and textile articles") imply a progression from a particular raw material to articles made from this material, which is then reflected in the order in which the six-digit HS products are numbered. I thus define an HS-based definition of raw materials based on the apparent dividing line between the raw material and "articles thereof" within each such category of the HS classification, with other HS categories classified as entirely constituted of either raw materials (e.g. "Ores, slag and ash") or processed goods (e.g. "Clocks and watches and parts thereof").[19] I define the classification only for nonagricultural products,[20] where the 'raw materials'-'processed goods' dichotomy is clearest.[21] I then define each four-digit industry as a 'raw materials industry' or a 'downstream industry' based on whether more than half of the products associated with that industry are raw materials by this definition.[22]

Reassuringly, this industrial classification is highly correlated to two possible alternative definitions based on other commonly used measures. A second definition might use the United Nations Broad Economic Categories (BEC) classification, which categorizes six-digit HS products as consumption goods, capital goods or intermediate goods according to the System of National Ac-

[19] See Appendix 2 for a more detailed description of this product-level classification.

[20] In particular, I omit all goods covered by the WTO's Agreement on Agriculture, which includes both primary agricultural products and processed agricultural goods such as food, beverages and tobacco products. I also omit fisheries and their products, which are mostly found within the food and beverages sectors, as well as key inputs to agriculture (fertilizers and pesticides).

[21] In agriculture, many products of primary industries, such as fruits, vegetables, eggs and milk, are also often consumed as final goods, and much processing is done in service industries (e.g. restaurants) or as home production.

[22] This results in one metal smelting industry, antimony smelting, being classified as a downstream sector while all other metal smelting industries are classified as producing raw materials, so I recode antimony smelting as a raw materials industry by hand. All results below are robust to putting this industry in either category.

counts. If I define raw materials products as all intermediate goods other than those specifically identified as "parts and accessories", and create an industry-level definition as above, the correlation between the HS and BEC classifications of raw materials industries is 0.69. Alternatively, using the 'liberal' measure of homogeneous goods provided by Rauch (1999), who identifies products as homogeneous if they are either sold on organized exchanges or reference-priced, yields a correlation coefficient with my measure of raw materials of 0.77.[23] The main results below are robust to using any of the three definitions.[24]

4 Empirical analysis

4.1 Import tariffs and export taxes

China entered WTO in December 2001, and as a condition of its WTO accession, agreed to permanently set its import tariffs at or below levels agreed in international negotiations. For almost all industries, the average bound tariff rate was the same or lower as China's applied tariffs in 1999 (the year in which agreement on its WTO accession was reached), and so tariff cuts were required in order to meet this condition. The schedule for implementation of China's bound tariffs extended from 2000 to 2010, with most tariffs to be reduced to their bound rates by 2005.

As shown in Figure 1, after a period between 1997 and 2000 in which China's nonagricultural tariffs changed relatively little, its average industry-level applied tariffs fell quickly to their bound levels (represented in Figure 1 by a dotted line) between 2000 and 2005. China's mean import tariff across four-digit industries decreased from 14% in 1997 to 8% in 2011. Importantly, these tariff cuts also involved a compression of the Chinese tariff schedule: Figure 1 shows that the standard deviation of China's applied tariffs across industries declined along with the mean.

Figure 2 displays the evolution of the mean and standard deviation across industries of the export tax equivalents of China's export VAT rebate policies and export duties between 1997 and 2011; the dotted line represents export taxes due to VAT rebate policies alone. According to Cui (2003), a policy of full VAT export rebates was adopted at the time of the introduction of VAT in 1994. However, widespread forgery of VAT invoices subsequently resulted in excessive fiscal obligations for the central government, and official rebate rates were significantly reduced as a consequence. This led to the high average export tax equivalents of rebate policies at the beginning of the period pictured in Figure 2. Rebate rates were raised again in the late 1990s in response to the

[23] The Rauch classification is often used in empirical analyses of international trade as a measure of product differentiation; it is thus a notable finding that the Rauch measure also appears to proxy for the position of an industry (or product) in the value chain.

[24] I do not use either of these classifications as my primary definition of raw materials because the BEC classification does not separately identify parts and accessories of consumer goods, and because some products of extractive sectors are neither sold on organized exchanges nor reference-priced.

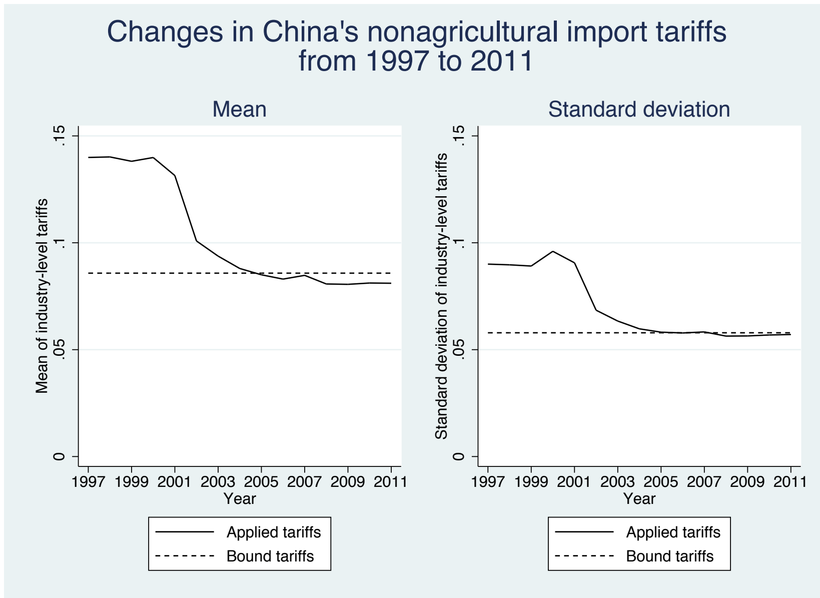

Figure 1: Changes in China's industry-level nonagricultural applied import tariffs 1997-2011

negative export demand shock associated with the Asian financial crisis, and China's export VAT rebate policy was then relatively stable until 2003.

However, an official notice in October 2003, less than two years after China's WTO accession, announced a significant reform of rebate rates to be effective in January 2004.[25] This was the first in a series of notices amending China's export rebate rates over the following several years. Figure 2 shows that these changes differed from the amendments to VAT rebate rates before China's WTO accession, in the sense that while earlier reforms of rebate rates tended to keep variation across industries in export taxes relatively low (even when average export taxes were high), the 2003 notice and subsequent reforms consistently increased the variation in export taxes across industries.

As shown by the solid line in Figure 2, which takes both policies into account, this rise in the variation in export tax incidence was reinforced by the application of export duties to some products. This is because since the mid-2000s, it is the goods with the highest export taxes from VAT rebate policy (via VAT rates of 17% and rebate rates of zero) that have increasingly tended to be subject to export duties, which themselves averaged approximately 15% at the eight-digit level, conditional on being nonzero, in 2011. Inclusive of both policies, the standard deviation across industries of China's export taxes rose from 0.027 to 0.107 between 2003 and 2011, having never exceeded 0.045 during the previous

[25] *Caizheng bu, guojia shuiwu zongju caishui* (2003) no. 222.

