# IMPERFECT COMPETITION AND TRADE POLICY

- **Once there is imperfect competition in trade models, what happens if trade policies are introduced?**

- **A literature has grown up around this, often described as "strategic trade" theory, producing some non-traditional results, e.g., an export subsidy may improve national welfare**

- **The literature tends to be full of a lot of special cases, changes in basic assumptions often reversing results, making it difficult to generalize**

- **As Dixit (1987) notes, a critical feature of the theory is the emphasis on interactions between rational agents such as firms and policymakers**

- **Strategic trade theory can be characterized in terms of non-cooperative, static and simultaneous- move games in the sense that agents do not coordinate their actions, the game is played once, and agents make their moves at the same time**

- **A critical feature of the analysis is that one agent, the policymaker, can make a move before other agents, which introduces the notion of pre-commitments**

- **Consider a situation where an international market is characterized as a duopoly, firms i =1, 2. Equilibrium concept is Nash equilibrium, where each firm simultaneously sets its relevant strategy variable $s_i$ (output or price) in order to maximize profits, given action of the rival firm, $s_j$**

- **Given profits are $\pi_i$, a set of strategic actions is a Nash equilibrium, if, for all i and any feasible action $s_i$:**

$$\pi_i = (s_i^*, s_j^*) \geq (s_i, s_j^*) \qquad (1)$$

**i.e., the set of actions, $s_i^*$, is an equilibrium if neither firm can change its action to increase profits, given its rival's action**

- **In the absence of government intervention, this equilibrium is consistent with free trade, neither firm being able to unilaterally improve its payoff**

- **If government i announces it will pay firm i an export subsidy before firm i selects its optimal strategy, this alters the level of potential profits $\pi_i$ and hence the behavior of firm i in equilibrium**

- **This captures essence of strategic trade theory: in imperfectly competitive markets, firms act strategically, and government credibly pre-commits to trade policies that change the final market equilibrium**

- **Government i has to have some reason for wanting to provide firm i with a subsidy at the first stage of the game**

- **The standard argument is that there are positive economic profits to be earned by firm i, and if these enter government i's objective function, it has an incentive to pre-commit to policies that increase firm i's profits**

- **Assuming government j is not active with respect to firm j, then the increase in firm i's profits can be thought of in terms of profit-shifting**

- **<u>The Brander and Spencer (1985) Result</u>**

  **Suppose there are two firms, i=1, 2, based in separate countries, each producing and exporting a homogeneous good to the world market under conditions of constant and equal marginal costs $c_i$**

**Neither firm is large enough to affect factor prices and there is no domestic consumption of the good**

**With no intervention, and assuming firms' strategic action $s_i$ is to set output to maximize profits, then the Nash equilibrium will be the standard Cournot outcome, neither firm being able to credibly pre-commit to any other level of output**

**Using reaction function analysis, result is described in Figure 1, where output is denoted as $x_i$, $RF_i$ are the respective reaction functions, and N is the Nash-Cournot equilibrium, generating profits $\pi_i$**

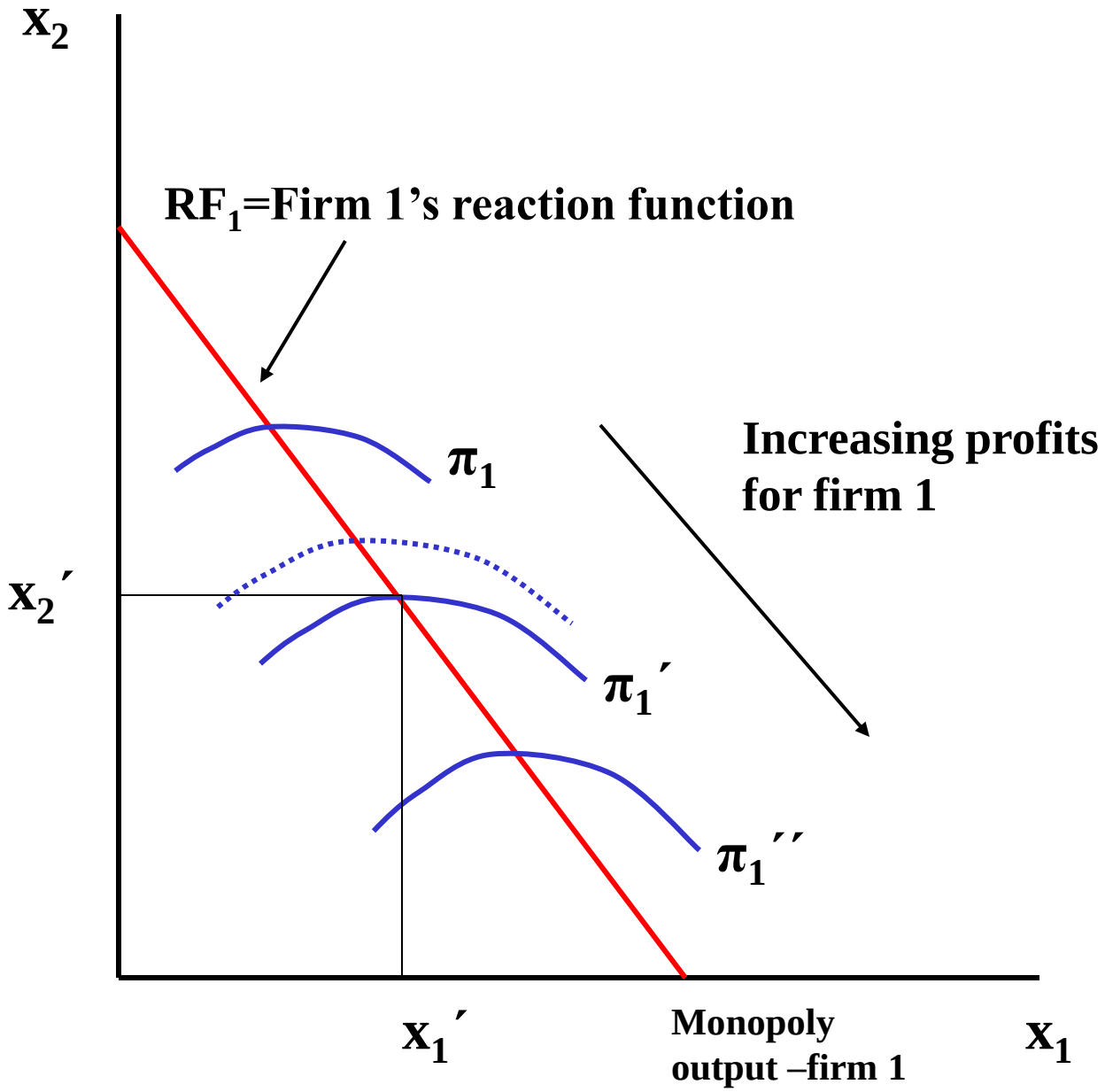
- **Suppose government 1 pre-commits to paying firm 1 a per-unit export subsidy e; the subsidy reduces firm 1's marginal costs, shifting its reaction function to the right to $RF_1'$, the new equilibrium being at S, which is formally equivalent to the Stackelberg outcome**

