ABSTRACT

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This dissertation involves two set of papers. The first chapter contains a brief introduction of the issues covered in this thesis. In the first set of papers (chapters 2 and 3) I investigate the use of product standards in international trade. Product standards relate to restrictions on the attributes of a product that must be satisfied before the product becomes eligible to be sold in a particular market. The World Trade Organization ruling on product standards requires member countries to apply equal standards on the home produced good and the imported good. This is called the national treatment rule. In the first part of the dissertation (Chapters 2 and 3) I analyze the role of national treatment rule in the case of product standards.

Chapter 4 evaluates the growth experience of Mauritius in the light of the explanations put forward in the empirical growth literature. As an African country Mauritius stands out as an exception, not only having a much higher growth rate than an average African country but also maintaining growth as a sustained phenomenon. I demonstrate that this exceptional growth performance of Mauritius has occurred because of some *unique* institutional features of Mauritius, making it different from the rest of Africa.

ESSAYS ON TRADE AND DEVELOPMENT

By

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DEDICATION

To My Family and to Prachi

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Chapter 1

Introduction

With trade liberalization in industrial products substantially completed in developed countries, especially in products they trade with one another, and agricultural products being traded in increasing quantities, product standards are emerging as a contentious issue in the WTO. The problem here is that there are legitimate reasons for countries to adopt product standards such as auto emission per gallon of gasoline. Yet, they can be used as disguised protection. The next two chapters of dissertation formally analyze the role of national treatment in minimizing the use of product standards as instruments of protection. I construct a general equilibrium model in which product standards help control a negative externality (pollution). It turns out in this model that the set of instruments to achieve the first best include standards on home and foreign products, a per unit consumption tax and an output tax/subsidy. I show that within a small country context, optimal standards on foreign and domestic firms would be different. Likewise, in a two-country context, optimal standards will be globally different from the global welfare standpoint. This raises the question why national treatment is a good rule.

In the third chapter I look at the rationale for a rule like the national treatment in the World Trade Organization. Since setting equal standards is in general not optimal, restricting a country to set equal standards on the home and foreign products leads to a

welfare loss. The simulation results show that this welfare loss is higher, the higher is the cost differential in meeting the standard between the domestic and the foreign producers. In reality governments are however influenced by special interests in their policy choices. I demonstrate that if domestic industrial lobbies exist that will potentially exploit discriminatory standards as an instrument of protection, national treatment may be a device to tie the hands of protectionist governments. In that sense national treatment might be a worthy rule.

In the fourth chapter I look at the exceptional growth performance of Mauritius relative to the other African countries. In the post-war period, few sub-Saharan African countries have made the transition to achieving high standards of living for their population. The record of sustained economic performance in sub-Saharan Africa is rare. Only sixteen countries, at various points in time, achieved high rates of growth. Very few such episodes have however been long and sustained enough to lead to high levels of income and standards of living. But Africa is not without its successes. At the very top of the short list of accomplishments is Mauritius. Between 1973 and 1999, real GDP in Mauritius grew on average by 5.9 percent per year compared with 2.4 percent in Africa. In per capita terms the corresponding numbers are 3.25 percent and about 0.7 percent.

Mauritius however was, if anything a strong candidate for failure because of being a very typical African economy—monocrop; prone to terms of trade shocks; witnessing rapid growth rate in population; and susceptible to ethnic tensions. All these factors have been

adjudged adverse for the growth prospect of an economy. This paper tries to evaluate the *unique* features of Mauritius that made it have such an exceptional growth performance and emphasizes the *limited* role of the traditional explanations in the case of Mauritius.

Chapter 2

Analysis of product standards in international trade

2.1 Introduction

This dissertation studies the use of product standards in international trade. In particular it focuses on those product standards that are characterized by market failure.[1] During the 1990s, as traditional trade protection measures such as tariffs, quotas, and voluntary export restraints (VERs) have been reduced or eliminated, domestic policies increasingly became the new frontiers of protection. One such domestic policy relates to product standards. In principle, product standards are designed to facilitate exchange of goods and services, guarantee quality, and achieve the provision of public goods such as clean air (Wilson and Maskus (2000). They may, however, also operate, by design or by circumstance, to restrain competition.[2]

Markets provide some product standards efficiently. The most common examples are standards known as the ISO series; the International Standards Organization certifies these standards. The reason these standards are provided efficiently by the market is that

[1] Hence process standards that are restrictions on inputs or the methods in production are not discussed in this paper. The World Trade Organization ruling on standards does not admit process standards.
[2] Wilson et al. (2001) find stringent environmental standards imply lower net exports of metal mining, nonferrous metals, iron, and steel and chemicals. According to them a trade agreement on a common environmental standard will cost a non-OECD country substantially more than an OECD country.

the benefits of such standards are internal to each consumer. On the other hand, if the benefits of a higher standard are external to economic agents, markets fail in providing the optimal level of the standard. An example would be emission standards in cars. The benefit of a higher emission standard in cars is the public good clean air.

The standards that are considered in this thesis are used to correct a *pure* consumption externality in the importing country. The reason for the choice of a consumption externality is because I focus on the case of product standards as opposed to process standards. Process standards affect the externality from production and not from consumption.

In controlling consumption externality, the government has at its disposal the following instruments (i) a per unit consumption tax, (ii) a standard on goods produced at home, (iii) a standard on the imports, and (iv) an output tax/subsidy. A consumption tax targets consumption directly by raising the price that consumers pay. Standards on the other hand, reduce the emissions intensity of consumption, defined as the amount of emission per unit of consumption. Therefore, taxes and standards must be employed in conjunction with each other. A foreign standard acts as a consumption tax as well as a production subsidy by raising the domestic price of the goods. Hence the standards on home and imported products are asymmetric.

The key features of the product standards that need to be incorporated in any meaningful discussion of product standards are: (i) Standards are employed to correct a market failure, (in this paper due to a consumption externality) (ii) The cost of meeting the standard can differ across producers in different countries. Given these key features, the optimal policy for the control of a consumption externality is a combination of three things, a per unit consumption tax, a production tax/subsidy, and discriminatory standards for home and foreign products.

The determination of consumption standards is considered by General Agreement on Tariffs and Trade (GATT) to be the legitimate domain of each national government. The World Trade Organization (WTO), however, intends to minimize the potential for exploitation of the standards for protectionist purposes. As a possible remedy to restrain the use of product standards for purposes of protection, the trading agreement under GATT binds countries to adhere to *national treatment* (NT) of standards. NT in case of product standards requires countries to set equal standards on home and the foreign produced good.

The initial rationale for the NT principle was to protect concessions reflected in tariff bindings that were agreed upon in the trade negotiations. The NT principle was later extended to internal taxes and other regulatory measures that had a protectionist or discriminatory impact on imports, even in the absence of such bindings.

NT is moreover a rigid rule in the WTO regarding standards. The rigidity of the rule follows from at least two features. (i) The rule is *not* product specific and (ii) exceptions are allowed under very strict conditions mainly if health and safety considerations require so. NT rule moreover, is applicable even when discrimination is also applied amongst domestic producers.[3] It is thus natural to ask the following question: Is national treatment of product standards a *nationally* optimal policy? This question is the counterpart of the issue of unilateral tariff liberalization by a small open economy.

I show that the efficiency of the NT rule is contingent on the per unit consumption tax being chosen optimally. This result follows from an important *asymmetry* between the standard on the home product and the standard on the imports. Both standards reduce the emission intensity identically but their incidences are different. Only the standard on imports acts as a consumption tax. Therefore, unless the consumption tax is set optimally, it is not efficient to set equal standards, even when the costs of meeting the standards are identical.

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[3] The example is the 1993 U.S. Environmental Protection Agency rule which required gasoline refineries to make cleaner gas. The EPA had opted for a program that allowed gradual improvement based on past performance. If past performance could not be reliably ascertained, a refinery's baseline was set to match the actual 1990 performance data of all oil refineries. Thus, some domestic and foreign producers were treated identically, while some domestic producers were held to different standards than foreign suppliers. In 1996 a WTO dispute panel decided the U.S. rules violated GATT's NT, despite the fact that the EPA rule was being applied equally to some U.S. producers.

After controlling for this asymmetry through the choice of an optimal consumption tax, efficiency requires equating marginal abatement costs across producers. This equalization at the margin results in equal standards only when the costs of meeting the standard are equal. Although the optimal policy package includes an output subsidy, discussion in this paper centers on there being no output subsidy. The full optimum with an output subsidy is discussed in Appendix A.1.

In the next section (2.2), I review the earlier literature related to product standards in international trade. Section 2.3 looks at the formal modeling of the standards. Section 2.4 describes the optimal policy for the control of a consumption externality using a general equilibrium model. Section 2.4.1 discusses the optimality of non-discriminatory standards for a small open economy when a per unit consumption tax is chosen optimally. Section 2.4.2 discusses the case when an optimal per unit consumption tax is *not* applied. Section 2.5 discusses the optimal policy when the country setting the standard is considered a large country; Section 2.5.1 focuses analysis on the unilateral choice by a large country with and without an optimal tariff in sections 2.5.1.1 and 2.5.1.2 respectively and Section 2.5.2 discusses the optimal policy from the point of view of global optimality. Section 2.6 draws conclusions based on the ideas presented in this chapter.

2.2 Literature review

There are broadly two strands of literature that are relevant from a trade policy perspective. The first strand of literature consists of papers that have analyzed the effects

of product standards in international trade. The second strand of literature consists of papers that evaluate international economic treaties in terms of the rules of the agreement. Bagwell and Staiger (1999) conducted pioneering work for the second strand.

The possibility that standards are used as disguised barriers to trade has been widely discussed in policy circles but has so far received scant attention in the literature. The existing theoretical literature considers standards as other forms of border measures like tariffs but with the revenue component missing. (Baldwin (2000), Markusen and Ganslandt (2001)) The fact that standards correct for some market failure is not highlighted in the literature on trade protection with the exception of Serra and Fischer (2001). As is evident from WTO documents this mixed bag regarding the nature of standards is well recognized. In this paper I try to rationalize the role of standards by treating the standards as instruments for correction of a pure consumption externality.

The existing literature has moreover, analyzed the role of standards in imperfectly competitive markets. Baldwin (2000), Copeland (2001), Serra and Fischer (2001), and Markusen and Ganslandt (2001) have considered the fixed costs of meeting the standards, and naturally consider models with imperfect competition. Moreover, since these papers (Copeland (2001), Serra and Fischer (2001) excluded) deal with standards that do not correct any externality, without political economy objectives need a set up where distribution of *excess rents* creates incentives for the government to choose standards. Without rent shifting and political economy motives, *purely protectionist standards* will

never be employed if markets are characterized by perfect competition.[4] In this paper by employing iceberg costs of meeting the standards I restrict the discussion to perfect competition.

A discussion of standards when markets are characterized by perfect competition is important for the following two reasons. (i) There exists an extensive literature on traditional trade barriers like tariffs and quotas under perfect competition so it is important to connect with that body of literature in the case of an another important trade barrier i.e. standards.[5] (ii) In the absence of rent shifting motive, the imposition of standards under perfect competition requires rationale for the use of standards that I provide by treating standards as instruments to control a pure consumption externality.

Bhagwati (1971) has pioneered the policy prescription in an open economy with distortions. The *targeting principle* proposed by Bhagwati envisages a standard Pigouvian consumption tax for the sector that causes the consumption externality. In relation to this paper, the result of Bhagwati's paper should be interpreted as the optimal policy in the case of restricted instruments. I expand the set of possible policy instruments to let the consumption tax and standards be jointly determined.

[4] Without any externality that the standard controls, a welfare maximizing government in a large country will always choose zero standard. This is because the terms of trade motive as in case of tariffs follows from the income transfer in terms of tariff revenue and standards do not have a revenue component.
[5] Bagwell and Stagier (2001) incorporate standards in a model with perfect competition. The focus of that paper however is on substitution between standards and tariffs for terms of trade purposes.

The role of NT in international agreements has been more or less untouched in the theoretical literature. The exceptions are Scotchmer (2002) and Battigalli and Maggi (2003). Scotchmer evaluates NT in case of intellectual property protection. Maggi and Battigalli (2003) show how NT rule affects the ex post-bargaining power over standards when there is ex ante uncertainty about the development of products. According to these authors, NT rule affects the efficiency of the ex post-bargaining by changing the outside option in bargaining relative to a regime of discrimination. This paper differs from their work in at least two important respects. First, I ask whether the NT rule is nationally efficient. Secondly, I incorporate the role of consumption tax and cost differences in meeting the standards; both have important effects on the value of the NT rule. The benefits of the NT rule as documented in international law literature and in the WTO documents follow mostly from the protectionist motives of the government. In this paper, I highlight the role of NT in counteracting the social welfare reducing effects of politics, which is in sync with the role of NT in the descriptive literature.

2.3 Modeling of Standards

In this section, I discuss in detail the modeling of the product standards. I consider a small open economy modeled as a two good economy with good two being the numeraire good. The consumption of good one results in emissions. Since the externality from consumption is pure, without government intervention, the goods are supplied at the least possible standard, that we normalize to zero. This is clearly sub-optimal since raising the

standards from zero will yield net benefits as pollution per unit of consumption is reduced.

There are two possible standards that can be imposed, standard on the domestic goods denoted as τ and the standard on imports denoted as τ^*. Higher standards correspond to higher values of τ and τ^*. Standards in this paper are assumed to reduce the *emissions intensity* in consumption. Assuming a simple linear technology, the emissions from good one takes the following form.[6]

$$Z = (T - \tau^*)m_1 + (T - \tau)S_1, \qquad (1)$$

where Z is the aggregate emission from consumption of good one and m_1 and S_1 denote the imports and domestic production of the good one. T is the emission intensity at zero standard. Equation 1 implies that at zero standards emissions from both imports and the home produced good are equal. The standard reduces the emission intensity for both products identically.

Next to be incorporated in the modeling of the standards is the cost of meeting the standard. This cost can differ between the home and the foreign producers. Production of

[6] We rule out standards that eliminate the externality like Compressed Natural Gas (CNG) standard in case of auto emissions. Such stringent standards are rarely employed suggesting their costs tend to outweigh the benefits.

good one uses labor (l_x) and a capital k. The production function in the home country is given as:

$$x = \frac{f(l_x, k)}{1 + a\tau} \tag{2}$$

Similarly the foreign production function can be written as:

$$x^* = \frac{f(l_x^*, k^*)}{1 + a^*\tau^*} \tag{2a}$$

This formalization can be interpreted as the production being a two-step process. First, labor and capital are employed to produce the *raw product.* Then raw product is converted into a standardized product, with the output being lower, higher the standard. The goods sold to consumers are the standardized products.

In modeling costs imposed due to the standards, the choice of the iceberg variety of the costs is deliberate. The iceberg variety of costs allows me to abstain from any economies of scale following from the fixed costs of meeting the standard. Thus I can focus on the case of perfect competition.

Because of the standard, there will be a difference between the price paid by the consumers and the effective price received by the producers. If the standard on imports is τ^* then the consumer price is equal to $1 + a^*\tau^* + \alpha$ where α is the per unit consumption

tax. The prices received by home and foreign producers are $\frac{1+a^*\tau^*}{1+a\tau}$ and 1 respectively.[7] Hence, the revenue functions of the home and the foreign economies are given as:

$$R = R(\frac{1+a^*\tau^*}{1+a\tau}, \overline{K}, \overline{L}) \text{ and } R^* = R^*(1, \overline{K}^*, \overline{L}^*),$$

where second and third arguments represent the endowments of capital and labor respectively. Based on the Hotelling's lemma, domestic and foreign supply functions (the derivative of the revenue functions with respect to the price of final output) are given by the relationships:

$$S_1 = \frac{R_1}{1+a\tau} \tag{3}$$

$$S_1^* = \frac{R_1^*}{1+a^*\tau^*}. \tag{3a}$$

Thus, higher is the standard imposed, lower is the effective supply for all prices.