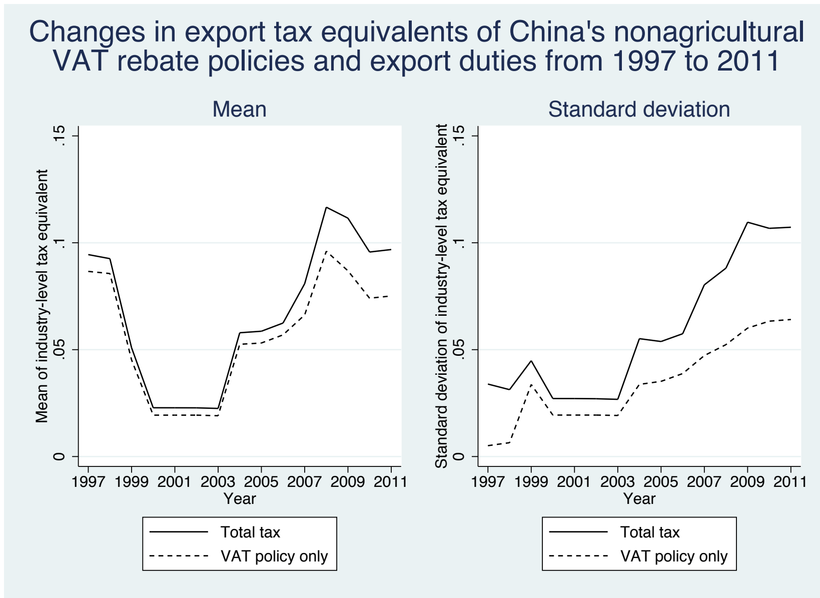

Figure 2: Changes in average industry-level tax equivalents of China's nonagricultural export VAT rebate policies and export duties 1997-2011

six years.

Because the agreed schedule for implementation of China's bound tariffs extended from 2000 to 2010, 1999 represents the final year in which Chinese tariffs were in principle unconstrained by its WTO agreements. Thus, to represent the tariff reductions associated with China's WTO entry, I define the variable $max\{tar_{bound} - tar_{1999}, 0\}$, where $tar_{bound} - tar_{1999}$ equals the difference between China's 1999 applied tariffs and its bound tariffs.[26] This variable corresponds very closely to the actual difference between China's applied tariffs in 1999 and 2011, with a correlation coefficient of 0.98 between the two variables at the four-digit industry level. I also define a long difference in total export taxes, including both export VAT rebate policies and export duties, between 1999 and 2011: i.e. $tax_{2011} - tax_{1999}$.

Figure 3 presents a scatter plot of these two variables at the industry level. The plot shows that the industries with the highest growth in export taxes from 1999 to 2011 tended to be those with particularly small reductions in import tariffs due to WTO accession, and vice versa.[27] The right-hand panel of Figure 3 indicates the top quartile of export tax rises and the bottom quartile of import

[26]Only seven industries were already subject to tariffs strictly below bound levels as of 1999; six of these were raw materials industries.

[27]The correlation between the two variables is 0.42, and a regression of export tax rises on the tariff reductions associated with China's WTO entry, clustering at the level of the sectors in China's 2007 input-output table, results in a statistically significant coefficient of 0.75.

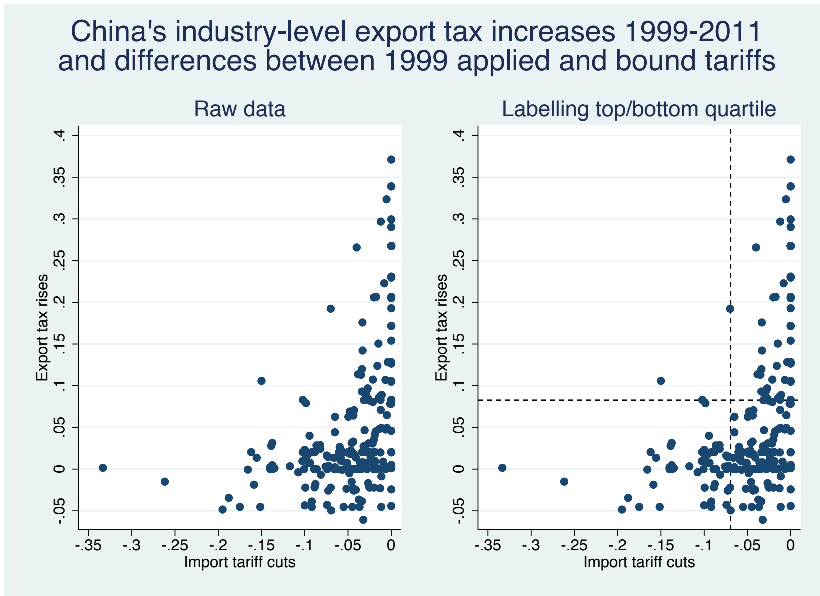

Figure 3: Export tax rises 1999-2011 and tariff cuts associated with WTO accession by industry

tariff cuts (i.e. the largest tariff cuts in absolute value) with dotted lines. The upper left-hand part of the scatter plot, representing industries in the highest 25% of both export tax growth and import tariff reduction, is almost empty.

Figure 4 makes clear that the relationship between the two variables is mainly due to variation across the value chain, by separately plotting raw materials and downstream industries.[28] Almost all of the industries experiencing the largest cuts in tariffs were downstream sectors, while raw materials industries make up the vast majority of the sectors in the top quartile of export tax increases during this period. The relationship between tariffs, taxes and this simple measure of the value chain is further developed in Tables 1 and 2.

I first show that China's 1999 applied tariffs were systematically higher for downstream industries than for raw materials producers. A simple regression of 1999 tariffs on a dummy variable for downstreamness shows that tariffs on downstream sectors were 10 percentage points higher on average than those on raw materials sectors in 1999 (Column (1) of Table 1). Moreover, according to the R^2 of this regression, this dummy explains almost 30% of the across-industry variation in China's 1999 tariff schedule. The regression in Column (2) of Table 1 divides downstream industries into producers of capital goods and non-capital goods, and shows that both of these groups of industries had significantly higher

[28]Figure A1, in Appendix 3, further breaks down this data by separating downstream sectors into producers of capital goods and other processed goods industries.