- **The government's objective function is defined as:**

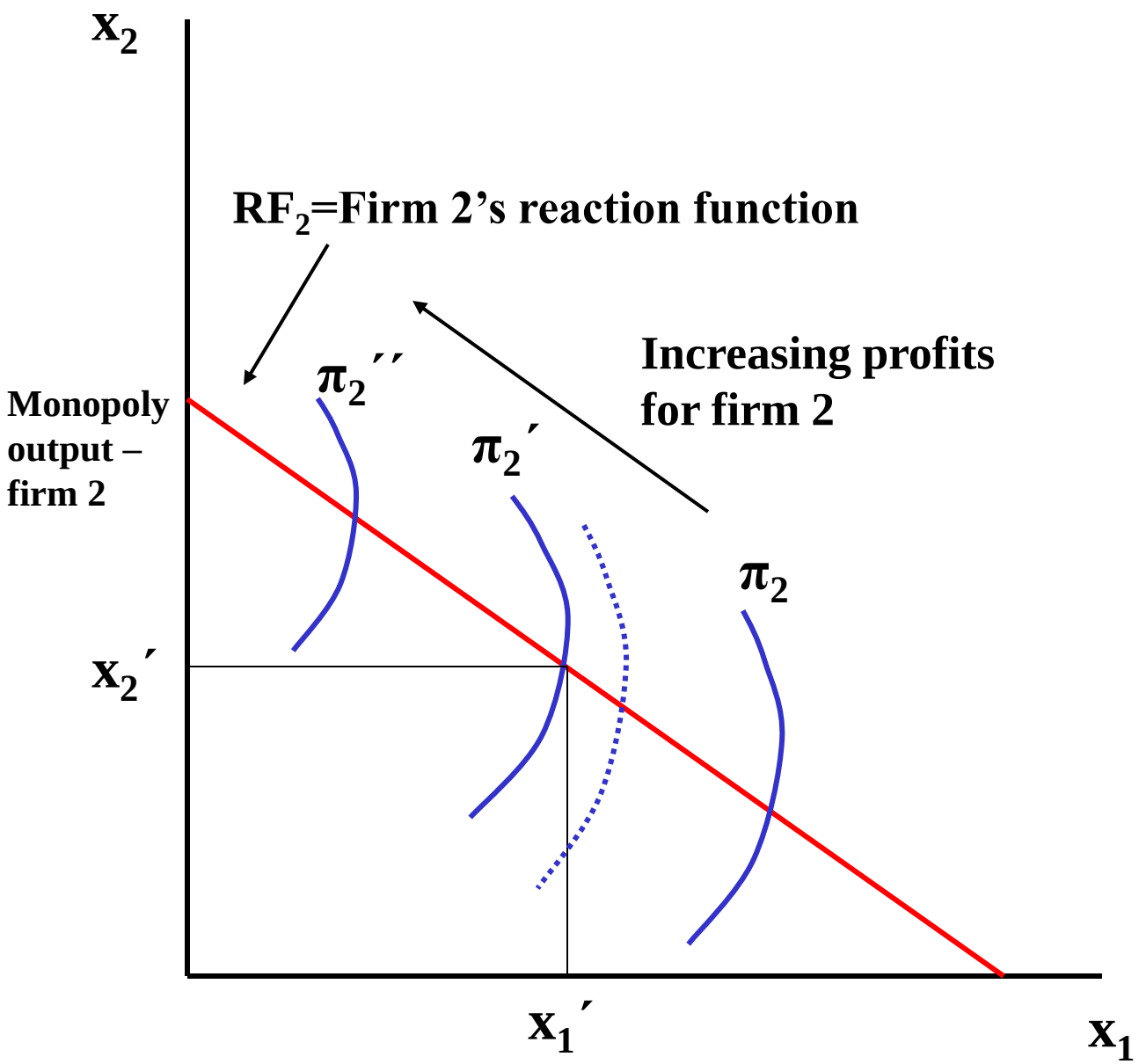
$$W_1 = [R_1(x_1, x_2) - (c_1 - e)x_1] - ex_1 \qquad (2)$$