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[7]Let the price charged to the zero profit bearing converters is p^*. The cost minimization problem of the converters i.e. who convert raw product to the finished product is given as: $Min\ p^*x$ subject to $\frac{X}{1+a\tau} = \overline{X}$. The Lagrangean is : $L = p^*x + \lambda[\overline{X} - \frac{X}{1+a\tau}] \Rightarrow$

$\lambda = p^*[1+a\tau] = q \Rightarrow p^* = \frac{q}{1+a\tau}$

2.4 Optimal policy for correction of a consumption externality in the case of a small open economy:

In this section I discuss the choice of the optimal policy where the government has at its disposal consumption tax and the standards on the home produced goods and imports. I show that the optimal standards regime depends on whether consumption tax is chosen optimally or not. As discussed in Appendix A.1, an optimal policy package also involves a production subsidy/tax scheme. However, this is suppressed, principally, because WTO rules do not permit production subsidies and usually result in countervailing duties.

2.4.1 In the presence of the consumption tax

In order to correct for the consumption externality emanating from good one I allow for three policy instruments: (i) A per unit consumption tax, denoted as α. (ii) An emission standard on home produced good, denoted as τ. (iii) An emission standard on imports, denoted as τ^*. The consumer price of good one in the absence of the standard is normalized to 1. Thus, the consumer price with the standard τ^* on imports is $1 + a^*\tau^* + \alpha$. The wedge from the world price thus occurs because of the consumption tax and the standard on the imports and is *not* due to the standard on the domestic good. This makes the two standards, the standard on imports and the standard on domestic goods, asymmetric instruments.

I can now consider the determination of optimal policy when both consumption tax as well as product standards can be chosen optimally.[8] The Pigouvian consumption tax equates the value of emissions per unit of consumption to the consumption tax. However, the emissions per unit of consumption are contingent on the standard chosen. The optimal consumption tax is equal to the value of emissions from unit consumption at the optimally chosen standard.

A distinction needs to be made, here, between the effects of applying a consumption tax as opposed to applying a tax on emissions. A Pigouvian tax on emissions generates incentives for the adoption of a cleaner good and the market can be relied on to provide the optimal standard. In contrast, an output tax such as a consumption tax does not induce consumers to adopt optimal emissions generating technology. See Appendix A.2 for an analysis of this argument.

Derivation of optimal policy instruments

The general equilibrium of the economy is represented by the following dual equation:

$$E(1+a^*\tau^*+\alpha,1,u,Z) = R(\frac{1+a^*\tau^*}{1+a\tau},1,\overline{K},\overline{L}) + \alpha E_1(1+a^*\tau^*+\alpha,1,u,Z). \qquad (4)$$

[8] Policies used by many European countries to control auto emissions are an example. In Germany, automobile tax rates are determined for every 100cc of engine capacity in accordance with emissions standards with rates for diesel vehicles being twice to those for gasoline. Similar standards based taxation are prevalent in the case of UK as well. Usually emissions taxes are not applied mainly owing to monitoring costs.

$E(.)$ is the expenditure function. The arguments of the expenditure function are consumer prices, utility and owing to consumption externality, the aggregate level of emissions Z.[9] $R(.)$ is the revenue function where the arguments are producer prices and factor endowments in the economy. $E_i(.)$ and $R_i(.)$ denote the derivative of the expenditure and the revenue function with respect to the i^{th} argument. E_1 denotes the Hicksian demand of good one. Equation (1) can be reformulated as:

$$Z = (T - \tau^*)E_1 + (\tau^* - \tau)\frac{R_1}{1 + a\tau}. \qquad (1')$$

The choice variables are α, τ^* and τ respectively. Totally differentiating equation (4) we have:

$$m_1 a^* d\tau^* + (E_u - \alpha E_{1u})du + (E_z - \alpha E_{1Z})dZ = -R_1 \frac{(1 + a^*\tau^*)}{(1 + a\tau)^2} ad\tau + \alpha E_{11}[a^* d\tau^* + d\alpha] . \quad (5)$$

Totally differentiating (1') we get the partial effect of the three instruments on pollution:

$$[1 - (T - \tau^*)E_{1Z}]dZ = \frac{\partial Z}{\partial \alpha} d\alpha + \frac{\partial Z}{\partial \tau^*} d\tau^* + \frac{\partial Z}{\partial \tau} d\tau + (T - \tau^*)E_{1u} du , \qquad (6)$$

where,

$$\frac{\partial Z}{\partial \alpha} = (T - \tau^*)E_{11} \qquad (7a)$$

[9] Since the social welfare depends on aggregate pollution, Z enters the expenditure function as an argument. The higher the emissions, the higher is the expenditure required to attain the same level of utility from the consumption of the goods.

$$\frac{\partial Z}{\partial \tau^*} = -m_1 + (T - \tau^*)a^* E_{11} + (\tau^* - \tau)a^* \frac{R_{11}}{(1+a\tau)^2} \quad (7b)$$

$$\frac{\partial Z}{\partial \tau} = -[\frac{R_1}{1+a\tau} + (\tau^* - \tau)R_{11}\frac{(1+a^*\tau^*)}{(1+a\tau)^3}a + (\tau^* - \tau)\frac{R_1 a}{(1+a\tau)^2}]. \quad (7c)$$

Ceteris paribus, the consumption tax reduces the level of pollution in the economy by reducing the demand. The more elastic the demand, the more pronounced the effect. The effect on pollution owing to changes in the standards is more complex. A rise in standard on imports reduces emissions on the existing level of imports, captured by the first term in equation (7b). At the same time, since a standard on imports taxes consumption at a rate equal to the average cost of meeting the standard, there is a reduction in pollution owing to this consumption tax. The second term in equation (7b) represents this effect. A higher standard on imports results in shifting the source of some consumption from imports to domestic producers. This switch can result in higher (lower) pollution depending upon whether the switched portion is consumed at a lower (higher) standard.

A similar interpretation applies to the equation (7c). The first term is, as before, the direct effect of a higher standard on the pollution from existing domestic supply while the other terms relate to the effects caused by the switch in source of consumption. Substituting equations (7a), (7b) and (7c) into equation (5)

$$[E_u - \alpha E_{1u} + A(T - \tau^*)E_{1u}]du = [\alpha E_{11} - A\frac{\partial Z}{\partial \alpha}]d\alpha + [\alpha a^* E_{11} - a^* m_1 - A\frac{\partial Z}{\partial \tau^*}]d\tau^* -$$
$$[R_1\frac{(1+a^*\tau^*)}{(1+a\tau)^2}a + A\frac{\partial Z}{\partial \tau}]d\tau \quad , \quad (8)$$

where $A = \frac{(E_Z - \alpha E_{1Z})}{(1-(T-\tau^*)E_{1Z})}$. $A(T-\tau^*)E_{1Z}$ measures the benefit to the society from reduction in emission through a reduction in demand. Substituting from (7a), (7b) and (7c) into (8), at an interior optimum, the coefficients of $d\alpha, d\tau$ and $d\tau^*$ should equal zero. Setting the coefficient of $d\alpha$ equal to 0 gives the rule setting the optimal consumption tax:

Rule setting the consumption tax

$$\hat{\alpha} = E_Z(T-\tau^*). \qquad (9)$$

E_Z (shadow price of pollution) measures the amount by which expenditure must go up in order to keep the utility constant (hat over α represents the equilibrium value). Multiplying by per unit emissions gives the increase in expenditure when consumption increases by one unit. This should precisely equal the optimal consumption tax. Thus this equation gives the Pigouvian tax for the optimal standard. Setting the coefficient of $d\tau^*$ equal to 0 implies the rule setting the optimal standard on imports:

Rule setting the standard on imports

$$-a^* m_1 + E_Z m_1 - E_Z(T-\tau^*)a^* E_{11} + \alpha a^* E_{11} - E_Z(\tau^* - \tau)a^* \frac{R_{11}}{(1+a\tau)^2} = 0. \qquad (10)$$

A standard on the imports taxes exporters to the home country. As the standard on imports is raised, the entering price of good rises by the full amount of the tax. Raising the standard on imports makes imports costlier, but also makes imports cleaner. The second term in (10) shows that a higher standard reduces the pollution from pre-existing volume of imports. The next two terms, represent the effect that follows from the consumption tax element of the standard on imports. The rise in price lowers consumption which has a cost as well as benefit, (as shown in the two terms in equation (10) above). This cost is zero if the consumption tax is set at its optimum because the presence of a consumption tax neutralizes this effect of the standard on imports.

The last term captures the effect of the change in source of consumption owing to different standards. The effect of a switch from imports to domestic production implies either a higher or lower emission depending on whether the switched portion is consumed at a relatively less or more stringent standard. Substituting from equation (9), (10) converts to:

$$a^* m_1 - E_Z m_1 + E_Z(\tau^* - \tau)a^* \frac{R_{11}}{(1+a\tau)^2} = 0\,. \qquad (10a)$$

Setting the coefficient of $d\tau$ equal to 0 implies the rule setting the optimal standard on home produced good:

Rule setting the standard on home produced good

$$E_Z \frac{R_1}{1+a\tau} + E_Z(\tau^* - \tau)R_{11}\frac{(1+a^*\tau^*)}{(1+a\tau)^3}a + E_Z(\tau^* - \tau)\frac{R_1 a}{(1+a\tau)^2} - \frac{(1+a^*\tau^*)}{(1+a\tau)^2}R_1 = 0\,. \quad (11)$$

The first term in (11) is the direct marginal benefit from reduced pollution due to an increase in the standard on home production. The next two terms are identical to the switching effect as in equation (10) albeit from the domestic production into imports. In (11), the consumption tax effect is absent because the domestic standard does not affect the consumption price. Having determined the optimal instruments in the presence of a consumption distortion, I evaluate the key provision in the WTO i.e. national treatment. This leads to the first proposition.

Proposition 1: The optimal policy for a small open economy involves national treatment if and only if the cost of meeting the standard between the home and the foreign producers is equal ($a^* = a$). *Furthermore, optimal standards on the foreign suppliers are higher (lower) as the foreign costs of meeting the standard are lower (higher) than the domestic suppliers.*

Given the consumption tax element in the standard on imports, a per unit consumption tax controls the asymmetry between the standard on home produced goods and on imports. After making the two instruments symmetrical, the optimal rule requires setting equal standards only if the marginal costs of meeting the standard are equal.

Proof: *Necessary* part- If $\tau = \tau^*$ then equation (10a) implies that $A = a^*$. Plugging $\tau = \tau^*$ and $A = a^*$ in equation (11) we get $a = a^*$.

Sufficiency part- Equation (10a) and (11) imply

$$E_Z(\tau^* - \tau)a^* \frac{R_{11}}{(1+a\tau)^2} = (E_Z - a^*)m_1 \tag{12}$$

$$-E_Z(\tau^* - \tau)[R_{11}\frac{(1+a^*\tau^*)}{(1+a\tau)^3}a + \frac{R_1}{(1+a\tau)^2}a] = [E_Z - \frac{(1+a^*\tau^*)}{(1+a\tau)}a]\frac{R_1}{(1+a\tau)}] \tag{13}$$

Dividing equation (12) by equation (13) and rearranging terms we obtain:

$$m_1R_1(a^* - a) + (\tau^* - \tau)R_{11}(1+a^*\tau^*)aa^*[E_1] = 0. \tag{14}$$

Equation (14) implies that cost symmetry is both necessary and sufficient for NT to be optimal. Since R_1, R_{11} and E_1 are all positive, equation 14 implies that if $a > a^*$ then $\tau^* > \tau$ and vice versa.[10] Since the important asymmetry in the two standards that is controlled by a consumption tax, I will next look at a case when optimal consumption tax is not applied.

2.4.2 In the absence of the consumption tax

[10] The result on NT can be extended to the general case with non-linear costs; proof available upon request.

In reality, governments in different countries use different instruments to control a consumption externality.[11] In this paper, I take the available set of instruments as exogenous. The reason for a reliance on certain instruments, even when optimality dictates otherwise, is explained in terms of politics and/or administrative costs. The basic result is that, in the absence of a consumption tax, national treatment is *not* an optimal policy even if the costs of meeting the standard are identical between home and foreign producers. This follows from the fact that in this case, a standard on imports substitutes for the missing consumption tax.

The equilibrium of the economy is represented by the same equation as (4) except for the fact that there is no consumption tax revenue term on the right hand side. The first order conditions that characterize the choice of the two standards are as follows:

Rule setting the standard on imports

$$a^* m_1 - Bm_1 - B(T-\tau^*)E_{11} - B\frac{(\tau^*-\tau)R_{11}a^*}{(1+a\tau)^2} = 0\,, \qquad (15)$$

where $B = \dfrac{E_Z}{[1-(T-\tau^*)E_{1Z}]}$

B has the same interpretation as A except for the change in the tax revenue term. Comparing equation (10a) to (15), the third term in (15) shows the benefit of reduced

[11] In the case of emission standard for example, the average gasoline tax is more than $2/gallon in many European countries, while in the U.S., federal taxes are only 18cents/gallon and average state taxes 22cents/gallon. (Gary Becker, Business Week, May 27, 2002).

pollution as the standard on imports works as a consumption tax. If the tax were set optimally, this effect would be exactly offset by the change in tax revenue.

Rule setting the standard on home produced goods

$$-\frac{R_1(1+a^*\tau^*)}{(1+a\tau)^2}+B[\frac{R_1}{1+a\tau}+(\tau^*-\tau)\frac{R_1 a}{(1+a\tau)^2}+(\tau^*-\tau)\frac{R_{11}(1+a^*\tau^*)a}{(1+a\tau)^3}]=0\,. \qquad (16)$$

It is interesting to compare the rule setting the standard on the home produced good to the case where optimal consumption tax is applied. The two equations are qualitatively identical except for the differences in the terms containing the consumption tax. The two rules lead us to the following proposition:

Proposition 2: If per unit consumption tax is not set optimally, then national treatment is not an optimal policy for a small open economy even if the costs of meeting the standard are equal. If the costs are equal, it is optimal to set a higher standard on imports relative to home produced goods. If the cost of meeting the standard is lower for foreign producers, then a higher standard on imports is optimal.

A standard on imports substitutes for the missing consumption tax, and that is why it is set higher even when costs are equal. Given the continuity of welfare functions, there would exist a point (where $a^* > a$) such that NT would be optimal. The dual role of the

standard on imports can thus justify a higher standard on imports even if the costs of meeting the standard are identical between home and foreign producers.

Proof: Dividing equation (15) by equation (16) we have:

$$\frac{\frac{R_1(1+a^*\tau^*)a}{(1+a\tau)^2}}{a^*m_1} = \frac{[\frac{R_1}{1+a\tau}+(\tau^*-\tau)\frac{R_1 a}{(1+a\tau)^2}+(\tau^*-\tau)\frac{R_{11}(1+a^*\tau^*)a}{(1+a\tau)^3}]}{[m_1-(T-\tau^*)E_{11}a^*-\frac{(\tau^*-\tau)R_{11}a^*}{(1+a\tau)^2}]}.$$

Cross-multiplying and simplifying terms the expression above converts to

$$(a^*-a)m_1R_1+aa^*(\tau^*-\tau)\frac{R_{11}}{1+a\tau}E_1 = -aa^*(1+a^*\tau^*)(T-\tau^*)E_{11}R_1. \qquad (17)$$

As m_1, R_1, R_{11}, E_1 are positive, E_{11} is negative, for equation (17) to hold, in cases where costs are equal or when cost of foreign producer is lower a higher standard on imports is optimal.