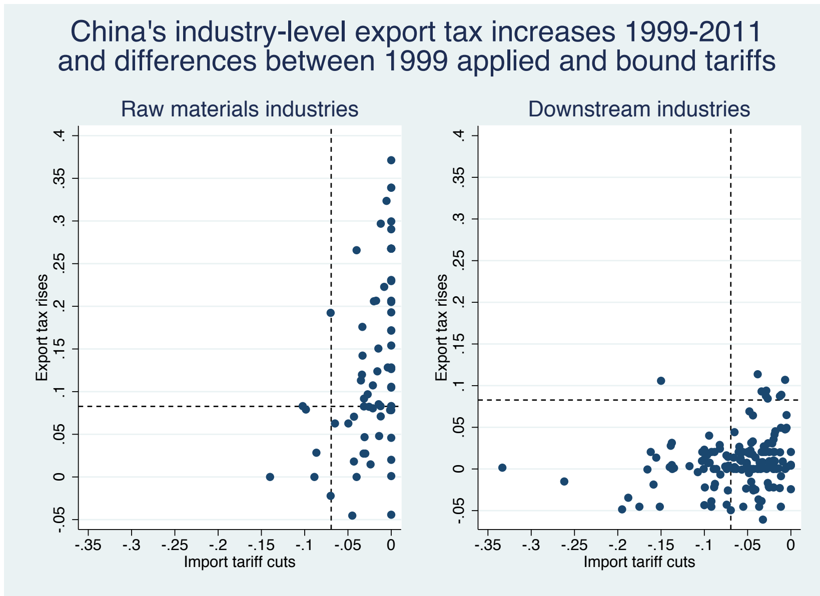

Figure 4: Export tax rises 1999-2011 and tariff cuts associated with WTO accession by industry

tariffs as compared to raw materials sectors.[29]

This relationship is not simply a product of a single category of raw materials or downstream industries with particularly low or high tariffs. Panel A of Table A1 (see Appendix 3) shows that if processed goods industries are linked to their primary raw materials using industry names and descriptions (e.g. "Manufacture of synthetic rubber", "Manufacture of metal products") and China's 2007 input-output table, all seven of the resulting materials categories had higher tariffs on downstream sectors in 1999.[30]

Since the tariff cuts associated with China's WTO accession served to compress its tariff schedule (see Figure 1), it is unsurprising that import tariffs on downstream industries were reduced by more than those on raw materials. This relationship is established for both capital-producing industries and other downstream sectors in Column (3) of Table 1, which shows that approximately 40% of the difference between nominal tariffs on downstream and upstream sectors was eliminated by WTO-related tariff cuts. Moreover, according to Panel B of

[29] An industry is defined as a capital goods industry if more than half of its six-digit HS products are defined as capital goods or parts of capital goods according to the BEC classification discussed in Section 3.2.

[30] The categories are chemicals, leather, metals, nonmetallic minerals, plastics, rubber and wood. Industries not allocated to any particular material include fuels, electronics, instruments and 'other manufacturing' sectors; these industries are not included in any of the regressions in Table A1.

Table 1: Chinese import tariffs on raw materials vs downstream industries

	(1) Tariffs 1999	(2) Tariffs 1999	(3) Tariff cuts	(4) Tariff cuts	(5) ERP 1999	(6) ERP 1999	(7) ERP cuts	(8) ERP cuts
Downstream	0.102***				0.292***			
	(0.0153)				(0.0517)			
Downstream (capital)		0.0673***	-0.0282***	-0.0272***		0.151***	-0.0457**	-0.0609***
		(0.0131)	(0.00714)	(0.00842)		(0.0376)	(0.0222)	(0.0212)
Downstream (other)		0.126***	-0.0481***	-0.0371***		0.395***	-0.129***	-0.115***
		(0.0170)	(0.00934)	(0.0118)		(0.0608)	(0.0318)	(0.0379)
US non-MFN vs MFN 1999				-0.0263				
				(0.0277)				
Japan non-MFN vs MFN 1999				-1.019***				
				(0.347)				
US non-MFN vs MFN 1999 (ERP)								-0.0121
								(0.0279)
Japan non-MFN vs MFN 1999 (ERP)								-0.788***
								(0.212)
Constant	0.0638***	0.0638***	-0.0212***	-0.0131**	0.0609*	0.0609*	-0.0210	-0.0108
	(0.0123)	(0.0123)	(0.00559)	(0.00576)	(0.0312)	(0.0312)	(0.0156)	(0.0138)
Observations	223	223	223	218	223	223	223	218
Clusters	55	55	55	55	55	55	55	55
R^2	0.298	0.374	0.173	0.231	0.165	0.251	0.083	0.123

Robust standard errors are clustered at the level of the sectors in the 2007 Chinese input-output table.
Small p-values are represented by *** (less than 1%), ** (less than 5%) or * (less than 10%).

Table A1, tariff reductions were higher for downstream industries in the case of six of the seven materials supply chains defined above.

Of course, if Chinese trade policy is seen through the lens of its effect on domestic industrial structure, then when studying the consequences of China's entry into WTO, it is also important to take account of potential changes in other countries' demand for Chinese products. For example, if China's WTO accession involved similar changes to both the schedule of Chinese tariffs and the pattern across industries of other countries' tariffs on Chinese goods, then WTO membership might have had little effect on China's industrial structure in practice, removing the impetus for policy substitution. I thus attempt in Column (4) to control for changes in the import tariffs faced by China abroad due to its WTO accession.

In practice, China already held most-favoured-nation (MFN) status in each of its main trading partners – the US, EU and Japan, which together accounted for more than two-thirds of Chinese exports (excluding Hong Kong) as of 1999 – at the time of its entry into WTO. This means that the schedule of tariffs that it faced in these countries did not change after its WTO membership. However, China's MFN status was renewed annually in the US Congress before 2001, with some associated uncertainty, and Pierce and Schott (2013) find that the difference between US MFN tariffs and the non-MFN tariffs that would otherwise have prevailed for China has explanatory power for the evolution of US manufacturing employment after 2001. I thus include the Pierce and Schott (2013) US tariff variable as a control in the baseline regression, using US tariffs from 1999. Such a schedule of higher-than-MFN tariffs does not exist for the EU, which anyway made China's MFN status permanent in 1980. However, I am able construct an analogous variable for Japan, and I use both of these variables as controls in the specification in Column (4). Including these variables has little effect on the relationship between Chinese tariff reductions and the value chain.

The estimated magnitudes of the differences between downstream and upstream tariff cuts in Columns (3) and (4) are relatively small, approximately 3 to 5 percentage points. However, as noted by Corden (1966) and others, the existence of 'tariff escalation' of this kind means that effective rates of protection (ERP) for downstream sectors are much larger than their nominal tariffs in general. I therefore calculate effective rates of protection implied by Chinese tariffs using the conventional formula of Corden (1966) and data from China's 2007 input-output table. Column (5) of Table 1 shows that the effective rate of protection on downstream industries was actually 29 percentage points higher than protection for raw materials sectors in 1999 according to this measure. According to the estimates in Column (6), this estimate was composed of ERPs that were 15 points higher for capital goods sectors, and 39 points higher for other downstream industries, as compared to upstream rates of protection. Column (7) of Table 3 then suggests that on average, approximately one-third of this protection was removed by compression in China's tariff schedule associated with its WTO accession. This result remains similar when controlling for increased export opportunities due to decreases in tariff uncertainty in the US and Japan, now in terms of effective rates of protection (Column (8)).