$$= [R_1(x_1, x_2) - c_1 x_1]$$

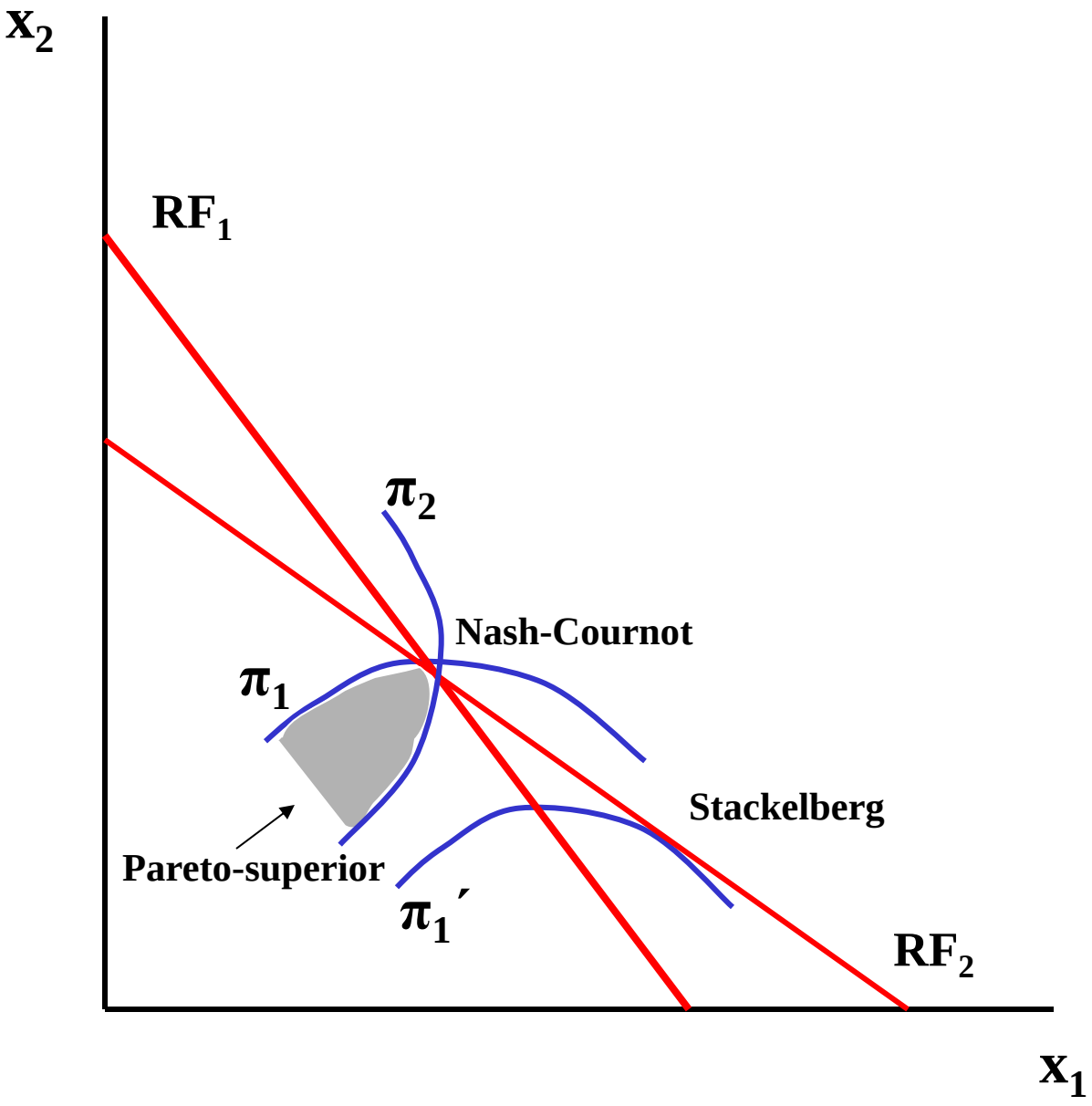
# Output Choices for Firm 1



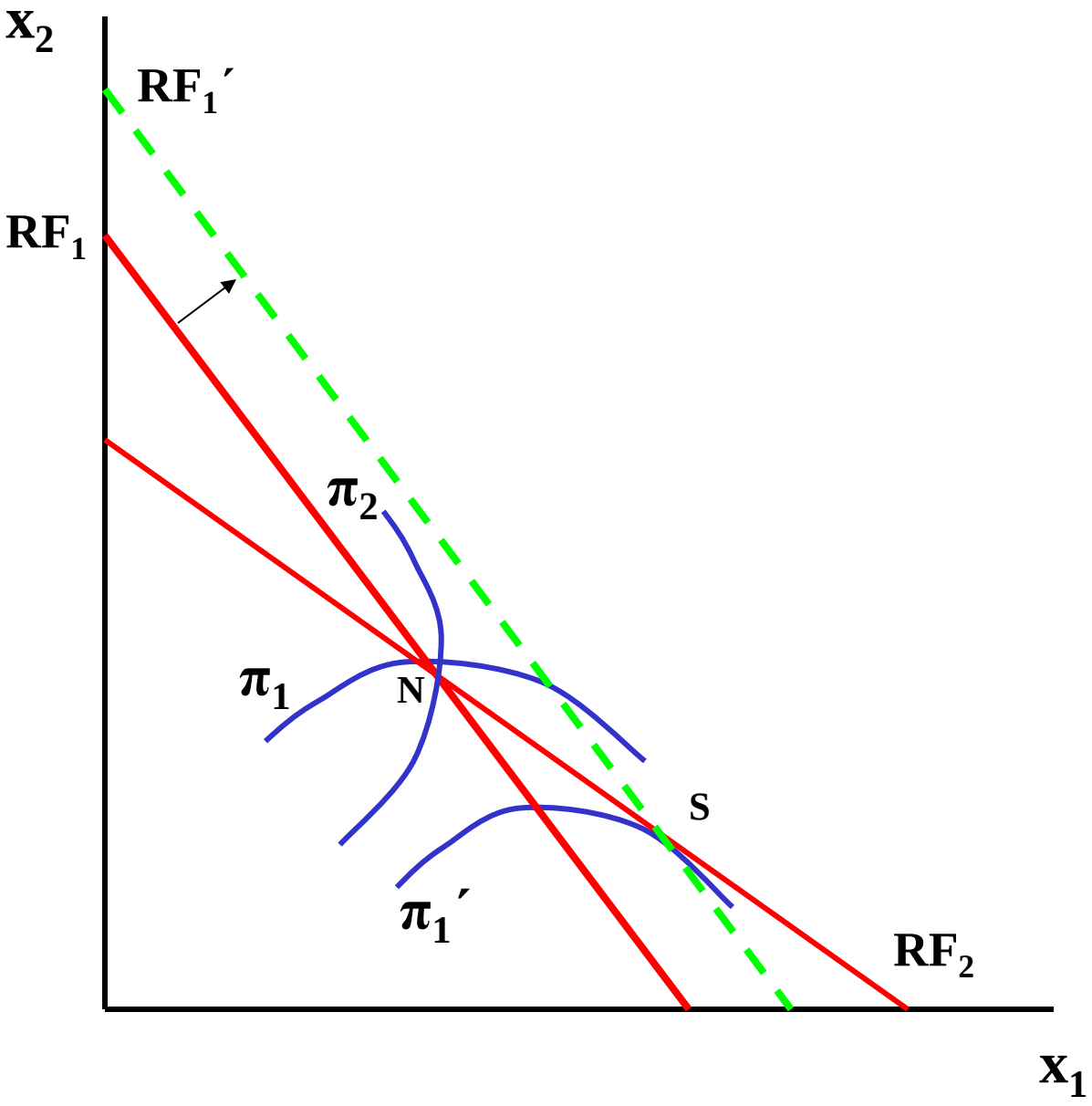
# Output Choices for Firm 2



# Nash-Cournot Equilibrium



# Figure 1: Export Subsidy to Firm 1



# Nash-Cournot Strategies

**Firm 1**

**Firm 2**

| $s_2$ \ $s_1$ | **Low output** | **High output** |
|---|---|---|
| **Low output** | **15, 15** **C** | **20, 5** **$S_1$** |
| **High output** | **5, 20** **$S_2$** | **10, 10** **N** |

**N = Nash-Cournot equilibrium**

**$S_1$ = Firm 1 is Stackelberg leader**

**$S_2$ = Firm 2 is Stackelberg leader**

**C = Collusive outcome**

where $R_1(x_1, x_2)$ is the revenue of firm 1 given its and firm 2's output decisions

By (2), firm 1's iso-profit contours can be re-interpreted as the iso-welfare contours for country 1, thus move from N to S represents an increase in welfare for country 1