2.5 Globally and nationally optimal policy

2.5.1. Unilateral optimal policy by a large country

The use of standards for market power reasons requires some clarification. In the absence of an externality, a large country will never adopt standards because, unlike with tariffs, the imposition of standards yields no revenue. A large importing country having market power will gain by imposing a tariff (This is the so-called *optimum tariff* argument). If,

however the tariff yields no revenue, then the country cannot gain by imposing it.[12] This is why, in the absence of an externality, the optimal standard chosen by a large country is zero.

However, in the presence of an externality, market power motives are resurrected. And unlike a small open economy, a large country will set discriminatory standards even if the consumption tax is set optimally and there is cost symmetry in meeting the standards. Thus the standards chosen by a large country may be sub-optimal from a global standpoint. If, however, a country can choose its tariffs *optimally,* then the relative level of standards chosen mimics that of a small open economy.

Given the pecuniary externality of standards chosen by a large country, one can determine the impact on prices received by the exporters by using the market clearing condition for the standardized good.

Impact on effective producer prices

Market clearing in the non-numeraire good is shown by the equation below:

$$\frac{R_1}{1+a\tau}\left(\frac{q}{1+a\tau}\right)+\frac{R_1^*}{1+a^*\tau^*}\left(\frac{q}{1+a^*\tau^*}\right)=d(q)\,, \tag{18}$$

[12] This applies when the markets are assumed to be perfectly competitive.

where $d(q)$ denotes the aggregate demand for the non-numeraire good. To determine the sign of $\partial q / \partial \tau$ and $\partial q / \partial \tau^*$ totally differentiating equation (18) we have:

$$-\frac{R_1 a}{(1+a\tau)^2}d\tau+\frac{R_{11}}{(1+a\tau)^2}dq-\frac{R_{11}qa}{(1+a\tau)^3}d\tau-\frac{R_1^* a^*}{(1+a^*\tau^*)^2}d\tau^*+\frac{R_{11}^*}{(1+a^*\tau^*)^2}dq-\frac{R_{11}^* qa^*}{(1+a^*\tau^*)^3}d\tau^*-d'dq=0$$

$$\Rightarrow \partial q/\partial \tau=\frac{\frac{R_1 a}{(1+a\tau)^2}+\frac{R_{11}qa}{(1+a\tau)^3}}{\frac{R_{11}}{(1+a\tau)^2}+\frac{R_{11}^*}{(1+a^*\tau^*)^2}-d'}>0$$

$$\Rightarrow \partial q/\partial \tau^*=\frac{\frac{R_1^* a^*}{(1+a^*\tau^*)^2}+\frac{R_{11}^* qa^*}{(1+a^*\tau^*)^3}}{\frac{R_{11}^*}{(1+a^*\tau^*)^2}+\frac{R_{11}}{(1+a\tau)^2}-d'}>0$$

The effect of raising the standard in our model is equivalent to a technology shock that raises the cost of production and results in higher consumer prices. This is true whether the standard is the one on imports or the one on home produced goods. Both standards reduce the world supply at any given price. Whether revenue received by the producers goes up, or not, depends on the elasticity of demand. If the demand is elastic, a rise in prices would diminish revenues. Therefore, we need to assess the impact on the price received in the units of the standardized good. Now,

$$\frac{\partial}{\partial \tau}\left(\frac{q}{1+a\tau}\right)=\frac{1}{1+a\tau}\frac{\partial q}{\partial \tau}-\frac{q}{(1+a\tau)^2}a$$

$$\frac{\partial}{\partial \tau}\left(\frac{q}{1+a^*\tau^*}\right)=\frac{1}{1+a^*\tau^*}\frac{\partial q}{\partial \tau}>0$$

Thus, from a global standpoint, the importing country would always under-provide the standard on home produced good. Similarly,

$$\frac{\partial}{\partial \tau^*}\left(\frac{q}{1+a^*\tau^*}\right) = \frac{1}{1+a^*\tau^*}\frac{\partial q}{\partial \tau^*} - \frac{qa^*}{(1+a^*\tau^*)^2}$$

$$= \frac{1}{1+a^*\tau^*}\frac{\frac{R_1^* a^*}{(1+a^*\tau^*)^2} + \frac{R_{11}^* q a^*}{(1+a^*\tau^*)^3}}{\frac{R_{11}^*}{(1+a^*\tau^*)^2} + \frac{R_{11}}{(1+a\tau)^2} - d'} - \frac{qa^*}{(1+a^*\tau^*)^2}$$

$$= \frac{\frac{R_1^* a^*}{(1+a^*\tau^*)^3} - \frac{R_{11} q a^*}{(1+a\tau)^2(1+a^*\tau^*)^2} + \frac{qa^* d'}{(1+a^*\tau^*)^2}}{\frac{R_{11}^*}{(1+a^*\tau^*)^2} + \frac{R_{11}}{(1+a\tau)^2} - d'}.$$

The sign of the term above depends on the sign of the numerator. (The denominator is unambiguously positive since the revenue function is convex and the slope of the demand function is negative). By adding and subtracting $\frac{R_1 a^*}{1+a\tau}$ to the numerator, the numerator converts to the following.

$$\frac{1}{(1+a^*\tau^*)^2}[a^*(qd'+d) - a^*[\frac{R_1}{1+a\tau} + \frac{R_{11}q}{(1+a\tau)^2}]]$$
$$= \frac{1}{(1+a^*\tau^*)^2}[a^*(1-\varepsilon_d) - a^*[\frac{R_1}{1+a\tau} + \frac{R_{11}q}{(1+a\tau)^2}]$$

If $\varepsilon_d > 1$, the above expression is negative, i.e., the demand is elastic, the importing country would set an excessively high standard on imports.

The first order condition that determines the choice of standards by a large country is given by the following equation:

$$\frac{(\tilde{\tau}^* - \tilde{\tau})\,R_{11}/(1+a\tilde{\tau})^2}{\frac{R_{11}}{(1+a\tilde{\tau})^2}+\frac{R_{11}^*}{(1+a^*\tilde{\tau}^*)^2}}\left[\frac{R_1^* a^*}{(1+a^*\tau^*)^2}+\frac{R_{11}^* q a^*}{(1+a^*\tau^*)^3}\right] = m_1 . \qquad (19)$$

Thus, even in the presence of cost symmetry and an optimally chosen consumption tax, a large country will choose a higher standard for the foreign product because of the pecuniary externality that is not internalized. Market power in the world market creates incentives for the large country to discriminate in its choice of the standards.

2.5.1.2 In the presence of an optimum tariff

Now, if the large country is allowed to choose its tariffs optimally then the market power basis for discrimination in the choice of the standards is no longer present and the relative levels of the standards chosen mimics that of the small open economy. The following equations give the optimum tariffs, the optimal consumption tax and the equation determining the relative levels of the two standards.

Consumption tax chosen by a large country in the presence of the optimum tariff

$$\hat{\alpha} = E_Z(T - \tau^*). \tag{20}$$

This consumption tax is qualitatively identical to the one chosen by a small open economy.[13]

Optimum tariff chosen by a large country

$$\hat{t} = \frac{m_1}{\dfrac{R_{11}^*}{(1+a^*\tau^*)^2}} - E_Z(\tau^* - \tau). \tag{21}$$

The first term in the tariff expression is the market power term and the second term is the production tax/subsidy term to the higher/lower standard producers. Using these two expressions and the first order conditions determining the choice of the standard on the imports and the standard on the home produced good we get the following equation which determines the relative levels of the standards between the home and the foreign producers.

$$(\tau^* - \tau)\Delta\left[\frac{R_1 R_{11}^* q a a^*}{(1+a\tau)^2(1+a^*\tau^*)^3} + \frac{R_1^* R_{11}(q+t)a}{(1+a^*\tau^*)^2(1+a\tau)^3} + \frac{R_{11}^* R_{11} q a^*(q+t)a}{(1+a\tau)^3(1+a^*\tau^*)^3}\right] + \Delta(a^* - a) = 0$$

, (22)

[13] In principle the value of the tax should equate to the higher of the two marginal damages. This is achieved by a production tax/subsidy to the lower/higher standard producers. The tariff in the large country case consequently has a production tax/subsidy element apart from the market power term.

where $\Delta = (m_1 - (\alpha + t)E_{11} + t\frac{R_{11}}{(1+a\tau)^2})$

Equation (22) implies that the choice of the standards by a large country in the presence of an optimal tariff is qualitatively identical to a small open economy.

2.5.2. Globally optimal policy with standards and consumption tax

The impact of the actions of a small open economy is confined to the economy itself. Consequently, one might argue that a global institution like the WTO would have reasons to evaluate the NT rule from a global perspective. Thus, I investigate the optimal policy from a global perspective. The choice of standards by a large country has external effects on the exporting country through the effect it has on the prices received (the pecuniary effect). Thus the individual choice of standards by a large country is likely to be sub-optimal from a global perspective. Here we focus on a case where a global social planner internalizes the pecuniary externality emanating from the choice of the standards.

In discussing the case for the global economy, three important considerations apply. (i) Prices are no longer exogenous but are determined by equating world demand and supply. (ii) The nature of optimality allows for international transfers. (iii) Trans-boundary pollution is ruled out. The analysis is focused on the standard of the importing

country that can also choose a consumption tax optimally. The proof in the absence of consumption tax is provided in Appendix (A.3).

Structure of the World Economy

The two countries are home (no*)* and foreign (*). Good one and two are the non-numeraire and the numeraire good respectively. In order to focus on the standards in the importing country, I suppress the consumption of the non-numeraire good in the exporting country. To obtain trade balance, home exports the numeraire good. Let Ω denote the transfer from the home country to foreign country. Income expenditure equality and market clearing conditions imply:

(a). Income expenditure equality in the home country.

$$E(q+\alpha,1,u,Z) = R(\frac{q}{1+a\tau}) + \alpha E_1(q+\alpha,1,u,Z) - \Omega . \quad (23)$$

(b). Income expenditure equality in the foreign country.

$$\overline{E}^* = R^*(\frac{q}{1+a^*\tau^*}) + \Omega , \quad (24)$$

where $\overline{E}^*$ denotes the expenditure on the numeraire good in the exporting country. (Above we have suppressed the factor endowments as arguments in the revenue function). Changes in $\overline{E}^*$ imply that welfare of the exporting country changes. Ω ensures

that the maximization of u maximizes world welfare since post optimization transfer is adjusted for the foreign country to have a constant level of welfare.

(c). Market clearing condition for good one:

$$E_1(q+\alpha,1,u,Z)=\frac{R_1}{1+a\tau}\left(\frac{q}{1+a\tau}\right)+\frac{R_1^*}{1+a^*\tau^*}\left(\frac{q}{1+a^*\tau^*}\right) \tag{25}$$

Totally differentiating (1') (taking into account the fact that the prices are now endogenous:

$$dZ=\eta_\alpha d\alpha+\eta_q dq+\eta_{\tau^*}d\tau^*+\eta_\tau d\tau+\eta_u du \tag{26}$$

$$\eta_\alpha=\frac{(T-\tau^*)E_{11}}{[1-(T-\tau^*)E_{1Z}]},\ \eta_q=\frac{(T-\tau^*)E_{11}+(\tau^*-\tau)\dfrac{R_{11}}{(1+a\tau)^2}}{[1-(T-\tau^*)E_{1Z}]},$$

$$\eta_\tau=\frac{-\dfrac{R_1}{1+a\tau}+(\tau^*-\tau)[-\dfrac{R_1}{(1+a\tau)^2}a-\dfrac{R_{11}qa}{(1+a\tau)^3}]}{[1-(T-\tau^*)E_{1Z}]}, \tag{26a}$$

$$\eta_{\tau^*}=\frac{-m_1}{[1-(T-\tau^*)E_{1Z}]},\ \eta_u=\frac{(T-\tau^*)E_{1u}}{[1-(T-\tau^*)E_{1Z}]}.$$

In addition to the direct partial effects of the instruments, there are additional effects here that result from the impact on the consumer prices. (In what follows we suppress the terms containing du). The effect on the prices of the change in the consumption tax, standard on the imports and the standard on home produced good is obtained by totally differentiating equation 21 and collecting terms $\Rightarrow$

$$dq = \frac{\Psi_\alpha}{\Delta} d\alpha + \frac{\Psi_\tau}{\Delta} d\tau + \frac{\Psi_{\tau^*}}{\Delta} d\tau^*, \tag{26}$$

$$\Delta = [E_{11} - \frac{R_{11}}{(1+a\tau)^2} - \frac{R_{11}^*}{(1+a^*\tau^*)^2} + E_{1Z}\eta_q], \tag{26a}$$

$$\Psi_\alpha = -[E_{11} + E_{1Z}\eta_\alpha], \tag{26b}$$

$$\Psi_\tau = -[\frac{R_1 a}{(1+a\tau)^2} + \frac{R_{11} q a}{(1+a\tau)^3} + E_{1Z}\eta_\tau], \tag{26c}$$

$$\Psi_{\tau^*} = -[\frac{R_1^* a^*}{(1+a^*\tau^*)^2} + \frac{R_{11}^* q a^*}{(1+a^*\tau^*)^3} + E_{1Z}\eta_{\tau^*}]. \tag{26d}$$

Setting $dq = 0$ in (26) so that terms of trade are unaffected by a country's policy, equations determining the choice of standards in a small country case can be recovered. Here we are dealing with a case where $dq \neq 0$. Equation (23) and (24) imply:

$$E(q+\alpha,1,u,Z) + \overline{E}^* = R(\frac{q}{1+a\tau}) + \alpha E_1(q+\alpha,1,u,Z) + R^*(\frac{q}{1+a^*\tau^*}). \tag{27}$$

The first order conditions are given by the following rules:

Rule setting the globally optimal consumption tax

$$\hat{\alpha} = E_Z(T - \hat{\tau}^*) + \frac{E_Z(\hat{\tau}^* - \hat{\tau})\frac{R_{11}}{(1+a\hat{\tau})^2}}{\frac{R_{11}}{(1+a\hat{\tau})^2} + \frac{R_{11}^*}{(1+a^*\hat{\tau}^*)^2}}. \tag{28a}$$

(^s represent the optimal values of the instrument). The consumption tax-setting rule in the case of global optimality includes an additional term relative to the small open

economy. The second term in (25a) is the terms of trade term that vanishes as $R_{11}^* \to \infty$ i.e. in case of a small open economy.

Rule setting the standard on imports

$$-\alpha E_{11}\frac{\Psi_{\tau^*}}{\Delta}+\frac{R_1^* a^*}{(1+a^*\tau^*)^2}+(E_Z-\alpha E_{1Z})\eta_{\tau^*}=0\,. \tag{28b}$$

Rule setting the standard on the home produced goods

$$-\alpha E_{11}\frac{\Psi_{\tau}}{\Delta}+\frac{R_1 a}{(1+a\tau)^2}+(E_Z-\alpha E_{1Z})\eta_{\tau}=0\,. \tag{28c}$$

In a small open economy, the partial effect of a consumption tax on pollution works only through changes in the effective consumer price for a given world price and the standards. For a given standard there is no supply side effect on pollution. In the case of global policy, the consumption tax also affects the supply side through the change in producer prices.

Proposition 3: A globally optimal policy regime is qualitatively similar to that of a small open economy. After choosing the consumption tax optimally, NT is optimal if and only if exporters and domestic producers have equal costs of meeting the standard. Moreover, it

is optimal to choose lower standards for producers whose cost of meeting the standard is higher.