Table 2 demonstrates that a strong link also exists between Chinese export taxes and the value chain. First, Column (1) shows that Chinese export taxes were 17.5 percentage points higher for raw materials industries than for downstream sectors in 2011, a relationship explaining 57% of the variation in these taxes. Column (2) confirms that this gap was of similar magnitude for both industries producing capital goods and other downstream industries. The results in column (3) then show that this difference in the mean tax rate across the value chain was mainly due to a rise in raw materials taxes between 1999 and 2011 that was larger by approximately 12.6 percentage points on average. Thus, while the extent of tariff escalation declined between 1999 and 2011 as a result of China's WTO-related tariff cuts, the gap between export taxes on these two stages of the value chain widened during the same period. In fact, export tax rises during this period accrued almost entirely to upstream industries, while the mean export tax on downstream sectors increased by only one percentage point. More than half of this increase was due to changes in the export tax equivalents of VAT rebates for exporters, as shown in Column (4), which displays the results of a regression dropping export duties from the tax measure used on the left-hand side.

This relative rise in taxes on raw materials was not simply due to changes in policy for goods in which China already lacked a comparative advantage. To confirm this, before calculating industry-level tax rates, I drop all products for which China was a net importer in 2003 (a year in which much of China's tariff liberalization was already complete, but its post-WTO export restrictions had not yet been imposed) before calculating average export taxes at the industry level, and then rerun the regression from Column (3) of Table 2. The relevant coefficient estimates, shown in Column (5), remain very similar after this restriction is imposed on the data. The regression in Column (6) controls for changes in the US and Japanese tariff policies facing China, as in Column (4) of Table 1, and again returns similar results to those in Column (3) of Table 2. Finally, Table A2 in Appendix 3 separately considers the change in export taxes between 1999 and 2011 for the seven materials categories defined above, showing that export taxes increased by more for raw materials as compared to downstream industries for six of seven of these materials supply chains. The only supply chain for which this was not the case was that of the one material (rubber) for which tariff escalation did not decline as a consequence of China's WTO accession.

Finally, Table 3 summarizes the relationships documented above by explicitly considering the extent to which changes in effective protection due to tariff cuts have been offset by rises in export taxes. To do this, I calculate ERPs resulting from both import tariffs and export taxes, again as in Corden (1966); in this measure, an export tax on an industry constitutes negative protection, while an export tax on an industry's inputs serves to protect that industry from foreign competition. Columns (1) and (2) regress industry-level ERPs inclusive of both 1999 export taxes and 1999 export tariffs on two different variables: the ERPs implied by the bound tariff schedule and 1999 export taxes, and the ERPs

Table 2: Chinese export taxes on raw materials vs downstream industries

	(1) Taxes 2011	(2) Taxes 2011	(3) Tax rises	(4) Tax rises via VAT policy	(5) Tax rises	(6) Tax rises
Downstream	-0.175***					
	(0.0258)					
Downstream (capital)		-0.204***	-0.126***	-0.0737***	-0.109***	-0.105***
		(0.0255)	(0.0231)	(0.00921)	(0.0141)	(0.0172)
Downstream (other)		-0.154***	-0.127***	-0.0756***	-0.112***	-0.0998***
		(0.0257)	(0.0239)	(0.0108)	(0.0150)	(0.0171)
US non-MFN vs MFN 1999						-0.0764**
						(0.0362)
Japan non-MFN vs MFN 1999						-0.488
						(0.684)
Constant	0.219***	0.219***	0.136***	0.0838***	0.120***	0.141***
	(0.0244)	(0.0244)	(0.0229)	(0.00887)	(0.0136)	(0.0185)
Observations	223	223	223	223	195	218
Clusters	55	55	55	55	54	55
R^2	0.574	0.610	0.464	0.483	0.433	0.473

Robust standard errors are clustered at the level of the sectors in the 2007 Chinese input-output table.
Small p-values are represented by *** (less than 1%), ** (less than 5%) or * (less than 10%).

Table 3: Chinese export tax rises, import tariff cuts and changes in effective protection

	(1) ERP from bound tariffs and 1999 taxes	(2) ERP from bound tariffs and 2011 taxes	(3) ERP from bound tariffs and 1999 taxes	(4) ERP from bound tariffs and 2011 taxes
Total ERP 1999	0.688***	0.871***	0.679***	0.802***
	(0.0436)	(0.108)	(0.0444)	(0.0801)
US non-MFN vs MFN 1999 (ERP)			0.00843	0.114***
			(0.0181)	(0.0396)
Japan non-MFN vs MFN 1999 (ERP)			-0.822***	-1.128***
			(0.297)	(0.200)
Observations	223	223	218	218
Clusters	55	55	55	55
R^2	0.799	0.597	0.809	0.626

Robust standard errors are clustered at the level of the sectors in the 2007 Chinese input-output table.

Small p-values are represented by *** (less than 1%), ** (less than 5%) or * (less than 10%).

resulting from bound tariffs and 2011 export taxes. Column (1) suggests that the imposition of bound tariffs narrowed the distribution of protection across industries so that one additional percentage point of protection in 1999 was associated with only 0.69 additional percentage points of protection under the schedule of bound tariffs. However, Column (2) indicates that moving from 1999 to 2011 export taxes shifts this number to 0.87, restoring more than half of the gap between the pre-WTO and post-WTO patterns of protection across industries documented in the previous regression. In Columns (3) and (4), I again use controls for US and Japanese policy uncertainty in order to account for changes in trade policies facing China abroad; the resulting estimates suggest that conditional on these control variables, approximately 40% of the loss in protection from WTO tariff cuts was restored by export taxes on average.

4.2 Other export policies

A key concern with the above analysis of Chinese export taxes is that these represent only a subset of Chinese export policies. It might be that instead of increasing the total restrictiveness of China's export regime, rising export taxes simply replaced other nontax export policies, such as export licenses, in a process of 'taxification' of export restrictions. Alternatively, increases in export taxes might not have been effective in practice because of the potential for substitution of the exports of affected products into China's export processing regime.

I address these issues in two ways. First, I do so directly, by collecting contemporaneous data on all other instruments identified as 'policies affecting exports' in the WTO's Trade Policy Reviews of China (as discussed in Section 3.1), and checking whether or not the changes in these policies have been coordinated with rises in export taxes. Second, I document the observed relationship between Chinese export taxes and China's export patterns over the period of study, looking for indirect evidence of changes in export policy in actual economic outcomes.