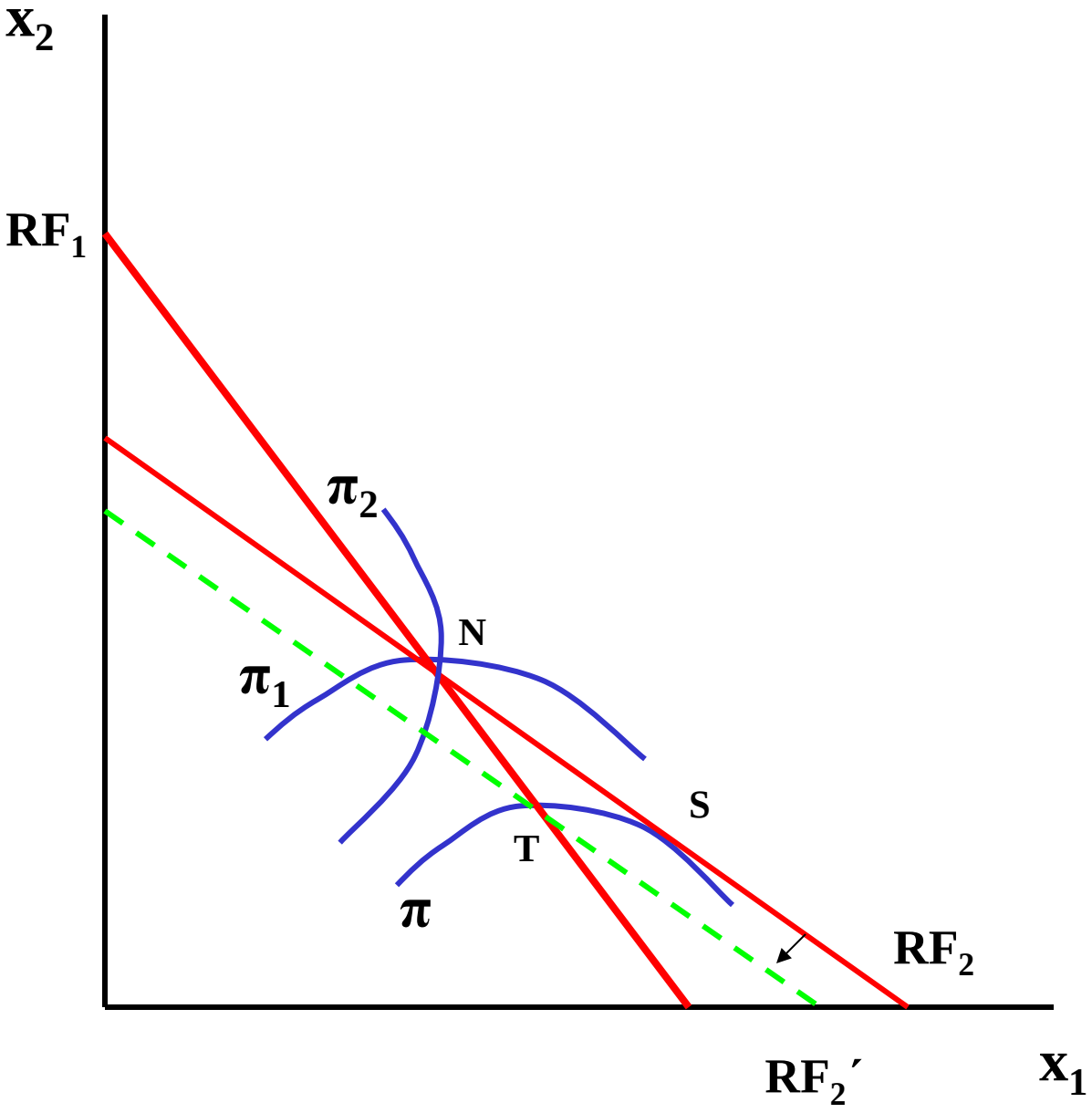
This comes about because, despite the cost of the subsidy and the deterioration in country 1's terms of trade, increase in firm 1's market share is sufficient to generate a welfare gain

- Similar analysis can be conducted for the case where firms 1 and 2 compete in firm 1's home market. In this case, policy instrument adopted by government 1 is a per unit tariff t levied on firm 2

- In terms of reaction function analysis, as shown in Figure 2, tariff raises firm 2's marginal costs, shifting its reaction function $RF_2$ down to $RF_2'$, the new Nash equilibrium being at T, the Stackelberg-equivalent level of profits

- Of course in this case, domestic consumer surplus enters government's welfare function along with the tariff revenue:

# Figure 2: Import Tariff on Firm 2



$$W_1 = R_1(x_1, x_2) - c_1 x_1 + \int f x dx + t x_2 \qquad (3)$$

where $\int f x dx$ represents domestic consumer surplus, and $t x_2$ is tariff revenue

- In this case, increase in price affects domestic consumer surplus, the effects being illustrated in Figure 3

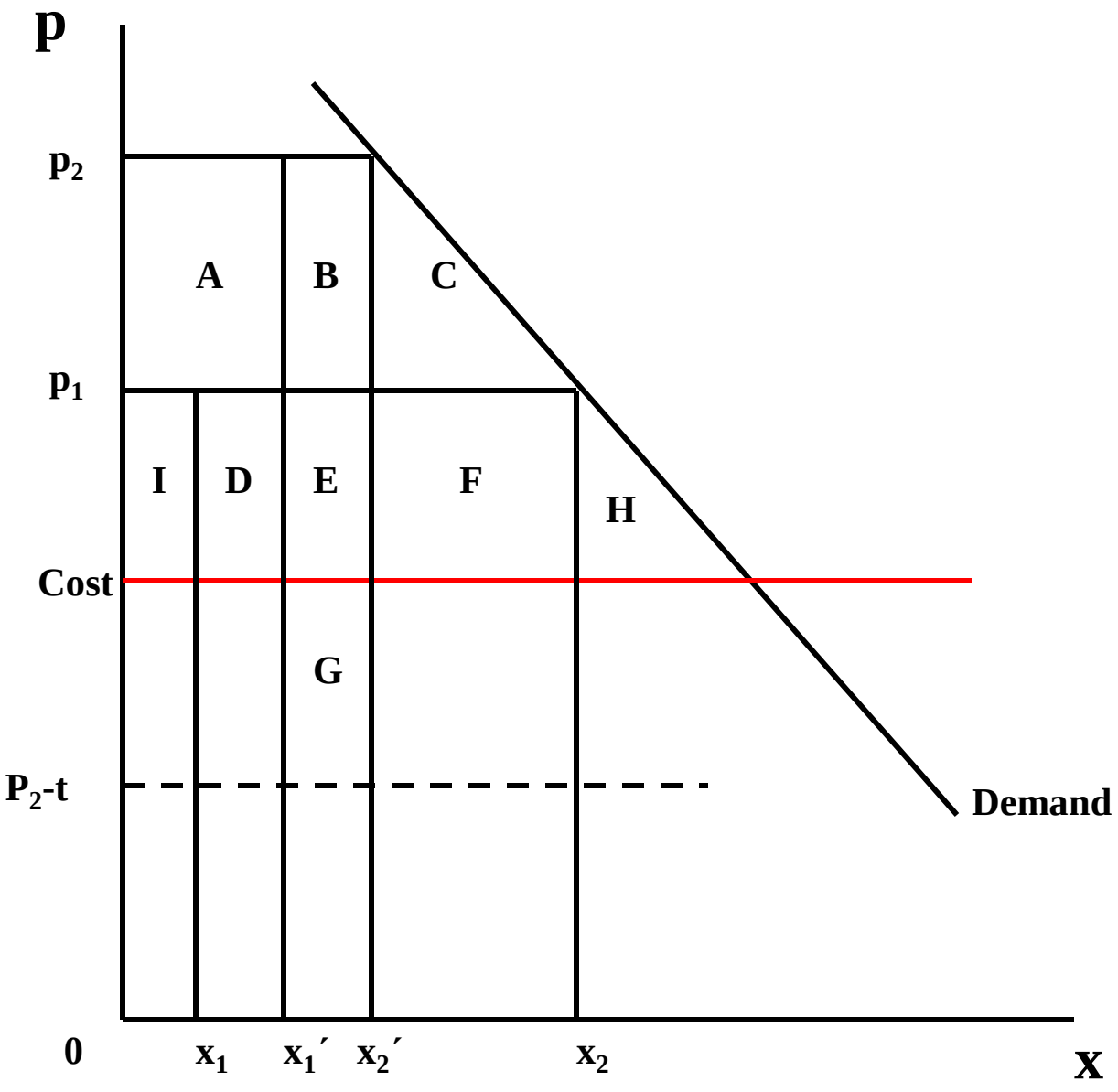
  With tariff of t, firm 2's market share falls to $x_1' x_2'$, while firm 1 expands market share to $0x_1'$, price rises to $p_2$, the terms of trade effects being $p_2 - t$