Corollary: In the absence of the consumption tax, the globally optimal standards regime requires setting higher standards on imports as long as costs to foreign producers for meeting the standard is either lower or equal to the cost of the home producers. (For the Proof, see Appendix A.3)

The results shown above are akin to a standard result in the tariff literature. With perfect competition, the optimal tariff regime for both a small open economy and the world as a whole is identical, i.e. zero tariffs. An importing country tends to set excessively high tariffs in order to exploit its market power, commonly known as the terms of trade motive. In the *absence* of any consumption externality, a large importing country has no incentive to impose any standard.[14]

The basis of this argument is that unlike tariffs, standards yield no revenue. It is only in the presence of an externality that market power motives are resurrected. The large country imposes too high a standard, from a global standpoint, since the burden of that higher standard falls partly on the exporters. For elastic demand, non-cooperative standards chosen by the importing country involve excessively high and excessively low standards on imports and home produced goods respectively (relative to a global social

[14] This can be seen by looking at optimization by an individual large country (not shown here) and setting Z=0.

planner). A first best solution internalizes the pure terms of trade externality in case of tariffs and pecuniary externality in case of standards, thereby rendering the same situation as found in a small economy where these external effects do not exist. Qualitatively similar results for global optimality are proven below.

Proof:

Let $\delta = \dfrac{\dfrac{R_{11}}{(1+a\tau)^2}}{\dfrac{R_{11}}{(1+a\tau)^2} + \dfrac{R_{11}^*}{(1+a^*\tau^*)^2}}$, $\delta < 1$.

By dividing equation (28b) by (28a), using the expression for optimal consumption tax and rearranging terms, we get:

$$E_Z[(\tau^* - \tau)\delta\{\frac{R_1^* a^*}{(1+a^*\tau^*)^2} + \frac{R_{11}^* q a^*}{(1+a^*\tau^*)^3}\} - \frac{R_1^*}{(1+a^*\tau^*)}] = \frac{R_1^* q a^*}{(1+a^*\tau^*)^2}. \quad (29a)$$

Similarly, dividing equation (28c) by (28a), we get:

$$E_Z[(\tau^* - \tau)\{\delta - 1\}\{\frac{R_1 a}{(1+a\tau)^2} + \frac{R_1 q a}{(1+a\tau)^3}\} - \frac{R_1}{(1+a\tau)}] = \frac{R_1 q a}{(1+a\tau)^2}. \quad (29b)$$

Now by dividing equation (29a) by (29b), then cross-multiplying and rearranging terms, we get:

$$\frac{(\tau^* - \tau)R_{11}^* R_{11} q}{(1+a\tau)(1+a^*\tau^*)}[E_1] + (a^* - a)[\frac{R_1 R_1^* R_{11}}{(1+a\tau)^2} + \frac{R_1 R_1^* R_{11}^*}{(1+a^*\tau^*)^2}] = 0. \quad (30)$$

Equation (30) implies that, under cost symmetry, NT is optimal (and also the converse) and that the relative level of standards and the level of costs for meeting the standards are inversely related.

The analysis above is done for identical emissions intensity at zero standard (T) between home produced goods and imports. If emissions intensities are different, the ordering of standards in an optimum is determined both by the ordering of the costs of meeting the standards as well as by the difference in the emissions intensities. Let T and T^* denote the emissions intensity of home produced goods and foreign produced goods at a zero standard respectively. Then the counterpart of equation (9), which determines the optimal consumption tax in a small open economy, is now given as:

$$\hat{\alpha} = E_Z(T^* - \tau^*). \tag{9a}$$

The rule setting the consumption tax is identical to the previous one. The counterpart of equation (14), which determines whether national treatment is optimal or not, is given as:

$$m_1 R_1(a^* - a) + (\tau^* - \tau)R_{11}(1 + a^*\tau^*)aa^*[E_1] + (T - T^*)\{aa^* m_1 R_1 + R_{11}(1 + a^*\tau^*)aa^* E_1\} = 0. \tag{14a}$$

The additional terms in equation (14a) that contain the differences in emissions intensity imply that at equal costs, the dirtier product will be optimally set a higher standard.

2.6 Conclusions

This chapter looked at the choice of optimal instruments in the presence of a consumption externality. The first contribution of the paper was to show that, given the way we think of standards as instruments to reduce the emissions intensity, optimality requires the use of a consumption tax as well as standards. Optimally chosen standards are, in general, discriminatory. Thus, optimality requires standards different from national treatment requirements.

Next, I looked at national treatment rule and established conditions for optimality of this rule. The availability of both a consumption tax and the condition that costs of meeting the standard be equal between the home and foreign producers is necessary and sufficient for national treatment to be optimal. Without a consumption tax, national treatment is not optimal even when costs for meeting the standard are identical. Asymmetry between the two instruments is uncontrolled in the absence of the consumption tax.

Chapter 3

National Treatment: Welfare and Politics

3.1 Introduction

In the third chapter I analyze the welfare implications of the imposition of a national treatment constraint both in a situation where the government maximizes aggregate social welfare in a small open economy and in a case where the government's choice of standards is influenced by an industrial lobby. Simulation results shown in this chapter indicate that with all other things being equal, losses from NT are lower if the cost differential in meeting the standard is smaller. Hence it is likely that welfare losses due to NT are smaller if NT is applied between two developed countries with similar costs than between developed and developing countries. Developing countries are expected to have relatively higher costs of meeting the standard.[15]

Given the well-known importance of organized special interest groups in the determination of trade policy, (Grossman and Helpman (1994,1995), Maggi and Goldberg (1999)) the role of NT must be considered when observing how special

[15] Meeting high standards is often technology-intensive, thus disadvantaging developing countries (Finger and Schuler 1999 and Wilson 2002). This disadvantage is however not confined to developing countries. Consider, the standard that cars sold in Sweden must have headlight wipers. Unlike foreign cars manufacturing of Swedish cars is optimized to this requirement. Thus, the regulation raises the relative cost of foreign cars in Sweden (Baldwin 2001)

interests of producers affect the choice of standards. When government places a higher weight on the welfare of the producers than on the welfare of the other citizens, simulation results indicate that NT has a role in moderating social welfare losses caused by politics relative to losses caused by a discriminatory regime. Hence for high degree of politics and a low cost differential, the aggregate social welfare is higher with NT than with discrimination, even though in absence of politics the social welfare is unambiguously higher in a regime allowing for discrimination.

For this reason, NT rule is a logical approach to standards. The constraint of national treatment restricts the government in pursuing protectionist goals. As a result, the supply of protection is lower under NT rule than it is in a regime that allows discrimination. To the extent the hands of the government are tied, it serves the underlying objectives of the WTO. There is a substantial body of literature that identifies the benefits of tying the hands restricting government's choices, especially in situations where government lacks commitment.

NT rule is optimal under very specific conditions, such as when consumption tax is set optimally and costs of meeting the standard are equal for the home and the foreign producers. In reality, costs of meeting the standard differ widely across producers, especially between domestic and foreign producers. Thus, in order to assess the effect on social welfare, I consider a situation wherein a specific factor combines with labor to produce the non-numeraire good. When considering the political economy of the choice

of the standards, I assume that this specific factor is organized and lobbies for protection. In particular, I look at the relationship between the welfare cost of NT as a function of the cost differential and the role of NT in the presence of producer special interests.

Section 3.2 shows the derivation of the social and political welfare function. Section 3.3 discusses theoretical ambiguity in the effect of national treatment. Section 3.4 examines the simulated impact on social welfare by imposition of national treatment as the cost differential in meeting the standards is changed. Section 3.5 analyses using simulations, the role of the national treatment in the presence of the special interest politics. Section 3.6 briefly discusses the role of NT as a commitment mechanism. The conclusion is shown in Section 3.7 and Section 3.8 presents possible future research.

3.2. Derivation of social and political welfare function with consumption externality and standards

This section shows the derivation of the social and political welfare function in a situation where the consumption of the non-numeraire good results in emissions and standards and tax can be used to control this externality. Important assumptions on the structure of the economy are as follows:

(i) Concentrated ownership of capital.

(ii) Consumption of only the numeraire good by the owners of specific factors.

(iii) No valuation for the consumption externality by the capital owners.

On the demand side the home economy is populated with L_K identical consumers of one type, i.e. those who own capital.

$$U_K = y_K . \tag{31}$$

With this utility function, the expenditure function for the owners of the specific capital is:

$$E_K = U_K . \tag{32}$$

The owners of labor are generalists in consumption whose direct utility function is of the quasi-linear form and is given as:

$$U_L = y_L + u(x) - (Z)^2 \tag{33}$$

$$Z = (T - \tau^*)d + (\tau^* - \tau)\frac{\Pi_1}{1 + a\tau},$$

where $u' > 0$ and $u'' < 0$. The last term in (33**)** represents the disutility from pollution.[16] The disutility from pollution is assumed to be quadratic. On the production side the structure is as follows: We assume that the numeraire good is produced using a linear technology of the form:

[16] Capital owners do not care for the externality generated by consumption which could be justified with the additional restriction that the capital ownership is highly concentrated and numeraire good consumption by itself can take place in such a way that externality can be avoided.

$$Y_N = L_N \tag{34}$$

Let $\Pi(p_p)$ denote the rent accruing to the owners of the specific factor. p_p is the effective producer price. The objective of the owners of the specific factor is to maximize the rent accruing to them. Since the wage rate is normalized to unity it is a function of only the producer prices. The maximization problem of the owners of the specific factor is as given below:

$$\text{Max}\,\Pi = p_p f(l_x, \overline{K}) - l_x \tag{35}$$

l_x

$f(l_x, \overline{K})$ is assumed to be constant returns to scale, increasing and concave in its arguments.

The expenditure minimization problem for the owners of the factor labor is given by the following minimization problem:

$$\text{Min} \quad y_L + qx$$

$$\text{s.t. } U_L = y_L + u(x) - Z^2 . \tag{36}$$

The solution to the expenditure minimization problem for labor generates the following expenditure function.

$$E_L(1, q, U_L) = U_L + Z^2 + qd(q) + \alpha d(q) - u(d(q)), \tag{37}$$

where $q = (1 + a^* \tau^* + \alpha)$ is the effective consumer price. The first order conditions generate the demand function $x = d(q), d(q)$ is the inverse of $u_x(.)$. With the demand and output for the non-numeraire good determined as functions of consumer and producer prices respectively, the output and demand for the numeraire good are determined as residuals. The aggregate utility in the economy is determined from the income-expenditure equality.

Since Income = Labor income + Profit Income + Consumption tax revenue and Expenditure = Expenditure of the labor owners +expenditure of the capital owners. Now income expenditure equality $\Rightarrow$

$$(L - L_K)[U_L + Z^2 + qd(q) - u(d(q)] + L_K U_K = L + \Pi(p_p) + \alpha d$$
$$\Rightarrow U = (L - L_K)U_L + L_K U_K = L + \Pi(p_p) + (L - L_K)CS(q) - (L - L_K)Z^2 + \alpha d .$$

We normalize the non-capital owning population to 1. $CS(q)$ is the per capita consumer surplus from the consumption of the non-numeraire good. Thus the social welfare function is given as:

$$W = L + \Pi(\frac{1 + a^* \tau^*}{1 + a\tau}) + CS(1 + a^* \tau^* + \alpha) + \alpha d(1 + a^* \tau^* + \alpha) - [(T - \tau^*)d + (\tau^* - \tau)\frac{\Pi_1}{1 + a\tau}]^2 . \quad (38)$$

The choice variables for the government in order to maximize this social welfare function are the consumption tax, a standard on imports and a standard on home produced good.

3.3 Relative welfare under NT rule and discrimination as a function of cost differential

This section analyzes theoretical ambiguity in the effect of national treatment on social welfare as a function of the cost differential in meeting the standard between the home and the foreign producers.

Let $(\vec{\alpha}, \vec{\tau}, \vec{\tau}^*)$ denote the consumption tax and standards chosen by a social planner who maximizes (38) in a regime where discrimination is allowed, and $(\hat{\alpha}, \hat{\tau}, \hat{\tau})$ is the choice under NT. Let W^{D^*} and W^{N^*} denote the maximized value of the aggregate social welfare under discrimination and NT respectively. Since NT is a potentially binding constraint, this implies that $W^{D^*}(\vec{\alpha}, \vec{\tau}, \vec{\tau}^*) \geq W^{N^*}(\hat{\alpha}, \hat{\tau}, \hat{\tau})$.

Let $\Delta W^* = W^{D^*}(\vec{\alpha}, \vec{\tau}, \vec{\tau}^*) - W^{N^*}(\hat{\alpha}, \hat{\tau}, \hat{\tau})$ denote the difference in social welfare in the two regimes. Given that NT is the optimal policy when costs are the same, i.e. $a = a^*$, the effect on change in social welfare as cost differential is changed is given by the following two derivatives:

$$\partial\left(\frac{\Delta W^*}{\partial a}\right) = -2Z^D \frac{\Pi_1^D}{1 + a\vec{\tau}} \frac{\vec{\tau}}{a} - \frac{(a^* m^N - 2Z^N d^N)}{a} \hat{\tau} \tag{39}$$

$$\partial\left(\frac{\Delta W^*}{\partial a^*}\right) = -2Z^D \frac{m_1^D \vec{\tau}^*}{a^*} - \{\frac{\frac{\Pi_1^N}{(1 + a\hat{\tau})^2}(1 + a^*\hat{\tau}) - 2Z^N d^N}{a^*}\}\hat{\tau}\,. \tag{40}$$

The superscripts D and N on the endogenous variables denote the values of those variables at the optimum under discrimination and under NT respectively. The main parameters of interest are a and a^*, which show the costs of meeting the standards. It is not possible to sign the effects in general even in the neighborhood of the respective optimum under the two regimes. With the analytical results pointing towards optimality of regime being related to the cost parameters I look at the effects of the *cost differential* by simulating the model for a range of cost parameters. Brief details of the simulated model are given in Appendix B.

3.4 Results from simulation

In this section I examine the simulated impact on social welfare by imposition of NT in a situation where the government chooses the consumption tax optimally. The main result is that the welfare loss due to the national treatment constraint is increasing in the cost differential. When the costs of the home and the foreign producers are equal there is no welfare loss due to the national treatment constraint. This follows from the analytical result in chapter 1. Simulation results show that for a given cost of one of the two producers (home or foreign), welfare loss due to national treatment can rise in either direction due to the rising cost differential. Figure 3.1 shows the effect of reducing the cost differential by varying the parameter a from a value smaller than $(a^* = 0.9)$ to a value greater than a^*. A similar pattern is obtained by varying a^* for a given a. As the

costs get closer, the ratio of welfare in the two regimes approaches 1. Figure 3.3 shows that the pattern in the absence of the consumption tax is similar to the pattern shown in Fig. 3.2. Analytical results shown in chapter 1 imply that the only difference is that equal welfare occurs at a point where $a^* > a$.

3.5. Special interest politics and the NT rule

This section will analyze simulations of the role of NT in the presence of special interest politics. The fundamental principles of GATT are aimed at reducing protection. According to the WTO, non-discrimination is the main principle on which rules of the multilateral trading system are founded. This non-discrimination principle prevents environmental policies from being abused or being used as *protectionism* in disguise. (www.WTO.org). In other words, there is a realization that NT rule works towards reducing protectionism. The inherent aim of WTO rules is to minimize potential *welfare losses* that follow from a politically driven choice of standards.