Both of the export policies discussed so far primarily affect only the approximately half of Chinese exports (by value) that do not leave the country via processing trade, the system by which inputs from abroad may be imported duty-free, processed and then re-exported, again duty-free. However, the list of products ineligible to be exported via processing trade also changed significantly after 2004, when a notice was published declaring that "[a]djustments and updates will be made annually to the list of prohibited processing trade goods ... in accordance with the country's economic development and industrial policies."[31]

To check whether or not the changes in this policy have been coordinated with rises in export taxes, I chart increases in the incidence of export processing prohibitions separately for products in different quantiles of total export tax growth. The results of such an analysis at the six-digit product level are shown

[31] *Shangwu bu, haiguan zongshu, guojia huanjing baohu zongju gonggao* (2004) no. 55.

in Figure 5, which divides products into three groups according to the rises in their export taxes between 1999 and 2011, and plots the changes in the proportion of each group included in the list of goods prohibited from export via processing trade.[32]

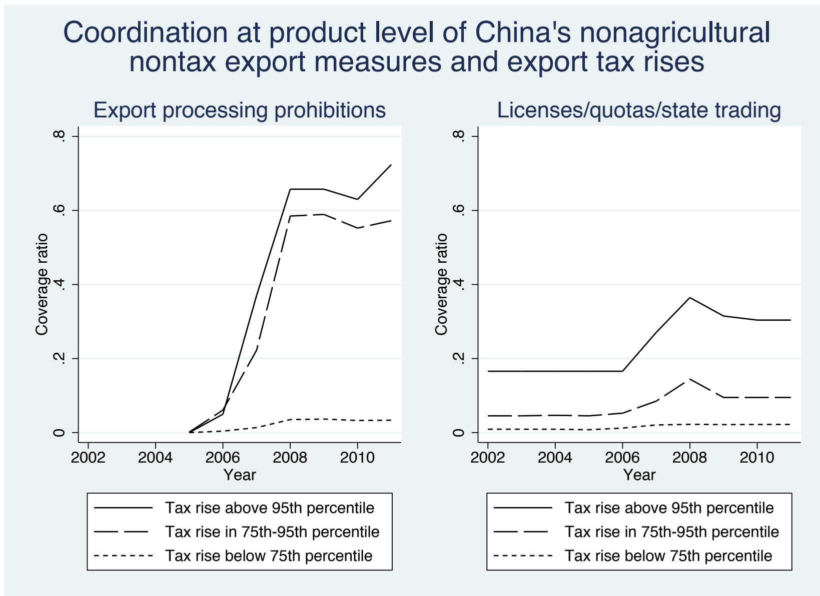

Figure 5: Coordination at product level of export tax rises 1999-2011 and other export policies

Figure 5 shows that the largest increases in the incidence of export processing bans occurred for goods that were also subject to the highest rises in export taxes. While only a miniscule proportion of products were prohibited from export via processing trade as of 2005, this share had risen to 72% for goods in the top 5% of export tax increases, 57% for the next 20% and 3% for the bottom 75% of products by 2011. This suggests that VAT export rebate policies, export duties and export processing prohibitions have been applied in a coordinated way since China's WTO accession.[33]

As discussed in Section 3.1, for some products, China requires that firms acquire a license before the good may be eligible for export, imposes quotas on the amount of the good that can be exported in a particular period, and/or allows only designated state-owned firms to export the good. Figure 5 shows

[32]This analysis is conducted at the six-digit level because concordances of product classifications over time are available for six-digit but not eight-digit goods. A six-digit product is defined as prohibited from processing trade in a given year if any of the eight-digit goods within that six-digit category are included on the list of prohibited products.

[33]In fact, product-level changes in VAT rebate policies and processing trade eligibility have often been made in the same official notice.

that changes to these policies also occurred in concert with rises in export taxes. Among six-digit products whose total export tax increase between 1999 and 2011 was in the top 5%, the share of goods subject to license requirements, quotas or state trading increased from 17% in 2002 to 30% in 2011. The other products in the top quartile of export tax rises saw a rise in the coverage ratio of these policies from 5% to 9%, while only 2% of the bottom 75% of goods were covered by such an export restriction in 2011, a rise of one percentage point from 2002.[34]

An indirect way to check that changes in the export tax equivalents calculated above represent effective changes in Chinese export policies is to consider whether export tax rises have been associated with shifts in China's actual export patterns. I begin by using information on trade in quantities from the CEPII BACI dataset, which translates UN COMTRADE data on trade flows into a single unit of quantity (tons). CEPII BACI is available only until 2010, and so I study a panel of Chinese export data spanning 1999 to 2010.

Column (1) of Table 5 displays the results of a panel regression with log exports (in tons) on the left-hand side and export tax equivalents on the right-hand side, both measured at the industry-year level. As controls, I include the 'threat point' US and Japanese tariffs to which China is subject in each year, positing that these are the countries' non-MFN tariffs until 2000 and their MFN tariffs afterwards. I also control for both industry and year fixed effects. The estimated coefficient on export taxes indicates that a rise in export taxes of one percentage point is associated with growth in exports that was slower by approximately 4.8 percentage points over the course of the 11 years of data. In column (2), I check the robustness of this estimate to a long-difference specification using data from 1999 and 2010, now simply including the difference between non-MFN and MFN tariffs in both Japan and the US as controls. The coefficient of interest remains similar to that in column (1) and is again statistically significant.

Columns (3) and (4) both include industry-level rises in export taxes between 1999 and 2010 on the right-hand side, but use data on log export quantities from two different periods on the left-hand side: 1999 to 2003, when there was little change in the variation in export taxes across industries (as shown in Figure 2 in Section 4.1), and 2003 to 2010. The former regression is thus effectively a placebo test of the result that changes in export taxes have been associated with changes in export quantities across industries. Reassuringly, the relevant coefficient estimate is statistically different from zero only for the period from 2003 to 2010; the results thus do not appear to have been driven by preexisting industry-level trends.

I next draw upon a different source of data – industry-level tabulations of China's annual firm-level survey of industrial production – to evaluate whether rising export taxes have also been associated with diversion of firms' output

[34] Because I observe these measures only as dummy variables, this depiction of these policies does not take any changes in the strictness of licensing requirements or the size of quotas into account, such as the much-publicized decrease in China's rare earths export quota in 2010. I also omit full export prohibitions (i.e. not only via processing trade), which affect only a tiny subset of products, from the analysis here; the results are unchanged if these are included.

Table 4: Chinese export tax rises, export growth and exports as a share of sales

	Log exports				Share of exports in sales			
	(1) Levels Panel	(2) Difference 1999-2010	(3) Difference 1999-2003	(4) Difference 2003-2010	(5) Panel Levels	(6) Difference 2000-2007	(7) Difference 2000-2003	(8) Difference 2003-2007
Export tax	-4.843***				-0.290***			
	(0.623)				(0.105)			
Δ Export tax		-5.102***	-0.792	-4.398***		-0.246**	0.142	-0.387***
		(1.406)	(1.017)	(1.614)		(0.116)	(0.161)	(0.103)
US threat point tariff	-0.356				-0.0436			
	(0.424)				(0.0336)			
US non-MFN vs MFN 1999		0.244	-0.0133	0.217		0.0551	0.0583**	-0.00312
		(0.597)	(0.427)	(0.429)		(0.0425)	(0.0254)	(0.0342)
Japan threat point tariff	0.681				0.957**			
	(6.215)				(0.437)			
Japan non-MFN vs MFN 1999		-2.803	5.767	-7.837**		-2.140***	-0.383	-1.757***
		(9.539)	(7.111)	(3.839)		(0.500)	(0.462)	(0.419)
Import tariff					-0.454**			
					(0.181)			
Δ Import tariff						-0.425**	-0.155	-0.269**
						(0.187)	(0.150)	(0.104)
Year FE	YES				YES			
Industry FE	YES				YES			
Observations	2,603	211	211	217	1,716	216	216	216
Clusters	55	55	55	55	54	54	54	54
R^2	0.382	0.109	0.009	0.112	0.067	0.101	0.014	0.140

Robust standard errors are clustered at the level of the sectors in the 2007 Chinese input-output table.
Small p-values are represented by *** (less than 1%), ** (less than 5%) or * (less than 10%).

towards the domestic market.[35] To do this, I use reported sales by value and export value (both in current Renminbi) to calculate the proportion of exports to foreign markets in firms' sales in each industry and year. I have data on both sales and exports by industry from 1999 to 2007, but because many industries are missing from the data in 1999, I use data only for 2000 to 2007 in the analysis here.