  Profits shifted to firm 1, their gain being (A+D), consumers lose (-A-B-C), and tariff revenue is (B+E-G); net welfare effect is (E+G+D-C)

- Argument here is that improvement in country 1's terms of trade and increase in firm 1's market share, along with receipt of tariff revenue, is sufficient to outweigh loss of consumer surplus

- Strategic trade theory seems to provide a simple and striking case for protection in imperfectly competitive industries, however, several key *caveats* need to be noted:

## Figure 3: Import Tariff Effects



**(1) Analysis assumes only one active government; clearly, government 2 will also be active if firm 2's profits enter its welfare function**

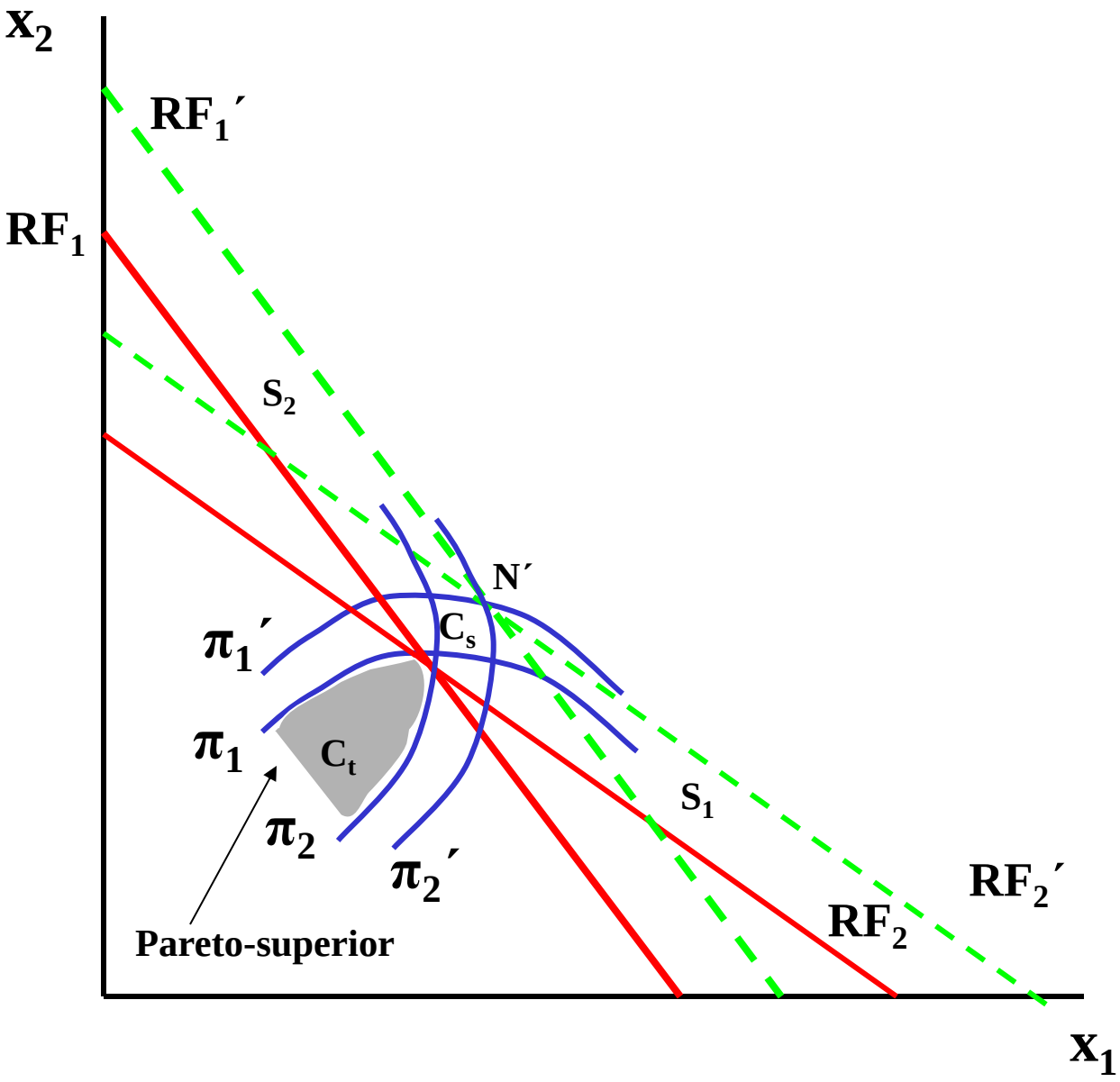
**In export subsidy case, suppose both governments pre-commit to paying an export subsidy, this lowers marginal cost for both firms, shifting their reaction functions out as shown in Figure 4**

**The new Nash equilibrium is at $N'$, where both firms' outputs have expanded, the world price is lower, and, in addition, both firms' profits, and hence respective national welfares, are lower**

**This is a Nash equilibrium that has structure of a prisoners' dilemma, i.e., failure by government j to implement an export subsidy, given it is optimal for government i to do so, leads to a lower level of welfare $w_j$ than if government j did implement a subsidy**

**Introducing both governments into analysis merely shows that export subsidies will be optimal, albeit self-canceling, although cooperation between the governments to not use subsidies will be Pareto-superior**

# Figure 4: Export Subsidies to Firms 1 and 2



# Prisoners' Dilemma
# For Countries 1 and 2

**Country 1**

| **Country 2** | $c_1$ / $c_2$ | **No export subsidy** | **Export subsidy** |
|---|---|---|---|
| | **No export subsidy** | **10, 10** **$C_s$** | **20, 5** **$S_1$** |
| | **Export subsidy** | **5, 20** **$S_2$** | **7, 7** **N´** |

**N´ = Nash equilibrium**

**$C_s$ = Cooperation over no export subsidies**

# Prisoners' Dilemma
# For Countries 1 and 2

**Country 1**

| **Country 2** | **$c_1$ / $c_2$** | **Export tariff** | **No policy** | **Export subsidy** |
|---|---|---|---|---|
| | **Export tariff** | **15, 15** **$C_t$** | **20, 8** | **25, 3** |
| | **No policy** | **8, 20** | **10, 10** **$C_s$** | **20, 5** **$S_1$** |
| | **Export subsidy** | **3, 25** | **5, 20** **$S_2$** | **7, 7** **N´** |