A politically motivated government puts extra weight on the welfare of the producers relative to aggregate social welfare. Hence, the welfare of the semi-benevolent government is given as:

$$W^p = L + \gamma\Pi(\frac{1+a^*\tau^*}{1+a\tau}) + CS(1+a^*\tau^*+\alpha) + \alpha d(1+a^*\tau^*+\alpha) - [(T-\tau^*)d + (\tau^*-\tau)\frac{\Pi_1}{1+a\tau}]^2, \quad (41a)$$

where γ captures the political weight of the lobby. Higher γ implies higher political weight for the producer special interest. It is important to note that the producer special interest, given the small country assumption, will lobby only over the standards, since consumption tax has no effect on producer prices. The first order conditions for the maximization of the political welfare function with respect to α, τ^* and τ in (41a) are given as:

$$\frac{\partial W^p}{\partial \alpha} = 0 \Rightarrow \hat{\alpha} = 2[(T - \hat{\tau}^*)d + (\hat{\tau}^* - \tau)\frac{\Pi_1}{1 + a\hat{\tau}}](T - \hat{\tau}^*)$$

$$\frac{\partial W^p}{\partial \tau^*} = 0 \Rightarrow \gamma \frac{\Pi_1}{1 + a\hat{\tau}} a^* - da^* + 2[(T - \hat{\tau}^*)d + (\hat{\tau}^* - \tau)\frac{\Pi_1}{1 + a\hat{\tau}}]\{m_1 - (\hat{\tau}^* - \tau)\frac{\Pi_{11} a^*}{(1 + a\hat{\tau})^2} = 0$$

$$\frac{\partial W^p}{\partial \tau} = 0 \Rightarrow -\gamma \frac{\Pi_1 (1 + a^*\tau^*)a}{(1 + a\hat{\tau})^2} + 2[(T - \hat{\tau}^*)d + (\hat{\tau}^* - \tau)\frac{\Pi_1}{1 + a\hat{\tau}}]$$
$$\{\frac{\Pi_1}{1 + a\hat{\tau}} + (\hat{\tau}^* - \tau)\frac{\Pi_1 a}{(1 + a\hat{\tau})^2} + (\hat{\tau}^* - \tau)\frac{\Pi_{11}(1 + a^*\tau^*)a}{(1 + a\hat{\tau})^3}\} = 0$$

Combining the first order conditions, after some manipulations gives:

$$\frac{\Pi_1 m}{1 + a\hat{\tau}}(a^* - a) + a^* ad\frac{\Pi_{11}(1 + a^*\hat{\tau}^*)}{(1 + a\hat{\tau})^3}(\hat{\tau}^* - \hat{\tau}) =$$
$$(\gamma - 1)[\frac{\Pi_1}{(1 + a\hat{\tau})^2}\{(a^*(1 + a\hat{\tau}^*)\frac{\Pi_1}{1 + a\hat{\tau}}\} + (1 + a^*\hat{\tau}^*)am] \qquad (42)$$

Comparing equation (42) to equation (14) in chapter 2, political distortion $(\gamma > 1)$ implies that even if the consumption tax is chosen optimally, and the costs of meeting the

standard are equal, the standard chosen on the imports is higher in equilibrium.[17] The same holds in the absence of consumption tax. Political distortion results in the difference between the standards on imports and the standards on home produced good being biased upwards relative to a social optimum.

National treatment requires that τ be always set equal to τ^*. Given this constraint, there are two effects. Since national treatment is not optimal, social welfare is lower if costs are unequal. Additionally, the cost of providing protection goes up for the government, since, if unconstrained, the government would likely set a higher standard on imports. The second effect results in a positive impact on social welfare, the net effect of the NT rule on social welfare is thus ambiguous.

The simulation results indicate that for the same lobbying parameter the transfer made to the special interest is lower in a regime requiring national treatment. Given the lower political distortion under national treatment, an increase in politics results in smaller losses in *aggregate social welfare* relative to a regime allowing discrimination. Thus, for high level of politics, it is plausible that the *aggregate social welfare* under national treatment ends up being higher even though the ranking might be opposite if government were maximizing social welfare.

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[17] The equivalent of equation 17 in chapter 1 in the absence of consumption tax is given as:

$$\frac{\Pi_1 m}{1+a\hat{\tau}}(a^*-a)+a^*ad\frac{\Pi_{11}(1+a^*\hat{\tau}^*)}{(1+a\hat{\tau})^3}(\hat{\tau}^*-\hat{\tau})=-(T-\hat{\tau}^*)d'\frac{\Pi_1}{1+a\hat{\tau}}\}+(1+a^*\hat{\tau}^*)a+$$

$$(\gamma-1)[\frac{\Pi_1}{(1+a\hat{\tau})^2}\{(a^*(1+a\hat{\tau}^*)\frac{\Pi_1}{1+a\hat{\tau}}\}+(1+a^*\hat{\tau}^*)am-((T-\hat{\tau}^*)d'\frac{\Pi_1}{1+a\hat{\tau}}\}+(1+a^*\hat{\tau}^*)a]$$

Figures 3.3 and 3.4 show the effect of varying the political parameter γ for high and low cost differentials respectively. The solid lines show the welfare under discrimination and the broken lines show the welfare under NT. Given the relative levels of welfare under the two cost differentials, the value of γ which equalizes the welfare in the NT regime to the welfare under discrimination is higher in a case where the cost differential is itself higher because the welfare gap is larger to begin with. Though not represented here, a higher cost differential is associated with a higher cut-off value of γ, i.e., the value of γ that equalizes the social welfare under the two regimes.

Both Figure 3.3 and Figure 3.4 are drawn for a case where the cost of meeting the standard is lower for home producers. The tendency for a politically motivated government under NT is to raise the standards relative to the welfare maximizing optimum. If the ordering of the costs were reversed, the tendency of a politically motivated government constrained by NT would be to lower the standard relative to a social optimum. Since the qualitative results are identical, this case has not been represented.[18] Under discrimination, simulation results indicate that for the range of parameters considered here, increasing politics implies a higher standard on imports and a lower standard on home produced good relative to the social optimum.

It is in these cases that the benefits of non-discrimination might make it a logical rule. NT raises the cost of politics for the government relative to non-discrimination. In a

[18] Simulation results indicate that as the degree of politics is raised under unfavorable cost asymmetry the standard on the home produced good is lowered and on imports raised relative to that in a social optimum.

discriminatory regime, the government has two flexible instruments with which to make a transfer to the special interest, the standard on imports and on home produced good. For a given relative cost structure, the government can make a transfer by raising one standard and lowering the other. Unless the two standards are perfect complements to each other in the government's objective function, the constraint of NT will always tie the hands of the government.

A similar pattern of welfare changes is obtained in the presence of the consumption tax. This is expected, given the small economy assumption, as a consumption tax cannot affect producer prices. Standards follow the same pattern (though their levels are different) with politics. National treatment restricts government in the same manner as the absence of a consumption tax would.

3.6. Tying the hands by binding NT rule

This section briefly discusses the role of NT as a commitment mechanism. Given the pattern of impact on social welfare, as shown above, we can pose the question: Why would a government adopt NT rule? Panagariya and Rodrik (1993) provide a political economy insight for the option of an existing welfare maximizing government to bind the choices of future protectionist governments by committing to uniform tariffs. NT might serve the same role in the case of product standards. A non-protectionist government

expecting a future protectionist government can tie the hands of that government by signing on to binding NT rule in advance.

If it is political welfare, and not the aggregate social welfare, that is the concern, there is at least one important way in which NT can play a pivotal rule in reducing inefficiency. This happens if the government lacks credibility, in the policy it sets, to provide protection to the special interest. If trade policy decisions are taken *ex ante*, after which allocation of resources takes place, then optimal policies may be time-inconsistent. If, for instance, capital is immobile in the short run but mobile in the long run, then output is flexible *ex ante* but is immobile *ex post*. The production distortion cost of protection becomes non-existent once the resources are allocated to respective sectors. This creates incentives for the government to surprise agents with high protection, since protection gets cheaper *ex post.*

Staiger and Tabellini (1987) show that a benevolent government with redistributive goals will have an incentive to reverse its pre-announced tariffs and surprise private agents with unanticipated protection. Under perfect foresight, such temptations yield an equilibrium outcome with an excessively high (sub-optimal) level of protection.

Maggi and Rodriguez-Clare (1998) consider the interaction between a government and its private agents in the import-competing sector (the lobby) in a Nash bargaining framework. They point out that when the government lacks credibility in setting trade

policy it leads to an inefficiently over-sized import-competing sector that can reduce the government's overall welfare, relative to free trade, the contributions from the lobby notwithstanding. As one may expect, the presence of such commitment-related inefficiencies creates an incentive for the government to seek suitable credibility-enhancing devices. Staiger and Tabellini consider the choice between committing, *ex ante,* to a tariff-only regime versus a subsidy-only regime, while Maggi and Rodriguez-Clare focus on free trade agreements as possible remedies.

What holds for tariffs from the point of view of time inconsistency also holds for standards once tariffs are no longer available as tools of protection. Political pressures result in the standards so that the allocation of capital is biased towards the sector in which prices turn out to be higher than at the standards that maximize aggregate social welfare. This is the distortion cost due to protection. In a fully anticipated incentive for the government to provide protection through the manipulation of the standards the factors can be *overinvested* in the sector to which protection is provided. If, as in Maggi and Rodriguez-Clare, the bargaining power of the government is small, then the overinvestment is large, and the distortion cost is so large that even with post contributions the welfare of the government can be lower.[19]

As a solution to this time inconsistency problem, the government can commit to a lower level of *ex post* protection by committing to the WTO rule of national treatment. Political

[19] A replication of Maggi and Rodriguez-Claire (1998) in the case of standards where the government has to choose between NT and a discriminatory regime of the standards requires the assumption that under cost symmetry the common optimal standard (that maximizes social welfare) is unique for a given size of the sector on which the standard is imposed.

welfare can be greater in a case where the cost of providing protection is higher than in a case where the government is free to choose discriminatory standards. With the cost of providing protection going up, the lobby can buy lower protection with the same amount of contributions, thereby reducing the incentive to over-invest in the politically organized sector.

3.7 Conclusions

The simulation results indicate that, for a small open economy, welfare loss due to the constraint of NT is higher if the cost differential in meeting the standard is higher. Hence, purely on efficiency grounds, countries with similar costs of meeting the standard should be subjected to similar standards. Countries with diverse costs should have different standards. The reason NT rule is logical for a small open economy is that it restricts the government while making transfers to special interests. This restriction implies that governments can supply lower protection in equilibrium.

3.8 Further Research

The most natural extension for this work is to evaluate the role of the NT rule in a two-country context on the lines of Bagwell and Staiger (1999). Here we have asked questions about the effects of NT from the point of view of a small open economy. By appealing to Bagwell and Staiger (2001), who show that market access rules in GATT are

"*globally efficient,"* one could look at the role of standards in a small open economy as a starting point.[20] There can, of course, be bargaining by nations over the standards, themselves, on the lines of reciprocity as highlighted in Bagwell and Staiger (1999).

The parallel of the unilateral adoption of NT in case of tariffs is the issue of unilateral tariff liberalization. The second step would be to look at issues of reciprocal liberalization. Extending the current framework to a two country set-up, it is possible that, for very different reasons, NT rule might come out as an outcome in a reciprocal bargain. If NT in a foreign market can be obtained conditional on NT being supplied domestically, then for a range of relative market sizes one can expect NT to evolve on the lines of reciprocity.

There are other prescriptive rules in the WTO, such as *harmonization* and *mutual recognition* of standards. I have not discussed the implications of these principles here, although these principles are important. To include these principles in an analysis, domestic consumption in the exporting country would have to be allowed for, and this paper has abstained from examining this factor.

While there is extensive literature on a three-country framework with tariff based regional arrangements, there is virtually no explicit analysis of product standards in a similar context, even though arrangements exist that would make such a study

[20] The terms of trade effects of standards in their framework could be controlled through concessions elsewhere.

worthwhile. There is also an important consideration here for the Vinerian analysis in terms of trade creation and trade diversion: the low cost supplier has to be defined with respect to each standard. Other important questions that need to be addressed ask how the standard related arrangements in a three-country case are similar to or different from regional arrangements, with respect to tariffs and other trade measures. Is a mutual recognition agreement between two nations welfare improving? What are the implications of such recognition for the third country? How do the answers to these questions differ under harmonization of standards?[21]

Finally, this paper considered only the variable costs of meeting the standards, although in several instances it is worthwhile to consider fixed costs. Welfare implications under the fixed costs of meeting the standard are likely to be quite different from the variable costs. Romer (1994) discusses the welfare costs of trade restriction in the presence of fixed costs. The key implication of this type of model is the first-order effect of small increases in the standards. Because standards are raised even by small amounts, products operating at near zero profit would disappear altogether from the market. Unless the standards confer a corresponding benefit, the standards will lead to high social costs.

[21] WTO has been encouraging member countries to adopt such policies for trade facilitation for a long time now but the issue is not covered with any detail in analytical literature.

Chapter 4

The Mauritian Miracle

4.1 Introduction

In the post-war period, few sub-Saharan African countries have made the transition to achieving high standards of living for their populations. The record of sustained economic performance in sub-Saharan Africa (hereafter Africa) is not heartening. It is not that there have not been periods of sustained growth: as Table 4.1 shows, sixteen African countries, at various points in time, achieved high rates of growth. However, very few such episodes have been long enough or sustained enough to lead to high levels of income and standards of living.[22] In 1998, only two African countries, Mauritius and Botswana, ranked among the top 50 countries in the world in terms of per capita GDP (calculated on a PPP basis), and none ranked among the top 50 on the UN's Human Development Index.[23]

But Africa is not without its successes. At the very top of this admittedly short list of accomplishments is Mauritius. Mauritius was however, if anything a strong candidate for failure because of being a very typical African economy—monocrop; prone to terms of trade shocks; witnessing rapid growth rate in population; and susceptible to ethnic tensions.

[22] In many cases, growth decelerated or ground to a halt around the time of the oil and debt crises which Rodrik (1999b) refers to as the growth collapse.

[23] These assessments exclude the Seychelles.

"Heavy population pressure must inevitably reduce real income per head below what it might otherwise be. That surely is bad enough in a community that is full of political conflict. But if in addition, in the absence of other remedies, it must lead either to unemployment (exacerbating the scramble for jobs between Indians and Creoles) or to even greater inequalities (stocking up still more the envy felt by the Indian and Creole underdog for the Franco-Mauritian top dog), ***the outlook for peaceful development is poor"*** (Meade, 1961; emphasis added).

History, or rather Mauritius, proved this dire prognostication by Noble Prize winner, James Meade, to be famously wrong. This paper seeks to understand this failed prediction in terms of three explanations of long-run growth performance: initial conditions, openness, and institutions.

The findings in the paper can be summarized as follows. The growth experience of Mauritius testifies to the country specific features that are not captured comprehensively in the standard cross country regressions. The exceptional growth performance of Mauritius, as in most cases is a result of a combination of factors. The inheritance in the case of Mauritius we show is if anything unfavorable. The openness of Mauritius was heterodox but on balance it still retains the slight anti export bias in the policy owing to the high dose of protection on the import side. One thing however which we do not capture in this analysis is the impact that the decline in the level of protection had on the Mauritian economy. This is particularly relevant in the light of increasing trade ratios for

Mauritius over the high growth period. The heterodox opening was however not a unique experiment in the case of Mauritius. Other countries chose this experiment and failed. This along with the political management of shocks points to the unique institutions that Mauritius developed that makes it different from the average African economy. The uniqueness of these institutions is hard to quantify; indeed the measures of institutional quality used in the literature fail to capture them.