Column (5) of Table 5 displays the results of a panel regression with the share of exports in sales on the left-hand side and export taxes on the right-hand side. The regression's controls are as in column (1), but also include import tariffs because of the potential effects of tariff cuts on domestic sales. The estimated impact of an increase in export taxes of one percentage point is to decrease the share of exports in total sales by 0.29 percentage points, a statistically significant result. When this regression is re-estimated in long differences using 2000 and 2007 data, with controls analogous to those in column (2), the estimated coefficient changes little and maintains its statistical significance (see column (6)). Finally, columns (7) and (8) show the results of dividing the left-hand side into two time periods, 2000 to 2003 and 2003 to 2007; only in the latter period is the rise in export taxes from 2000 to 2007 associated with a negative and statistically significant decline in the share of exports in total sales. Again, this robustness check suggests that the results are not simply the product of other trends originating prior to the observed growth in the variation of export taxes across industries.

5 Conclusion

In this paper, I have examined the question of whether the worldwide decline in tariff escalation during the GATT/WTO era has meant an end to industrial policies intended to move countries into downstream sectors. I have proposed that an alternative to imposing import tariffs on downstream industries is to impose export restrictions on upstream sectors, and have found evidence of such policy substitution in China around the time of its WTO accession. In particular, declines in protection on downstream industries due to import tariff cuts associated with China's WTO accession were partly offset by growth in export taxes on raw materials between 1999 and 2011. Moreover, rises in export taxes have been coordinated with changes in various other export policies, and are associated with falls in Chinese exports of raw materials and diversion of sales of raw materials to the domestic market.

To what extent would China's post-WTO policy of high export restrictions on raw materials be a feasible industrial policy in other countries? China's situation with respect to raw materials production is an exceptional one, thanks to its large size, capital stock and land endowments. In practice, many countries are net importers of most of their raw materials, and very few countries produce a large proportion of world output in more than one or two raw materials sectors.

[35] This data, collected by China's National Bureau of Statistics, includes all non-state industrial firms with sales above five million Renminbi and all state-owned industrial firms.

For most countries, then, a policy of restrictions on raw materials exports would probably have a limited aggregate effect.

This is not to say, of course, that substitution for import tariffs via *any* policy instrument is infeasible outside of China. For example, a subsidy to imports of raw materials could have an analogous effect to the export restrictions discussed here. China itself may have taken this approach for sectors in which it lacks a substantial raw materials endowment, through its post-WTO policy on state-supported outward foreign direct investment:

> Preferential export credit interest rates as provided by the Export-Import Bank of China shall apply to the special loans for overseas investments [which] shall be mainly used for supporting the following key overseas investment projects: (1) overseas resource development projects which can make up for the relative insufficiency of domestic resources...[36]

According to Wang (2012), more than 70% of Chinese industrial FDI between January 2003 and June 2010 was invested in raw materials sectors; to what extent this investment was supported by preferential credit and other government support is unknown.[37]

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A1 Calculation of total export taxes

A1.1 Export duties

According to Chinese regulations, for a published export duty rate t_x^k for a product k (hereafter this k is dropped), the tax owing on export sales of that product is calculated according to:

$$t_x \cdot \frac{exportsales^{FOB}}{t_x + 1}$$

Here, the FOB price is the price at which goods are sold abroad (i.e. the price of goods *after* clearing customs). This implies a tax rate of t_x on export sales in terms of pre-duty prices.

A1.2 VAT export rebates

For each product and time period, the data specifies a VAT rate, a rebate rate and the type of rebate policy applied to the product. Different policy types imply different calculations of equivalent export taxes based on the associated Chinese regulations (see e.g. Chan 2008, Deloitte Touche Tomatsu 2005).

First note that firms whose sales are entirely domestic normally pay VAT on value added (at rate t_v^k for product k), by paying VAT on sales while claiming credit for the VAT paid on purchases of inputs; i.e. they are charged for 'output

VAT' while claiming credit for 'input VAT'. This corresponds to the following formula (again omitting k):

$$t_v \cdot \frac{sales}{t_v + 1} - inputVAT$$

A1.2.1 Nonzero rebate, not tax-exempt

Consider a firm which produces the goods it sells abroad, and which exports in a single product category for which the rebate rate is not zero. Such a firm may calculate its VAT payable as the difference of output VAT on local sales and input VAT on local purchases as above, plus a third term d:

$$d = (exportsales^{FOB,k} - \sum_{k'} bonded^{k'})(VATrate^k - rebaterate^k)$$

where $bonded^{k'}$ corresponds to purchases of imported inputs in sector k' that do not go through customs, which may be nonzero if the firm participates in processing trade.

Say that the firm does not purchase bonded imports, and that its input purchases may be unambiguously allocated across inputs used for goods sold domestically and inputs used for exported goods. Then the tax applicable on exports is:

$$exportsales^{FOB,k} \cdot (VATrate^k - rebaterate^k) - inputVAT$$

Under the assumption that the nondistortionary policy is a full rebate of VAT on exports, this would imply an export tax bill on a given product with VAT rate t_v and rebate rate r of:

$$(t_v - r) \cdot exportsales^{FOB}$$

While the firm's actual tax bill will differ from this depending on its input VAT, the firm may be assumed to take reimbursement of input VAT into account when purchasing inputs; i.e. the reimbursement of input VAT may be considered to be a component of input prices. This implies a tax rate of $\frac{t_v - r}{1-(t_v-r)}$ on pre-tax export sales.

Note that if the firm does not produce the goods exported, but instead buys these from another firm for export, then input VAT (here, the amount of VAT paid by the firm producing the goods to be exported) is rebated to this firm according to the prevailing rebate rate, so that it should be the pre-tax rather than the FOB price that is used in the calculation above. I abstract from this distinction by assuming that all exporters are the producers of the goods exported.

A1.2.2 Zero rebate, not tax-exempt

Products with a zero rebate rate are treated as products sold domestically, so that the applicable formula for tax payable is:

$$t_v \cdot \frac{sales}{t_v + 1} - inputVAT$$

Again assuming that that the nondistortionary policy is a full rebate of VAT on exports, this implies a tax rate of t_v on pre-export sales.