**N´ = Nash equilibrium**

**$C_s$ = Cooperation over no export subsidies**

**$C_t$ = Cooperation over export tariffs**

**(2) The Nash equilibria outlined are all based on assumption that quantity is relevant strategic action; may be the case that firms set price in order to maximize profits**

**Eaton and Grossman (1986) show that optimal policy intervention in export case is highly sensitive to choice of strategic action by firms**

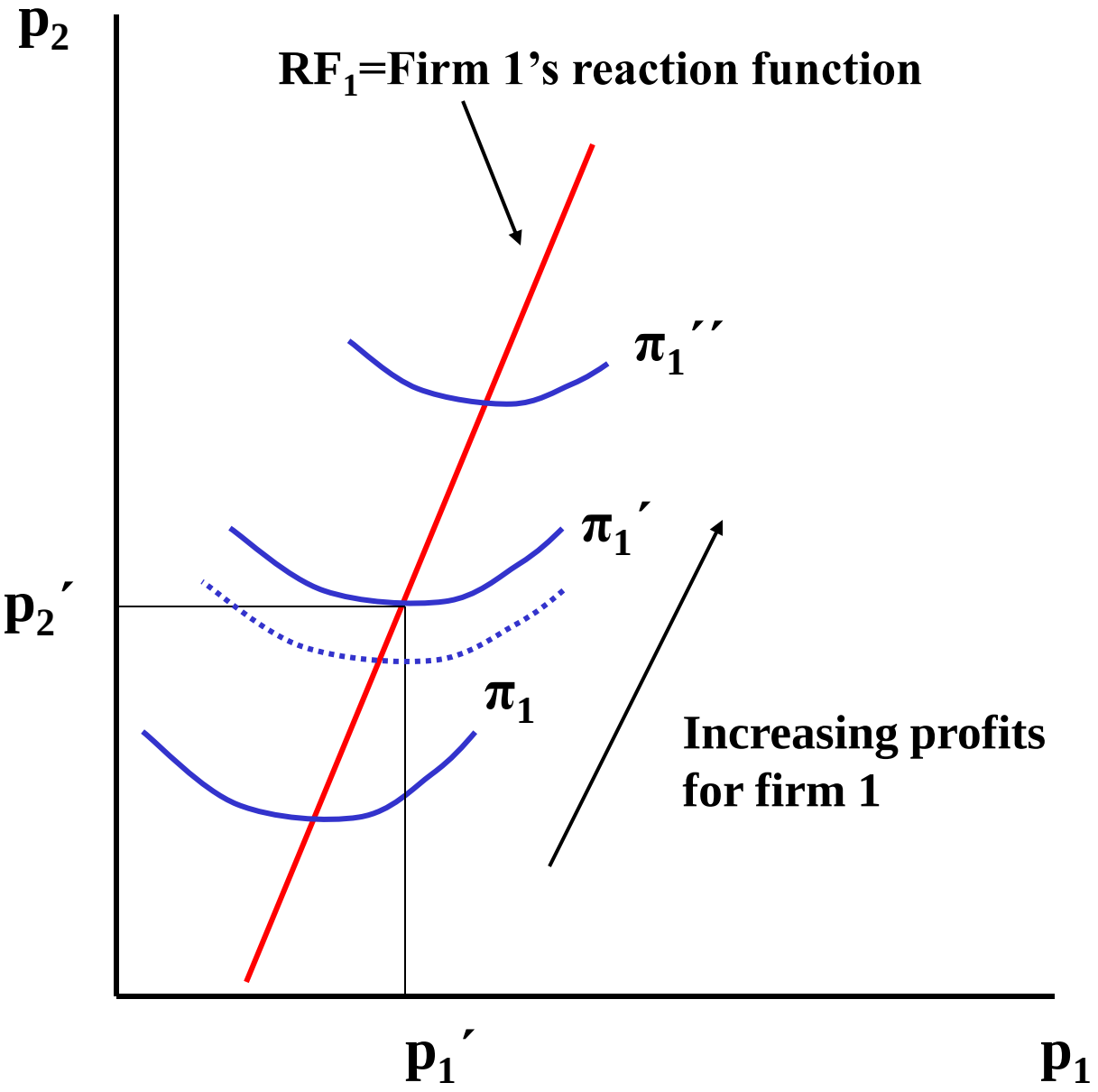
**In Figure 5, where $p_i$ denotes price, $RF_i$ are respective reaction functions in price, and B is the Bertrand-Nash equilibrium**

**Optimal policy is for government to use an export tax, such that in the final equilibrium, both firms raise prices, i.e., *to facilitate collusion*; if government commits to an export subsidy, overall effect is to lower prices**

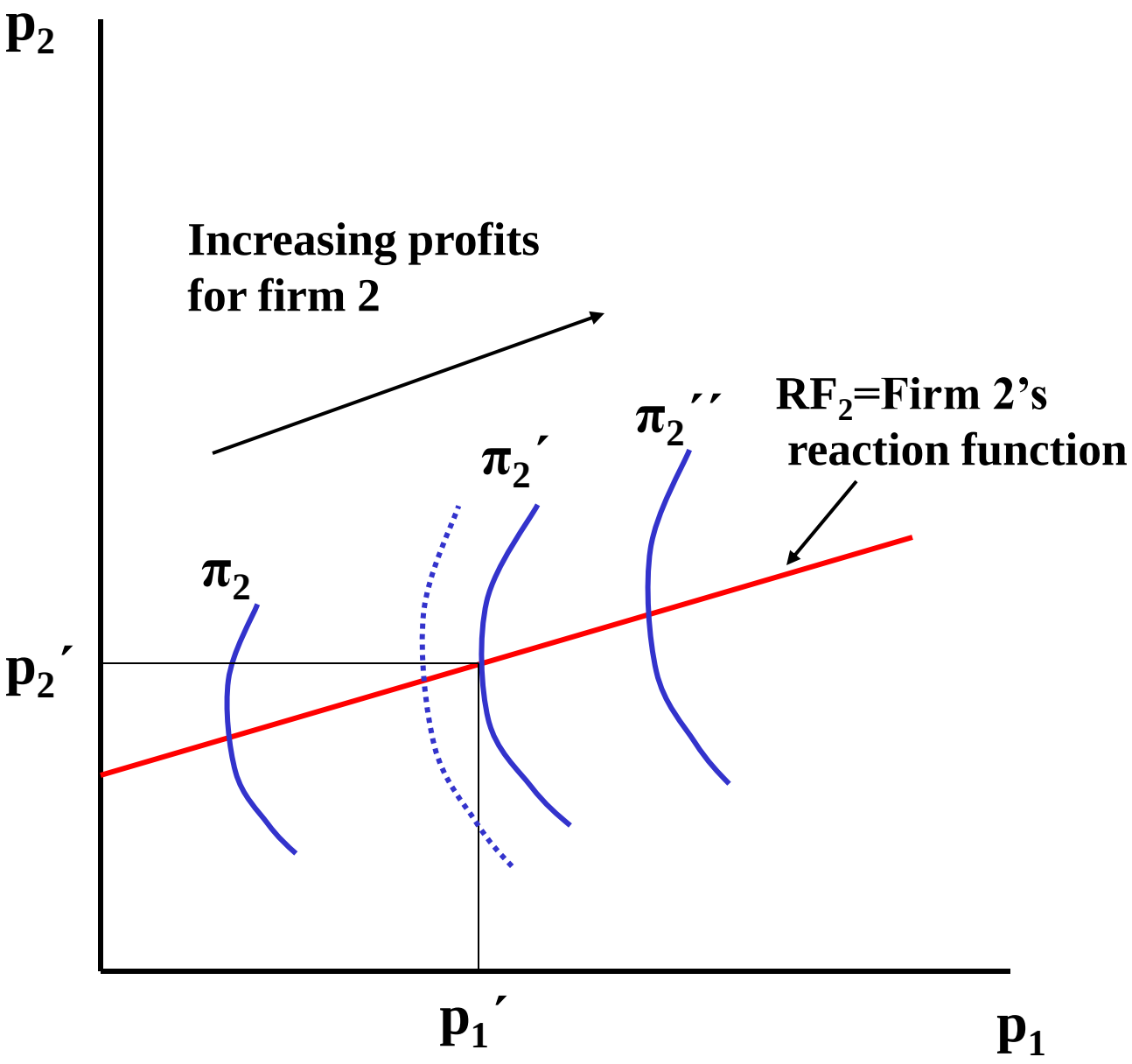
**Optimal if both governments tax exports, Figure 6**