Section 4.2 provides a brief economic history of the country highlighting the economic achievements. Section 4.3 describes the various aspects of the initial conditions in Mauritius. Section 4.4 introduces the important points about Mauritius' openness strategy. Section 4.5 looks at the openness outcomes in the case of Mauritius as articulated by Sachs and Warner (1995, 1997) (section 4.5.1), Rodrik (1999a) (35.2). Section 4.5.2.1 discusses the role of the preferential access to the western markets. Section 4.5.3 discusses the explanation for Mauritian experience owing to Romer (1993). Section 4.5.4 concludes regarding the openness of Mauritius. Section 4.6 discusses the role played by institutions in Mauritian economic performance. Section 4.7 presents econometric results that shed light on the different explanations. Finally, Section 4.8 offers some concluding observations.

4.2 Economic Accomplishments of Mauritius

Between 1973 and 1999, real GDP in Mauritius grew on average by 5.9 percent per year compared with 2.4 percent in Africa. In per capita terms, the corresponding numbers are 3.25 percent and 0.7 percent. In terms of the chronology of growth performance,

Mauritius started with a reasonable but low (2.5-3 percent) growth rate in the 1970s; and it was in the late 70s and the beginning of the 80s that the Mauritian transition to very high growth rates occurred. The Mauritian economy maintained high levels of the growth in the 1990s. The country was apparently resilient to the depressed global conditions in the early 1990s and to financial crises in Asia and other places later in the decade.

The economy, once reliant on sugarcane, received a boost in the 1980s through the export boom of the textile and apparel sector. The process of diversification of economy was furthered by the policy thrust that favored new sectors like tourism and financial services. Sugarcane still occupies nearly 90 percent of the cultivated land area and continues to account for roughly one-fifth of export earning, but manufacturing now accounts for the largest portion of national output.

The Export Processing Zone (EPZ) was established in 1970 with the purpose of diversifying exports into manufactures. Although the setting-up of the EPZs was conceived as a way of developing a range of manufacturing enterprises, in practice, the EPZ became synonymous with the textiles and clothing industries. Some 80% of investment and exports, and 90% of employment in the EPZ sector, are from the textiles and clothing industries. The years 1970-75 were one of moderate growth of the EPZs. The period of growth started with the signing of the Lome Convention in 1975. The

number of textile and clothing firms increased from 8, in the beginning of 1971, to 45 by 1976. Employment in the textiles and clothing industry rose by 35.6% to 19,400.

The momentum of EPZ activity slowed during the period 1976-80. A rising real exchange rate tended to considerably reduce Mauritius' international competitiveness. After 1980, the performance of the EPZ improved through technological change, and to some extent, through outsourcing. The growth rate of investment (constant prices) dropped to –0.7% in the period 1976-80. It touched 4.5% in the period 1981-86, which was even higher than investment growth in 1971-75 (2.8%). The growth rate of exports in real terms (32.4%) was nearly as high as in 1971-75. The number of firms reached an all time high as it crossed the 400 mark. During this period, employment in the EPZ grew from approximately 21,000 to almost 90,000.

The golden period of the EPZ was undoubtedly the decade beginning 1980. In the early 1990s, growth in investment, employment, and exports slowed due to an increase in the closures of both small and large firms. Inefficient firms were forced to close because of labor shortages. Today, EPZ firms are coping by shifting to higher value added segments, and by shifting their hardware bases to labor surplus areas like Mozambique and Madagascar.

Figure 4.1 depicts the comparative growth performance for a cross-section of countries over two periods, 1961-75 and 1976-99. The 45^{o} line represents the locus of points of equal growth in the two periods. Countries above the line grew faster in the later period,

while countries below the line grew slower. Countries are mostly clustered below the line, confirming Rodrik's (1999b) characterization of growth collapse after the first oil shock. Mauritius defied this trend; its per capita growth rate of 4.2 percent in the later period being about one and a half percentage points above the earlier period. In terms of growth performance, moreover, very few countries outperformed Mauritius in both periods. Very few countries lie to the northeast of Mauritius. This group comprises the East Asian tigers and Botswana, the only African country to have registered high rates of growth.

Improvements in human development indicators have been equally impressive. Life expectancy at birth increased from 61 years in 1965 to 71 years in 1996; primary enrollment increased from 93 to 107 between 1980 and 1996 compared with 78 and 75, respectively in Africa. Income inequality has also seen impressive improvements: the Gini coefficient declined from 0.5 in 1962 to 0.42 in 1975 and 0.37 in 1986-87.

High growth rates have been delivered along with macroeconomic stability. Between 1973 and 2000, consumer price inflation averaged 7.8 percent per annum, compared with over 25 percent overall in Africa (Figure 4.2). Although subject to episodic spikes, the variability of inflation in Mauritius has also been well below the rest of Africa; the standard deviation of inflation in Mauritius (2.4%) has been half of that in Africa.

As interesting as this cross-section comparison is, the temporal evolution in Mauritius' economic performance is also interesting. A growth accounting framework analysis

highlights the contrasting performance between the 1980s and 1990s (Table 4.2). In the former period (1982-1990), economic growth was intensive; that is, it was motored predominantly by the growth of inputs—capital and labor—which together accounted for 90 percent of the annual average rate of GDP growth of 6.2 percent. It is worth noting that the stellar performance of employment growth in this period, which averaged 5.2 percent a year resulted in a sharp decline in the unemployment rate, from nearly 20 percent in 1983 to 3 percent in the late 1980s. (Figure 4.3)

In contrast, economic growth in the 1990s has been driven to a greater extent by productivity growth. As wages started to climb, firms economized on the use of labor, focusing instead on sustaining growth through higher productivity. TFP growth during this period averaged 1.4 percent a year and accounted for a full 25 percent of total growth. This improvement in TFP performance also augurs well for the future as Mauritius runs into labor shortages and limits to capital deepening.

Finally, it is worth mentioning that Mauritian economic performance has been sustained by a comprehensive social protection. This protection has taken several forms: a large and active presence of trade unions with centralized wage bargaining; price controls, especially on a number of socially-sensitive items; and generous social security, particularly for the elderly and civil servants. Generous social protection, so far, has not necessitated higher taxes. This reflects both strong growth and a favorable demographic

structure with a high proportion of the population being of working age.[24] However, in the coming years, the OECD affliction of a changing demographic structure, reflecting a rising number of dependents, looms large for Mauritius.

4.2 Meade and the Mixed Inheritance of Mauritius

Meade's prophecy of doom for Mauritius was based on what he saw as the country's very adverse inheritance, foremost of which was the country's impending population explosion. Imbued as Meade was by the prevailing labor surplus doctrine, he saw little prospect for expanding the traditional agricultural sector, and was equally pessimistic about possibilities in manufacturing. In his view, there was little technical know-how in manufactures, and little experience, other than the sugar factories, in the conduct of industry. There was a scarcity of capital, there were few raw materials available within boundaries, and the domestic market was miniscule. Meade moreover noted that the Mauritian society was highly fragmented across all lines—ethnic, economic and political—which made the task of progress much more difficult than elsewhere.[25]

But was Meade's reading of an adverse inheritance correct? A retrospective answer to this question can be based on indicators that current growth literature suggests as

[24] The tax to GDP ratio for Mauritius has been high in the 70s and the 80s (0.26 and 0.24 compared to 0.21 and 0.19 for the countries at comparable levels of per capita GDP). In the 1990s, the ratio for Mauritius (0.20) has been very close to that of developing countries (0.21).

[25] Meade's development strategy hence proposed wage restraint, agricultural diversification, a rapid change in industry structure, overseas welfare assistance, a system of welfare benefits for the unemployed, emigration of workers to other British colonies, and an effective family planning system.

important for long-run growth. Table 4.3 depicts how Mauritius scores on these indicators, both in absolute terms and in comparison with three other groups of countries. These indicators are selected from Sachs and Warner (1997) and are supplemented by other indicators considered important for long run growth. One of the most important of these indicators relates to the phenomenon of catch-up, or convergence, which says that the higher the per capita income at the beginning of the growth process, the slower will be the subsequent rate of growth. As the scatter plot for a selected group of countries shows, Mauritius had the highest per capita income in 1960 and hence was likely to witness slower growth rates than that of other African countries. (Figure 4.4)

One variable on which Mauritius scores highly is human capital. For example, in Mauritius in the early 1970s, life expectancy at birth (60.4 years) was substantially higher than even the life expectancy shown by the fast growing economies of Asia. On most of the other variables however, Mauritius fares either more poorly than other African economies, or at least no better than them. Geographically, Mauritius is not landlocked, but it does have a fully tropical climate (score of 1 on the tropics variable). And in terms of its remoteness from world markets, Mauritius fares the worst, being about 25 percent further away from the world's economic center than the average African country, and 30 percent further away than the average developing country.[26]

[26] Being accessible by sea though could easily put Mauritius at some advantage compared to those African countries which are as far but are also landlocked.

Two other points about Mauritius' inheritance are worth highlighting. First, empirical growth literature increasingly points to the adverse effects of being commodity dependent. (see Dalmazzo and Guido de Blasio (2001). The adverse effects stem not just from secular decline, or increased variability associated with commodity prices, but also from the rent seeking and corruption to which they give rise. Mauritius actually fares much worse than the average African economy in terms of commodity dependence. In 1970, the share of exports accounted for by commodities was nearly 30 percent, compared with 18 percent average of the African economy.

But is it possible that Mauritius was less susceptible to commodity dependence because sugar (Mauritius' main export) fared better than other commodities? It is certainly true that Mauritius' terms of trade have been less variable than for the average country, but this may be a misleading indicator of the adverse impact of commodity dependence. The reason is that Mauritian sugar *production* has been subject to a series of cyclone and drought related shocks which have imparted great variability to the export earnings derived from sugar. The importance of production shocks is suggested by an interesting result in Cashin and Patillo (2000). According to their results, shocks to Mauritius' terms of trade have been less persistent than for the average commodity exporting country, but the shocks to Mauritius' income terms of trade (terms of trade multiplied by exports) have indeed been far more persistent than for the average country.

Ironically, Meade's greatest fear of rapid population growth proved to be a blessing for Mauritius. Mauritius' demographic inheritance was extremely favorable, with its growth in labor force outpacing growth in the overall population. Rapid job creation in the last two decades—to the extent that Mauritius now imports substantial amounts of labor to meet its demands—has meant that Mauritius is now a labor scarce rather than labor surplus economy.[27]

The overall conclusion is that Mauritius' excellent growth performance since the late 1970s cannot be attributed to Mauritius' favorable initial conditions because Mauritius fares worse than the average African economy. Meade's facts were not entirely wrong. Although he misread the demographic inheritance and missed the very favorable initial stock of human capital, he was broadly correct in the assessment that Mauritius' overall inheritance was unfavorable.

4.4 Mauritius' Openness Strategy

Perhaps the most interesting aspect of the Mauritian development experience has been its openness strategy, defined broadly as its openness to trade and foreign investment (FDI). Different economists read into this experience their own interpretation, but a proper understanding of this experience is interesting as well as controversial.

[27] It is estimated that over 30 percent of the labor force in textile and clothing sector is imported.

4.5 Openness Outcomes

At one level, the Mauritian experience can be advanced as a showpiece for the prescription associated with the Bretton Woods Institutions (the so-called Washington consensus) that openness is unambiguously beneficial. Figure 4.5 illustrates this. Between 1983 and 2000, the volume of imports and exports of goods grew quite rapidly, at a rate of 8.7 percent and 5.4 percent, respectively, per year; the openness ratio (the ratio of trade in goods-to-GDP) increased from 70 percent to 100 percent over this period, compared with an openness ratio for Africa that stagnated around 45 percent. Particularly strong was the growth in manufacturing exports, originating predominantly from the export processing zone (EPZ).[28]

To say that Mauritius' growth performance was due to the rapid growth of its trade begs the next obvious question: why did trade grow as much as it did? Three explanations have been offered. The first, according to Sachs and Warner, is that Mauritian trade policy was open. The second, according to Rodrik (1999a) is that Mauritian trade policy was heterodox. Rodrik's argument is that Mauritian trade policy involved segmentation with imports being "closed" and exports being relatively open. The third, according to Romer (1993), is Mauritius' openness to FDI and its favorable consequences. Each of these explanations will be examined separately.

[28] However, Mauritius has been considerable less open than the fast growing countries of East Asia whose openness ratio increased from 85% to 180% between 1973 to 2000.

Trade Policies

One of the most important insights of trade theory due to Abba Lerner is that a restrictive import regime imposes a tax not just on imports but also on exports, and hence, on trade as a whole. Thus, quantitative restrictions and high tariffs reduce the size of a country's total trade. An import tax reduces exports by raising the cost of inputs, which make exports less competitive in world markets. In a more fundamental sense, however, import taxes increase the attractiveness of domestic production of import-competing goods, hence divert resources away from export sectors where a country has comparative advantage. Empirical results for Africa show that, on average, if trade taxes go down by one percentage point, the trade-to-GDP ratio increases by an equivalent amount. (Rodrik, 1998)[29]

4.5.1 The Sachs-Warner Assessment

Trade policies affect not only trade, but also have an affect on long-run economic growth. In two papers, Sachs and Warner (1995, 1997) showed that one of the key determinants of long-run growth is a country's trade policy. Using an elaborate scheme for classifying various aspects of trade policies, they computed a binary measure for determining whether a country was open or closed. According to that measure, in 1980, eighteen countries in Africa were classified as closed, and only seven countries were classified as

[29] The estimates are highly significant at 99% confidence level.

open.[30] Sachs and Warner's estimates indicate that if a country moved from being closed to open its long-run growth rate would increase by 2.2 percentage points. Trade policies could thus significantly affect a country's standard of living.

Mauritius was one of the countries that Sachs and Warner classified as being open; that is, it followed liberal trade policies. But this categorization of Mauritius as an open economy in terms of its import policies does not seem correct. Tables 4.4 and 4.5 provide estimates of the restrictiveness of Mauritius' trade policy regime. During the 1970s and 1980s, Mauritius remained a protected economy, with the rate of protection high and dispersed. In 1980, the average effective protection exceeded 100 percent, and although this diminished by the end of the 1980s, it was still very high (65 percent. Moreover, until 1989, there were extensive quantitative restrictions in the form of import licensing, covering nearly 60 percent of imports.

An alternative classification scheme devised by the International Monetary Fund ranked Mauritius as one of the most protected economies in the early 1990s, when Mauritius elicited a rating of 10, the highest possible category of policy restrictiveness. It is only in the late 1990s that conventional measures of trade protection began to decline. By 1998, Mauritius obtained a rating of 7 on the Fund's index. This rating is amongst the highest in the world, and certainly the highest in Africa. (Subramanian et. al. 2000) A more recent

[30] The Sachs and Warner (1995) results have been criticized on a number of grounds, and particularly by Rodriquez and Rodrik. (1999) The main argument is that effect of the measure is driven overwhelmingly not by tariffs and quotas but by the black market premium for the exchange rate and a measure of state export monopoly.

study by Hinkle and Herrou Aragon (2001) concludes that (Table 4.5). On nearly every trade policy indicator, Mauritius fares worse than the average African economy.

The conclusion that can be drawn is that Mauritius, only for a smaller part of the period and in some broad sense (examined below) was indeed open, but was not open based on the indicators of import policies. On the contrary, Mauritius had a highly restricted economy during much of the 1970s, 1980s, and the early 1990s. More specifically, the data suggests that Mauritius would not have met two of the criteria—relating to average tariffs and coverage of quantitative restrictions—that seem logical for classifying a country as open during this time period.