A1.2.3 Exempt from taxes

A small subset of products are classified as 'exempt from taxes', which means that they pay no output VAT on exports, but their input VAT is not reimbursed. I model the applicable export tax in this case as equal to exporters' input VAT. I use the 2007 Chinese input-output table, in which I observe pre-tax gross output and input shares, to calculate the rate of implied export tax per unit of pre-tax gross output for a given input-output industry. I then use a concordance between HS codes and 2007 Chinese input-output industries to apply these export tax rates to each product in the 'tax-exempt' category. This assumes uniformity of production functions across products within input-output industries.

The export tax rate per unit of output for a given input-output sector k will thus be calculated to be:

$$\sum_{k'} \beta^{kk'} \frac{t_v^{k'}}{1 + t_v^{k'}}$$

where $\beta^{kk'}$ is the observed expenditure share per unit currency of (pre-tax) output of industry k on inputs from industry k'.

A1.3 Aggregating the two taxes

Here, I calculate the export tax rate jointly implied by the two policies above, for each of the three types of VAT export rebate policies.

A1.3.1 Nonzero rebate, not tax-exempt

The applicable export taxes are:

$$\frac{t_x}{t_x + 1} exportsales + (t_v - r) \cdot exportsales$$

We may calculate the tax rate on pre-tax export sales using:

$$\begin{aligned} p^{pretax} &= p^{FOB} - \frac{t_x}{t_x + 1} p^{FOB} - (t_v - r) \cdot p^{FOB} \\ \implies p^{FOB} &= \left(1 - \frac{t_x}{t_x + 1} - (t_v - r)\right)^{-1} p^{pretax} \\ \implies p^{FOB} &= \left(\frac{t_x + (t_v - r) + t_x(t_v - r)}{1 - (t_v - r) - t_x(t_v - r)} + 1\right) p^{pretax} \end{aligned}$$

So the applicable export tax rate on pre-tax export sales is $\frac{t_x+(t_v-r)+t_x(t_v-r)}{1-(t_v-r)-t_x(t_v-r)}$.

A1.3.2 Zero rebate, not tax-exempt

The applicable export taxes are:

$$\frac{t_x}{t_x+1} exportsales + \frac{t_v}{t_v+1} exportsales$$

We may calculate the tax rate on pre-tax export sales using:

$$\begin{aligned}
p^{pretax} &= p^{FOB} - \frac{t_x}{t_x+1} p^{FOB} - \frac{t_v}{t_v+1} p^{FOB} \\
\implies p^{FOB} &= \left(1 - \frac{t_x}{t_x+1} - \frac{t_v}{t_v+1}\right)^{-1} p^{pretax} \\
\implies p^{FOB} &= \left(\frac{t_x+t_v+2t_xt_v}{1-t_xt_v} + 1\right) p^{pretax}
\end{aligned}$$

So the applicable export tax rate on pre-tax export sales is $\frac{t_x+t_v+2t_xt_v}{1-t_xt_v}$.

A1.3.3 Exempt from taxes

The export tax rate on pre-tax sales due only to non-reimbursement of input VAT may be calculated as:

$$\begin{aligned}
p^{VAT} &= p^{pretax} + \sum_{k'} \beta^{kk'} \frac{t_v^{k'}}{1+t_v^{k'}} p^{VAT} \\
\implies p^{VAT} &= \frac{1}{1-\sum_{k'} \beta^{kk'} \frac{t_v^{k'}}{1+t_v^{k'}}} p^{pretax}
\end{aligned}$$

Export duties then imply that:

$$\begin{aligned}
p^{FOB} &= p^{VAT} + \frac{t_x}{1+t_x} p^{FOB} \\
\implies p^{FOB} &= \left(1 - \frac{t_x}{t_x+1}\right)^{-1} \left(\frac{1}{1-\sum_{k'} \beta^{kk'} \frac{t_v^{k'}}{1+t_v^{k'}}}\right) p^{pretax} \\
\implies p^{FOB} &= \left(\frac{t_x + \sum_{k'} \beta^{kk'} \frac{t_v^{k'}}{1+t_v^{k'}}}{1-\sum_{k'} \beta^{kk'} \frac{t_v^{k'}}{1+t_v^{k'}}} + 1\right) p^{pretax}
\end{aligned}$$

So the applicable export tax rate on pre-tax export sales is $\frac{t_x + \sum_{k'} \beta^{kk'} \frac{t_v^{k'}}{1+t_v^{k'}}}{1-\sum_{k'} \beta^{kk'} \frac{t_v^{k'}}{1+t_v^{k'}}}$.

A2 Product-level raw materials definition

Industrial raw materials are defined at the product level within the six-digit Harmonized System 1996 classification as follows.

Section V. Mineral products - raw materials

Section VI. Products of the chemical or allied industries - raw materials up to category 29 (where goods are still described as ‘chemicals’), parts/articles from 30 (where goods are ‘products’ of chemicals)

Section VII. Plastics and rubber and articles thereof
39 - Plastics and articles thereof - raw materials up to 3915 (where plastics are ‘in primary forms’), parts/articles from 3916 (where items are ‘of plastics’)
40 - Rubber and articles thereof - raw materials up to 4005 (where rubber is ‘in primary forms’), parts/articles from 4006 (where products are first described as ‘articles’)

Section VIII. Raw hides and skins, leather, furskins and articles thereof, saddlery and harness, travel goods etc., articles of animal gut
41 - Raw hides and skins (other than furskins) and leather - raw materials
42 - Articles of leather, animal gut, harness, travel goods - parts/articles
43 - Furskins and artificial fur, manufactures thereof - raw materials up to 4302, parts/articles from 4303 (‘articles of furskin’, ‘artificial fur and articles thereof’)

Section IX. Wood and articles of wood; wood charcoal; cork and articles of cork; manufactures of straw etc.; basketware and wickerwork
44 - Wood and articles of wood, wood charcoal - raw materials up to 4413 (where goods are still described as ‘wood’), parts/articles from 4414 (where goods are described as ‘wooden’ articles)
45 - Cork and articles of cork - raw materials up to 4502 and 450410, parts/articles 4503 (‘articles of natural cork’) and 450490 (‘articles of agglomerated cork’)
46 - Manufactures of plaiting material, basketwork, etc. - parts/articles

Section X. Pulp of wood or other material, paper and paperboard and articles thereof - raw materials up to 4812, parts/articles from 4813 (where paper products are first for a specific purpose)

Section XI. Textiles and textile articles - raw materials up to 60, parts/articles from 61 (‘articles of apparel’), but there are some clear exceptions in categories 56 to 59
56 - Wadding, felt, nonwovens, yarns, twine, cordage, etc. - raw materials except for 5601 (includes ‘articles’ in description), 5608 (‘nets’) and 5609 (includes ‘articles’ in description)
57 - Carpets and other textile floor coverings - parts/articles
58 - Special woven or tufted fabric, lace, tapestry, etc. - raw materials except

for 5805 (‘tapestries’ and ‘kit sets’), 5807 and 5808 (include ‘articles’ in descriptions)
59 - Impregnated, coated or laminated textile fabric - raw materials up to 5907 (‘fabric’) except 5904 (floor coverings), parts/articles from 5908 (textile articles)