**Government uncertainty about choice of strategic action by firms can lead to wrong trade intervention in the export case - does not hold in the import case, where import tariff would be the correct policy, irrespective of the strategic actions of firms**

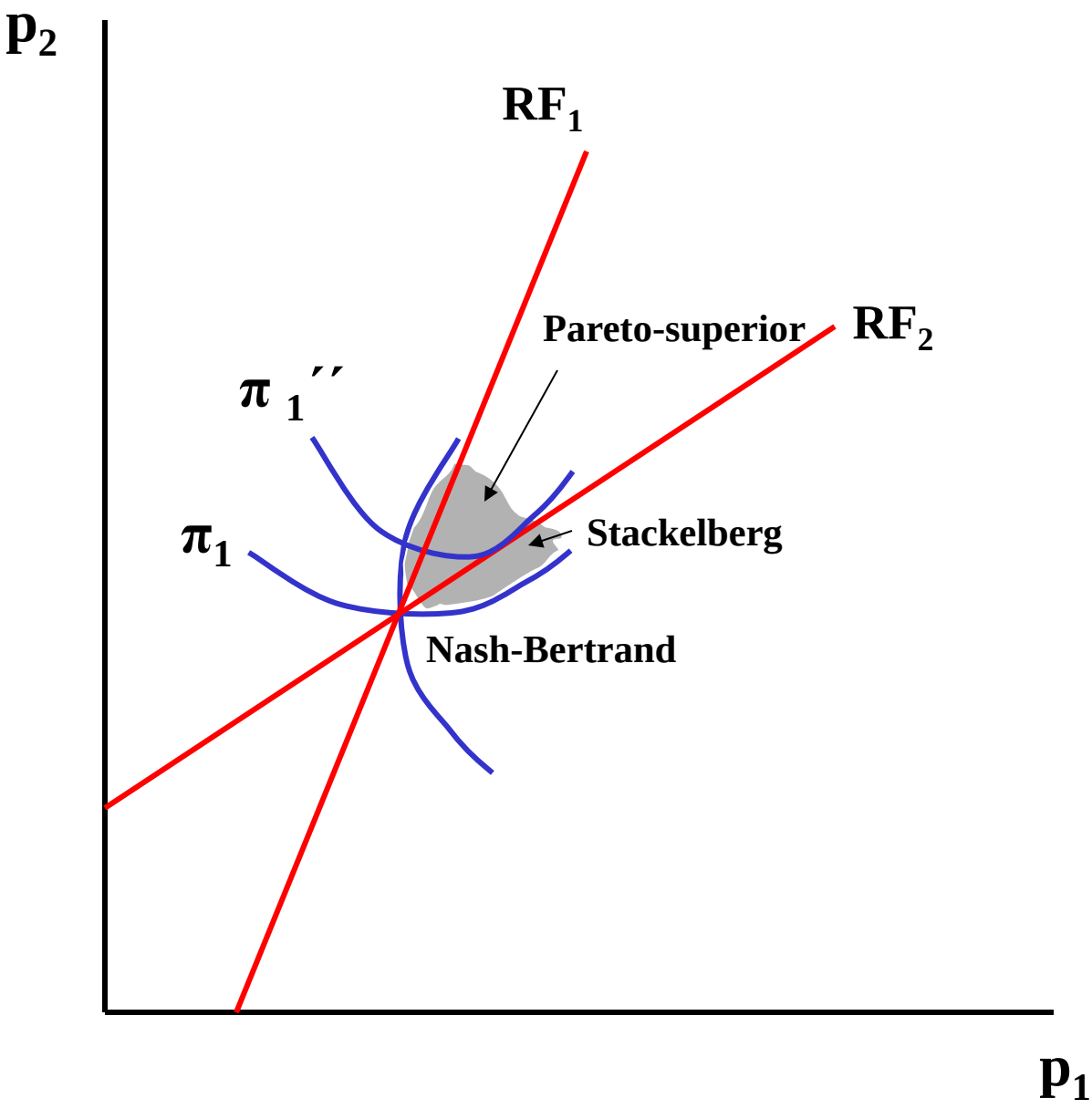
## Price Choices for Firm 1



# Price Choices for Firm 2



# Nash-Bertrand Equilibrium



# Nash-Bertrand Strategies

**Firm 1**

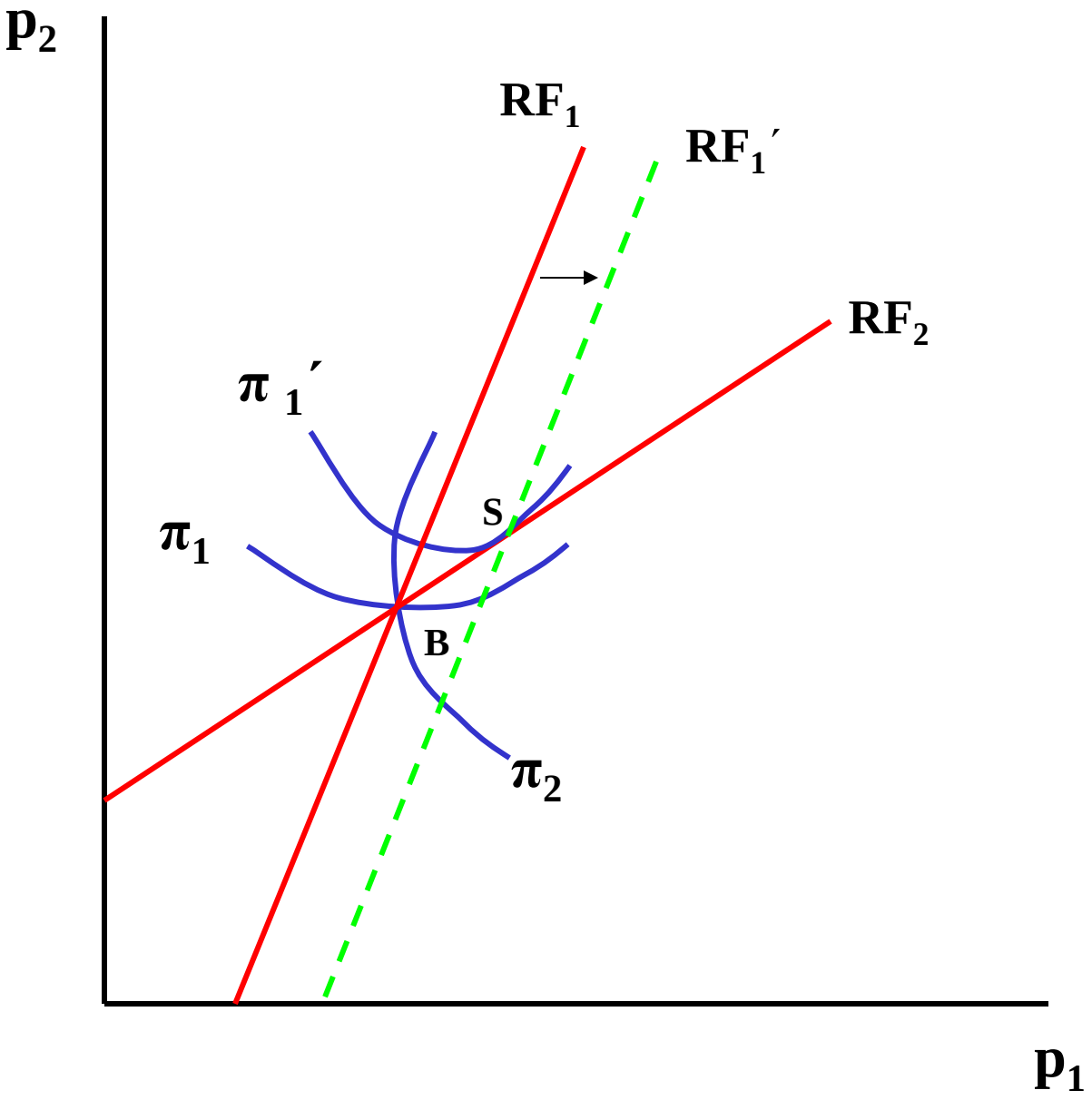
**Firm 2**

| $s_2$ \ $s_1$ | **High price** | **Low price** |
|---|---|---|
| **High price** | **15, 15** **C** | **20, 5** |