In terms of explaining the role of the openness in Mauritius' growth performance, the evidence above is not intended to lead to a conclusion that openness had no role to play in the sterling growth performance of Mauritius. What matters is not only the level of protection but also a change in the levels of protection in the period under consideration. The level of protection in Mauritius remains high, but does show a downward trend. A binary measure even if more comprehensive than Sachs and Warner is unlikely to capture such a change unless the magnitude is large. The evidence for the impact of declining levels of protection is substantiated by Mauritius' robust growth in imports in this period.

4.5.2 Heterodox Opening (Rodrik)

Clearly, by the most usual measures for determining trade policy openness, Mauritius had a restrictive trade regime. But why did this not translate into an export tax and then a tax on all trade? (This would follow the Lerner symmetry theorem.) According to Rodrik (1999a), Mauritius chose an unusual strategy of trade liberalization that effectively tried to segment competing export and import sectors. By intervening on the export side, Mauritius tried to offset the taxation implicit in the import taxes. This combination ensured high returns to the export sector, returns high *enough* to prevent domestic resources from being diverted to its inefficient import competing sector.

The institutional mechanism for achieving *segregation* of the exporting sector from the importing sector was the creation of the export processing zone (see below). The idea of segregation in Rodrik is not substantiated empirically[31]. The policy instruments used were:

- Duty free access was provided to all imported inputs. This ensured that the export sector's competitiveness on world markets was not undermined by domestic taxes that could have raised the cost of inputs used in export production.[32]

[31] To the extent that labor is mobile between export and import competing sectors, full effective segregation is not feasible.
[32] Note that duty drawbacks and equivalent schemes do not entail export subsidization, they merely offset the bias from restrictive import policies.

- A variety of tax incentives were provided to firms operating in the export processing zones. This had the effect of *subsidizing* exports.[33] This subsidization was a key element for offsetting the impact of the implicit tax on exports.

- The labor market for the export sector was effectively segmented from the rest of the economy (and, in particular, from the import competing sector.) (refer to footnote 31 here) Different labor market conditions prevailed at least until the mid-to-late 1980s. Employers had greater flexibility in discharging workers in the EPZ sector and the conditions of overtime work were more flexible. For example, no severance allowances had to be paid before retrenching workers, and advance notification of retrenchment to a statutory body was not required.

- Most importantly, although legal minimum wages were the same in the EPZ sector as in the rest of the economy, minimum wages for women were fixed at lower levels (Hein, 1988; Wellisz and Saw, 1993). Since EPZs employed a disproportionate number of female workers to male workers (in 1990, the EPZ workforce comprised 60,372 females and 27,886 males), these labor market measures also acted as an implicit subsidy for exports by increasing the incentive to produce in the export-competing sector. Figure 4.6 illustrates the wage differential between the EPZ and the rest of the economy in the 1980s

[33] The main incentives included a 10-year tax holiday on retained earnings, and a partial tax holiday for periods beyond that; free repatriation of capital and profits; and preferential interest rates for firms in the EPZ.

and 1990s.[34] EPZ wages were about 36-40 percent lower in the 1980s, with the differential narrowing to between 7 percent and 20 percent in the 1990s.

The creation of the EPZ generated new opportunities of trade and of employment (for women), without taking protection away from the import-substituting groups and from privileged male workers. The segmentation of labor markets was particularly crucial, as it prevented the expansion of the EPZ from driving wages up in the rest of the economy, and thereby disadvantaging import-substituting industries. New profit opportunities were created at the margin, while leaving old opportunities undisturbed. There were no identifiable losers (Rodrik (1999a)).

To summarize, Mauritius managed to *partially* offset the anti-export bias due to the high dose of intervention on the import side by subsidizing the export sector. On one hand, imports were restricted through high trade barriers. On the other hand, extensive and selective intervention occurred on the export side to offset this intervention. Thus Mauritius appears to follow the dirigiste approach of Korea, Taiwan, and Japan rather than the approach of Singapore and Hong Kong SAR.

4.5.2.1. Openness: The Role of Preferential Access

The policy of heterodox opening would probably not have been successful, to the extent that it was, without the policies of Mauritius' trading partners. These trading partners

[34] For example, in 1984, 79 percent of total employment in the EPZs was female, compared with 31 percent in the rest of the economy (Hein, 1988).

played an important role in ensuring the profitability of the export sector. Mauritius has enjoyed preferential access to markets of its major trading partners, Europe and the United States. This access has affected the two main products, sugar and apparel, that together have accounted for over 90 percent of Mauritian exports. Since its independence in 1968, Mauritius has been guaranteed a certain volume of sugar exports to the European Union. Moreover, these quotas are at a guaranteed price that has been, on the average, 90 percent above market price between 1977 and 2000. (Figure 4.7) The resulting rents to Mauritius have amounted to a hefty 5.4 percent of GDP on average each year, and up to 13 percent in some years.[35]

Mauritius has also enjoyed preferential access for its textile and clothing exports. Foreign investment in the clothing sector, which largely originated in Hong Kong (Special Administrative Region- SAR), was motivated in part by the need to circumvent clothing and textile quotas that were constraining Hong Kong SAR exports. The Multi-Fiber Arrangement (MFA) was an attempt by the European Union (EU) and the United States (U.S.) to limit imports into their own markets. These limits were achieved by awarding country-specific quotas to the different textile and apparel exporting countries. One of the effects of the quotas was to redistribute production away from low cost production

[35] Most, but not all of these rents accrued to producers because of the export tax on sugar, which has averaged about 12 percent between 1975 and 1995. The sugar rents contributed to sizable levels of domestic savings and financed investment in the EPZ sector. Sugar barons have substantial interests in the EPZ sector. The majority of the EPZ firms were either directly owned by the sugar barons or through a complex web of corporate businesses. In fact the sugar barons have also used their privileged corporate links with the largest Mauritian-owned commercial bank to obtain credits for investment in both the EPZ and the tourism sectors. The bulk of commercial banks' credit to the EPZ is underwritten by the state-owned development bank of Mauritius. The commercial banks therefore do not hesitate to lend to the EPZ sector.

sources and towards high cost production sources. Thus, high-cost-producing countries gained an advantage relative to low-cost producers, resulting in higher production than would otherwise have taken place.

Table 4.6 provides quota rents for Mauritius in the apparel sector, under the MFA arrangement, as a percent of the Mauritian GDP.[36] The table shows that subsequent rents accruing to Mauritius were substantial. From a macroeconomic perspective, these rents played a crucial role in sustaining high levels of investment, and explain the fact that, during the growth boom in Mauritius, domestic rather than foreign savings financed domestic investment. Calculations suggest that rents in Mauritius from preferential access in sugar and clothing amounted to 7 percent of the GDP in the 1980s, and to 4.5 percent of the GDP in the 1990s.

Thus, Mauritius benefited from the protectionist policies of the EU and the U.S. in the sugar, textile, and clothing sectors at the cost of other exporting countries. Had other industrial countries liberalized their markets, it is quite likely that the Mauritian trade performance would have been quite different. It is no surprise, then, that Mauritius has not been enthusiastic about dismantling protection in agricultural and clothing markets.

Trading Rules

Another less well-known aspect of the international trading regime is relevant to the analysis of Mauritian trade policies. Under the WTO, developing countries have

[36] The quota rents are actually an upper bound under the assumption of perfectly elastic export supply.

generally been exempted from undertaking obligations that rein in protectionist trade policy. This favorable treatment of developing countries has, until the Uruguay Round, extended to export subsidies. The Mauritian regime for export processing zones, particularly the favorable tax treatment of EPZ firms, could not have been used if the prohibition of export subsidies by developed countries had also been applied to developing countries. In this respect, the international regime was indulgent towards Mauritius.[37] In the same vein though there remains a question mark that if international trading regime had indeed obligated developing countries to comply, Mauritius would also have had lower import protection. Thus it is difficult to predict whether on balance Mauritius would have been more open or closed.

4.5.2 Export Processing Zones: FDI and Ideas (Romer)

By any conventional measure, the EPZ experiment in Mauritius has been a resounding success because it has transformed the Mauritian economy. Since 1982, output in the EPZs has grown, on the average, by 19 percent per annum. Employment has grown by 24 percent, and exports by about 11 percent. The EPZ sector, which had a base of zero in 1971, now accounts for 26 percent of GDP, 36 percent of employment, 19 percent of capital stock, and 66 percent of exports.

[37] Interestingly, the WTO rules do not treat differential labor regulations between the export and other sectors as a subsidy.

It could be argued that this performance is a reflection of the various financial incentives provided to firms operating in EPZs and that a proper economic evaluation incorporating the social costs of these incentives might portray a different picture. To test this proposition, a growth accounting analysis was conducted for the EPZ sector and compared with that of the economy as a whole. The results are striking. For the period 1983-1999, productivity growth in the EPZs has averaged about 3.5 percent compared with 1.4 percent in the economy as a whole. For the 1990s, EPZ productivity growth was spectacular, averaging 5.4 percent per annum, a level not matched even in the fast growing countries of East Asia. (Table 4.8) In order to sustain growth as wage costs in Mauritius have risen, firms have economized on their use of inputs and improved their efficiency,

Does the performance of the EPZ reflect the benefits of FDI? Romer (1992) has strongly argued that the Mauritian experiment vindicates the strategy of importing ideas and allowing the economy to generate high rates of growth based on the new ideas. Romer's conceptualization of ideas as a public good implies that governments need a policy that subsidizes the *use/production* of ideas. According to Romer, "The only obvious candidate for explaining the success of Mauritius is the policy of supporting an EPZ, which made investment attractive to foreigners." Beginning with Meade, who took a narrow view of Mauritian entrepreneurial expertise, Romer's study shows how foreign entrepreneurs brought an array of ideas to a new line of activity, textile and apparel. The experience of the EPZ sector in Mauritius confirms that useful ideas are reflected in rising productivity.

4.5.4. Openness: What to Conclude?

Of the three explanations, Sachs and Warner's explanation (openness in terms of import policy) does not appear to hold true for much of the time period being studied. The levels of import protection were high almost throughout this period, but import protection fell during the high growth period. The effect of a drop in levels of protection is reflected in the rising imports overtime. It is likely that protection falling from a high level of initial distortion played an important role in Mauritian growth.

Romer's explanation encounters two problems. While it may have been true that the initial wave of investments triggering the growth in EPZ output was largely foreign, the Mauritian EPZ sector, unlike that in many other countries, had a substantial local presence. For example, in 1984, only 12 percent of the total employment in the EPZ was accounted for by wholly foreign-owned operations. This can be compared with 72, 42, and 64 percent respectively in Korea, the Philippines and Malaysia. It is estimated that Mauritian nationals owned 50 percent of the total equity of firms in the EPZ. In other words, ownership figures do not provide *unambiguous* support for the notion that ideas originated from abroad and were mediated through foreign direct investment.

A second problem is more general. True, the Mauritian government did support the export processing zones as we have discussed above, but was this support unique to Mauritius? Besides Mauritius, EPZ facilities and attendant incentives were provided by a host of other African countries, such as Zimbabwe, Senegal, Madagascar and Cameroon.

Hinkle and Herrou-Aragon (2001) rated countries like Zimbabwe and Senegal at par with countries without the EPZs for the reason that these countries provided for EPZs but implemented the arrangements so poorly that they were judged to be no better off than African countries without the EPZs. Other countries, like Cameroon, that tried the same experiment had only moderate success. While Romer's insight on Mauritian's successful use of ideas (mediated through FDI) may be valid, the question of why FDI flowed to Mauritius, rather than to other countries that attempted to similarly attract FDI, remains unanswered.

This poor performance in other African countries was not limited to the EPZs alone. In fact, in their review of the system of export incentives in 13 African countries, Hinkle and Herrou-Aragon conclude that no sample country came anywhere close to international best practice for export incentives. They attribute this unambiguous failure to fiscal constraints and to limited administrative capacity, the latter resulting in leakage of commodities benefiting from the incentives to the domestic market, favoring import competing rather than export-oriented activities. There seems to be more to the Mauritian EPZ experience than just the import of ideas through subsidies.

The heterodox opening argument due to Rodrik where offsets to the implicit tax in import protection were obtained using export subsidies appears inadequate. As we have seen the degree of offset was not large enough to wipe out the anti export bias in the trade policy. Also Rodrik's explanation like that of Romer's could only to be a proximate one. Other

African countries established EPZs and enjoyed preferential access to foreign export markets without comparable success. There seems to be more to the Mauritian experiment than interventionist policies at home and generosity abroad.

4.6 The Role of the Institutions

The role of efficient and properly functioning institutions as a precondition to investment, entrepreneurship, innovation, and long-run growth is being increasingly emphasized in growth literature. It has been argued that institutions confer two types of benefits. First, institutions enhance long-run growth. (Collier and Gunning (1999), Acemoglu et al. (2000). Secondly, they impart resilience to an economy, allowing it to adjust to exogenous shocks. (Rodrik (1999b)

As is evident from the partial scatter plot in Figure 4.8, fast growers have, on average, better institutions.[38] In reality, though, it is difficult to identify all the attributes of the capital called institutions. There is social capital in the form of trust, work ethics, and religious and ethnic tolerance, and civic capital in the form of infrastructure (not all of which can be captured in the form of trade costs), legal and judicial systems, etc. In practice, different institutions embodying these varying attributes tend to be highly

[38] The measure of institutional quality is due to Acemoglu et. al. (2000). The index of institutional quality is in fact the fitted value from the first stage of the 2SLS regressions. The measure captures the protection against the risk of expropriation of property.

correlated, and cross-country evidence on growth has tended to be robust across different indices.[39]

Collier and Gunning (1999) argue that the long-run growth process itself is directly related to the quality of domestic institutions. Public social capital consists of government institutions that facilitate private activity such as well-functioning courts which ensure contract enforcement and respect of property rights. This reduces the risks of private investment, leading to larger quantities of investment flow. Public social capital also ensures that government policy is not dominated by any single favored-groups whose interests are at variance to the community as a whole. As witnessed in Africa, expansion of the public sector, import substitution, and the taxation of agriculture have resulted, in part, from the lack of mechanisms for inclusiveness in policy making. Finally, poor social capital has led to a high incidence of corruption.

The most compelling empirical evidence on the importance of institutions is from Acemoglu et. al. (2000) who show that there is a strong systematic relationship between institutions and economic performance. The European colonizers, like in the United States, Australia, New Zealand, etc., developed and sustained better institutions in those places where the mortality rates were lower, and consequently, settlements rates were higher. In their study, one important result that follows is that, after controlling for

[39] For our sample, the correlation between the ICRGE index and democracy and the ICRGE index and index of participation are respectively, 0.71 and 0.72. The correlation between democracy and participation index is 0.95.

institutions, geography does not matter. In other words, institutions might well be the most critical determinant of economic performance.

Rodrik (1999b) has argued very strongly that the post-war growth experience, notably the slow-down of economic growth after the first oil shock, needs to be explained in terms of the ability of governments to adjust their macroeconomic policies to exogenous shocks. In his view, the key determinant of this ability is the quality of domestic institutions. Macroeconomic responses to exogenous shocks have serious domestic distributional implications.

Take the standard example of an oil shock that creates a balance of payments problem. The IMF and textbook recommendation is for countries to implement policies to reduce domestic absorption (mainly by tightening fiscal policies) and to switch expenditure from foreign goods to domestic goods. But which ones and how? Should fiscal tightening take the form of tax increases or expenditure reductions? If the latter, should cuts fall on defense, capital projects, health, or education? Should expenditure switching be accompanied by an incomes policy?