Section XII. Footwear, headgear, etc. and parts thereof, prepared feathers and articles made therewith, artificial flowers, articles of human hair - parts/articles (there is no separate category for ‘prepared feathers’)

Section XIII. Articles of stone, plaster, cement, asbestos, mica or similar materials, ceramic products, glass and glassware
68 - Articles of stone, plaster, cement, asbestos, mica or similar materials - parts/articles
69 - Ceramic products - parts/articles
70 - Glass and glassware - raw materials up to 7007 (where goods are still described as ‘glass’), parts/articles from 7008 (where goods are described as ‘of glass’)

Section XIV. Natural or cultured pearls, precious or semiprecious stones, precious metals, metals clad with precious metal, and articles thereof, imitation jewelry, coin - raw materials up to 7112, parts/articles from 7113 (‘jewellery and parts)

Section XV. Base metals and articles of base metal - I assume that the dividing line between category 72 (‘Iron and steel’) and 73 (‘Articles of iron and steel’) also applies to analogous product types in the other metal categories (74 to 81); any six-digit category containing both raw materials and parts/articles by this definition is classified as ‘parts/articles’
72 - Iron and steel - raw materials
73 - Articles of iron and steel - parts/articles
74 - Copper and articles thereof - raw materials up to 7410, parts/articles from 7411
75 - Nickel and articles thereof - raw materials up to 7506, parts/articles from 7507
76 - Aluminum and articles thereof - raw materials up to 7607, parts/articles from 7608
78 - Lead and articles thereof - raw materials up to 7804, parts/articles from 7805
79 - Zinc and articles thereof - raw materials up to 7905, parts/articles from 7906
80 - Tin and articles thereof - raw materials up to 8005, parts/articles from 8006
81 - Other base metals, cermets, articles thereof - raw materials include 810110 to 810193, 810210 to 810293, 810310, 810411 to 810430, 810510, 810710, 810810, 810910, 811211, 811291; all other goods are parts/articles
82 - Tools, implements, cutlery, etc of base metal - parts/articles
83 - Miscellaneous articles of base metal - parts/articles

Section XVI. Machinery, equipment, TV and sound recorders and reproducers and parts thereof - parts/articles

Section XVII. Vehicles, aircraft, vessels and associated transport equipment - parts/articles

Section XVIII. Optical, photographic, measuring, medical, etc. instruments, clocks and watches, musical instruments, parts and accessories thereof - parts/articles

Section XIX. Arms and ammunition, parts and accessories thereof - parts/articles

Section XX. Miscellaneous manufactured articles - parts/articles

Section XXI. Works of art, collectors' pieces and antiques - parts/articles

A3 Additional figures and tables

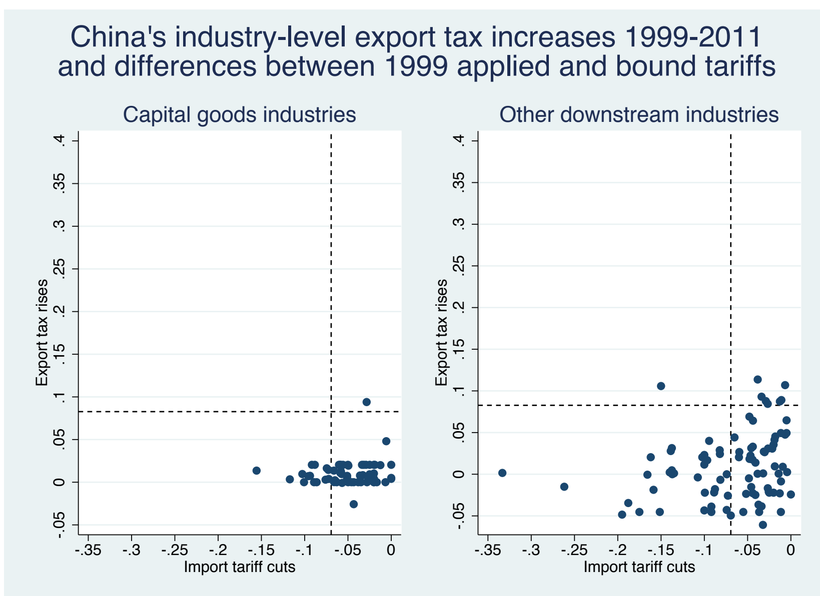

Figure A1: Export tax rises 1999-2011 and tariff cuts associated with WTO accession by industry

Table A1: Chinese nonagricultural tariffs and tariff cuts by materials supply chain

(a) Panel A: 1999 applied tariffs

	(1) Chemicals	(2) Leather	(3) Metal	(4) Nonmetal	(5) Plastic	(6) Rubber	(7) Wood
Downstream (capital)			0.100***				
			(0.00899)				
Downstream (other)	0.0671***	0.123***	0.180***	0.108***	0.0216*	0.0227	0.0567
	(0.0224)	(0.00528)	(0.0273)	(0.0227)	(0.00782)	(0.0485)	(0.0467)
Observations	18	5	106	25	6	9	16
R^2	0.221	0.978	0.476	0.464	0.277	0.031	0.106

(b) Panel B: Differences between bound tariffs and 1999 tariffs

	(1) Chemicals	(2) Leather	(3) Metal	(4) Nonmetal	(5) Plastic	(6) Rubber	(7) Wood
Downstream (capital)			-0.0357***				
			(0.00558)				
Downstream (other)	-0.0431**	-0.0930**	-0.0634***	-0.0414***	-0.00224	0.00305	-0.0490
	(0.0168)	(0.0259)	(0.0153)	(0.0121)	(0.00483)	(0.0194)	(0.0375)
Observations	18	5	106	25	6	9	16
R^2	0.173	0.518	0.240	0.291	0.011	0.003	0.130

Robust standard errors.
Small p-values are represented by *** (less than 1%), ** (less than 5%) or * (less than 10%).

Table A2: Chinese nonagricultural tax rises by materials supply chain

	(1) Chemicals	(2) Leather	(3) Metal	(4) Nonmetal	(5) Plastic	(6) Rubber	(7) Wood
Downstream (capital)			-0.174***				
			(0.0177)				
Downstream (other)	-0.0780***	-0.0474	-0.163***	-0.0843**	-0.0584***	-0.00193	-0.0955***
	(0.0246)	(0.0298)	(0.0184)	(0.0327)	(0.00568)	(0.0303)	(0.0289)
Observations	18	5	106	25	6	9	16
R^2	0.388	0.175	0.641	0.252	0.841	0.001	0.344

Robust standard errors.

Small p-values are represented by *** (less than 1%), ** (less than 5%) or * (less than 10%).