| **Low price** | **5, 20** | **10, 10** **B** |

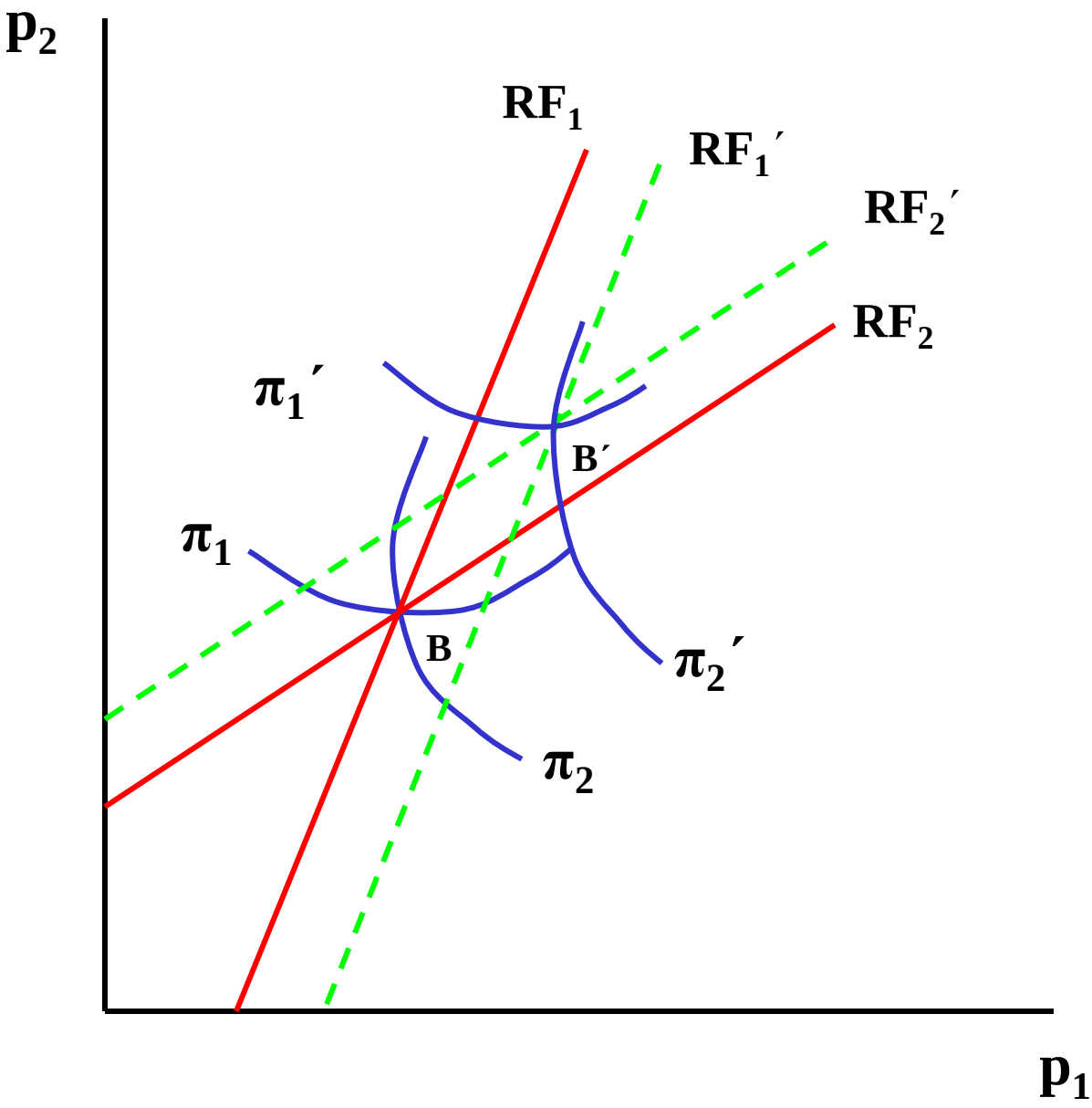
**B = Nash-Bertrand equilibrium**

**C = Collusive outcome**

# Figure 5: Export Tax on Firm 1



## Figure 6: Export Taxes on Firm 1 and Firm 2



**(3) Export subsidy case is also quite sensitive to assumption of there being only one firm in each country**

**If number of firms based in country 1 is increased, and their choice of strategic actions is quantity, Cournot-Nash outcome asymptotically approaches competitive equilibrium, and optimal policy intervention is a tax on exports (Dixit, 1984)**