Each of these actions has very different distributional implications. If the inevitable distributional conflict can be managed, the impact of the shock can be mitigated. If not, the shocks emanating from the domestic social and political conflicts amplify the economic shocks. This creates long-run damage for the economy. The countries that can

manage the shocks well, such as by implementing fewer growth inhibiting policies, suffer smaller declines in growth. Rodrik (1999b) provides evidence to support this argument.

That, institutions might be important in explaining Mauritian economic performance is suggested by the high quality of its institutions. Mauritius ranks well above the average African country with respect to all indices of institutional quality, political as well as economic (Table 4.9), and also above the fast growing economies on most indices. The role of institutions in Mauritian growth and development is illustrated by at least three examples shown below.

Gulhati and Nallari (1990) have argued that Mauritius' success in overcoming its macroeconomic imbalances in the early 1980s owes to domestic institutions. Macroeconomic adjustment was in fact implemented by three different governments of apparently divergent ideological persuasions: this presupposed consultation and a recognition of the need to evolve a national consensus in favor of the adjustment.

A second illustration of the role of institutions relates to the success of the EPZs in Mauritius compared with the rest of Africa. EPZs have failed in most countries because institutions and governance have not been able to manage the rent seeking, corruption, and inefficiency that is required to manage the high degree of selective interventionism embodied in EPZs. It is likely that a well paid civil service (which was part of the political bargain between the political and economic elites) contributed to lower levels of

corruption and inefficiency in Mauritius, and hence to lower costs of doing business there.

A third example is the success of the sugar sector in Mauritius. Sugar is the prime agricultural product in Mauritius, and like most other African countries, the dependence on the primary product has been high. Where Mauritius differed from the rest of Africa is that it nurtured and developed the sugar sector, rather than tax it. While the rest of Africa killed its cash cow, the Mauritian sugar industry thrived. The role of institutions in achieving this success is elaborated on in greater detail in the concluding section.

4.7 An Econometric Investigation of the Mauritian Growth Experience

In this section, we test econometrically the validity and relative importance of the different explanations of the Mauritian growth experience. To do this, we use as the benchmark two widely cited cross-country-growth studies: the first is the study by Sachs and Warner (1997), which seeks to explain long-run growth performance. The second is the study by Rodrik (1999b), which seeks to explain the *change* in the growth performance since the oil crises of the 1970s and the debt crisis of the early 1980s.

The explanatory variables in Sachs and Warner (1997) can be placed in four broad categories: initial conditions, geography, policy including openness, and institutions.

Given our prior position that institutions can potentially be an important determinant of growth performance in Mauritius, it is essential to draw attention to this variable.

Much of the literature on cross-country growth uses a few, or common, set of institutional variables. The most commonly used variable is the International Country Risk Guide (ICRGE), a publication from a private firm that provides consulting services to international investors. The IGRGE captures aspects of the government that directly affect property rights and/or the ability to carry out business transactions. Knack and Keefer (1995) have compiled information on these aspects of the government from the ICRGE. The problem, however, is that there is a two-way relationship between institutions and growth. While institutions clearly influence growth, higher incomes increase the demand for participation, accountability and transparency, and also provide the public resources that can be devoted to improving institutions.

Thus, much of the existing literature uses a variable for institutions that is prone to endogeneity bias.[40] To address this problem, we can draw upon the results of Acemoglu et. al. (2000) who use settler's mortality data in the former colonies as an instrument for

[40] Ideally one should recognize the two-way relationship between institutions and economic growth. Several attempts have been made to deal with the endogeneity of institutions by using an instrumental variables approach. Mauro (1995) instruments for corruption using ethnolinguistic fractionalization which is not such a good instrument after all if growth is accompanied with emergence of a centralized state and integration via markets, moreover as Easterly and Levine (1997) argue, the further problem with ethno linguistic fractionalization is that it can directly affect performance by causing political instability. Hall and Jones (1999) use distance from equator as instrument since the distance from equator proxies "Western Influence." Acemoglu et al. (2000) critique Hall and Jones on empirical grounds that it is not easy to argue that Western influence led to better institutions and cite as an example the Belgian influence in Congo. To our knowledge, Acemoglu et al. (2000) appears to be the best attempt at getting the right instrument for institutional quality.

the variable that captures institutional quality.[41] Table 4.10 presents results based on the Sachs and Warner regressions, while Table 4.13 presents those based on Rodrik (1999b). Table 4.11, also based on Sachs-Warner regressions, lists the estimated deviation in Mauritian growth from different groups of countries.

Given earlier discussion about Mauritius' trade policy, we run the Sachs Warner regression, characterizing Mauritius once as a closed economy and once as an open economy. One issue needs to be clarified here. In order to be conclusive on the causality of openness on growth, one needs a measure of openness that accounts for all reasonable changes in level of openness. A binary measure, like Sachs and Warner, is not likely to capture the change in levels of protection for all the countries included in the cross-country regression. To the extent this happens, the impact of openness on growth can be underestimated or overestimated. Treating Mauritius as closed for the entire period would underestimate the impact as the level of protection was falling.

On this basis, we ran the original Sachs-Warner regression (Column 1: Table 4.10) as well as the one with instrumented institutional variable due to Acemoglu et al. (2000). The fitted values for institutional quality used in the second stage have been obtained by regressing the index of protection against expropriation on historical settler's mortality and a host of geographical and other exogenous variables. Two aspects of the results are striking. First, the dummy for Mauritius is significant and positive (both where Mauritius

[41] Acemoglu et. al. (2000) instrument for institutional quality in an equation with the log of income per capita (rather than growth of this variable).

is characterized as closed, and when it is characterized as open), implying that there are other explanations other than openness that need to be taken into account. In other words, cross-country growth regression is inadequate in explaining Mauritian growth performance. [42]

The assessment of Mauritius as a relatively closed economy seems in conformity with the data, but to further explore Mauritius' trade performance, we estimated a gravity model based on Subramanian and Tamirisa (2001). The gravity model checks whether Mauritius was an exceptional trader. The results presented in Table 4.12 are interesting because the results indicate that Mauritius has simply been an average trader. For the early 1980s and the late 1990s, the Mauritian dummy in the regressions is not statistically different from zero. This is in contrast to the vast majority of African countries that are typically *under traders,* and to the tigers of East Asia that are consistent *over traders*. Two points need mention here. First, Mauritius is consistently a bigger trader than the rest of Africa and has also been experiencing a decline in protection (in % terms) greater than rest of Africa.

In the Rodrick regressions, the same results, namely the uniqueness of the Mauritian growth record, holds. The significance of the Mauritian dummy is robust to alternative measures of institutional quality (Figure 4.13) including the Acemoglu variation. The results are stronger on the uniqueness of Mauritius because the Rodrik regressions are

[42] The interesting result from a general perspective is that instrumenting for institutions *trumps* openness. The openness variable in the SW regressions is no longer significant once the 2SLS methodology is adopted, nor are the geography variables. In fact the central message of the Acemoglu et. al. paper is that once institutions are controlled for, geography does not matter. Sachs and McArthur (2001) contest this result.

aimed at explaining performance of the post 1975 period relative to the pre-1975 period, and it is in the latter period that Mauritian growth accelerated. Relative to most other countries in Africa and in Latin America, Mauritius enjoyed a sustained boom while others suffered a growth collapse.[43]

4.8 Concluding observations—What might be unique about Mauritius

The foregoing discussion can be summarized as follows: first, the Mauritian growth performance between 1960 and 1990, and especially since the 1970s, has been exceptional. In standard cross-country growth regression models, Mauritius is an outlier, implying that conventional determinants of growth do not fully capture the country's performance.

Second, initial conditions have had an ambiguous and often negative impact on subsequent growth performance. Mauritius' initial inheritance of human capital and demographic characteristics were favorable, but its higher level of initial income, commodity dependence, and unfavorable geography has exerted a drag on growth. Certainly, in the growth race, Mauritius did not possess an advantage relative to countries in Africa. Table 4.11 indicates that the initial conditions disadvantaged Mauritius relative to all groups of developing countries. Mauritius' inheritance implied a drag on growth of

[43] Because of the high coefficient of the initial growth rate (between 1960-75), the Rodrik regressions come very close to being a conventional growth regression for the period 1975-89 rather than a "change in growth" regression.

about 1 percentage point relative to the average African country, and close to 2 percentage points relative to the fast growers.

Third, Mauritius adopted a distinctive approach to openness. Its import regime for much of the 1970s, 1980s, and 1990s had been restrictive. Mauritius did try to prevent an import tax from becoming an export and trade tax. Through a mixture of segmentation of the competing import and export sectors, and intervention to promote the export sector (initially though more liberal labor market policies but also through the tax system), *only part* of the anti-export bias was offset.[44] The creation of EPZs was the institutional distinctiveness that gave effect to Mauritius' segmentation. These were the heterodox aspects of Mauritius' openness strategy.

But because the favorable trade environment and the creation of EPZs were not unique to Mauritius, these are proximate rather than underlying causes of Mauritian growth success. Other developing countries had similar trade opportunities and adopted similar policies, but failed where Mauritius succeeded. To some considerable extent, strong domestic institutions contributed substantially to Mauritian success, and these institutions are a good candidate for explaining the Mauritian miracle. Compared with many developing countries, Mauritius has since independence, been a democracy, and has developed strong participatory institutions.

[44] Technically speaking, the term anti export bias is defined for a given terms of trade. Our perspective here is to compare the profitability in the export sector versus the import competing sector and this calculation requires looking at both the role of domestic policy as well as policies of the trading partners that affect the terms of trade.

Econometric results, however, suggest that even after accounting for the role of institutions, there is a sizable unexplained component to Mauritian growth. Cross-country growth models, by definition, cannot capture country-specific idiosyncratic effects. In Mauritius, there were many such effects. But one particularly important one, ironically, appears to be the very diversity and ethnic fragmentation that Meade lamented as a curse.

Diversity has three important benefits. One, it brings about a repository of communities (or diasporas) that have important linkages with the rest of the world, creating positive externalities for the country. Two, it forces the need for economic balance (which explains the preservation of the sugar sector.) And three, it forces the need for participatory political institutions which are important in maintaining stability, law and order, rule of law, and mediating conflict.

The role of business and social networks in promoting trade and investment has attracted increased research interest in recent years. Casella and Rauch (1999) develop a model of trade that reflects the difficulty of introducing one's product in a foreign market. Access to local sources can provide information about the market and facilitate entry into the market. One prominent source of information transmission is co-ethnicity. A well-known example of the role of ethnic networks in trade is provided by the overseas Chinese who have created both formal and informal societies that help information flow and even, at times, help in the enforcement of contracts. Head, Ries and Wagner (1997) find that immigrants significantly increase trade between Canada and the source countries. Rauch

(1999) presents evidence that common language and colonial ties play an important role in international trade.

Just as business and social networks are important for trade, owing to similar mechanisms, they are conceivably important for investment, also. Mauritius' small Chinese population played an important role in attracting the first wave of foreign direct investment flows from Hong Kong SAR. Entrepreneurs from Hong Kong SAR chose Mauritius as an investment location in order to circumvent quotas on exports of textiles and clothing from Hong Kong SAR. In a similar manner, the offshore financial sector of Mauritius has grown because of Indian diasporas that led to the signing of a double taxation treaty between Mauritius and India. As a result, Mauritian offshore centers have mediated large financial flows to India and Mauritius has become the largest investor in India.

Diversity had other important consequences. One distinctive element of Mauritian diversity is the nice, almost symbiotic, separation of economic and political power in Mauritius. Compared to resource rich countries in Africa, for instance Ghana and Nigeria, where economic power and political power were vested in the same authority, Mauritius did not have a system of a ruling elite that derived economic power from the control over resources. Economic power was vested in the minority French community.

This had one important consequence: Mauritius managed to avoid one of the major mistakes made in most of resource-rich Africa, namely of killing their cash cow. In part, this was imbued by ideology—the push toward import-substituting industrialization. The newly independent government in Mauritius—of a distinctly socialist persuasion—was as susceptible as other countries to the siren call of taxation.[45] Yet the call was resisted. Political economy played an important role. In the case of Mauritius, the cash cow was the sugar sector owned predominantly by the minority French community. It was farsighted of the majority Indian community not to have nationalized or heavily taxed this sector. Equally, the economic elite—the French—exercised their clout and ensured that an adverse outcome for them did not result. The cleavage between the economic elite (a political minority) and the political elite, and the need to achieve balance between the two in a newly independent state, thus ensured the fortunes of the sugar sector.

In return for guaranteeing the rights of the sugar owners, the political majority did implicitly extract a compromise in terms of transferring some of the rents from sugar to itself. One important aspect of this transfer was a large, relatively well paid civil service (staffed predominantly by the majority Indian community) and a generous system of social protection, particularly related to pensions. The success of the sugar industry in Mauritius can be seen as an example of optimal rent sharing between the political (predominantly Indian) and economic elites (predominantly non-Indian).

[45] The first Prime Minister, Sir Seewoosagur Ramgoolam, was a Fabian socialist and wedded ideologically to a socialist model of development.

Diversity also had important political consequences. To some extent, Mauritius had no choice but to evolve such institutions. Just prior to independence, in a referendum on this question, 44 percent of the population (virtually the entire non-Indian population) rejected independence and wished to remain a British colony. Assuaging the misgivings of such a large section of the population made participatory politics in the post independence era a necessity.[46] Mauritius' institutions have ensured free and fair elections, the rule of law, a vibrant and independent press, and respect for property rights, all of which make Mauritius an attractive investment location.

Both politics and economics were shaped by the diversity of the population and by the need to accommodate this diversity in the face of large fissures. Another less well-known choice made by Mauritius, which in retrospect seems far-sighted, is related to the sugar quota. Mauritius, in the 1970s, was offered the choice between access at the then high world price with limited quotas and access at a lower domestic EU price but with higher guaranteed quotas. Many countries chose the former, attracted by the high price prevailing at that time. Mauritius chose the latter. The larger quantitative access, combined with the pressure from the domestic EU producer's lobby, which raised domestic EU prices, handed Mauritius huge rents, which proved to be vital in financing private investment and generating growth.

[46] The extraordinary effort devoted to assuaging minority interests is reflected in the 'best loser' system discussed above.

One clear message is that attempting to replicate the Mauritian experiment might be hazardous for other countries, in part because the trading environment is now less favorable. Preferential margins for African countries will slowly but inevitably decline as global liberalization proceeds. Perhaps, more importantly, it may be difficult for other countries to replicate the key elements of the Mauritian globalization strategy—heavy intervention, extensive subsidization, and targeting, including the creation of EPZs—because the preconditions for ensuring that an interventionist strategy succeeds, notably, the quality of domestic institutions and political processes, generally are not in place. More often than not, interventionist policies have themselves accounted for degradation of institutions over the long run.

Appendix A

A.1 Optimal policy package including output subsidy (the non-linear cost function case)

Emissions function:

$$Z = (T - \tau^*)E_1(1 + \phi_f(\tau^*) + \alpha, 1, u, Z) + (\tau^* - \tau)\frac{R_1}{1 + \phi_h(\tau)} \bullet \quad (1)$$

General Equilibrium of the economy

$$E(1 + \phi_f(\tau^*) + \alpha, 1, u, Z) = R(\frac{1 + \phi_f(\tau^*) + s}{1 + \phi_h(\tau)}) + \alpha E_1 - s\frac{R_1}{1 + \phi_h(\tau)}. \quad (2)$$

Totally differentiating 1 and rearranging terms we have:

$$dZ = \eta_{\tau^*} d\tau^* + \eta_\alpha d\alpha + \eta_s ds + \eta_\tau d\tau + \eta_u du, \quad (3)$$

where

$$\eta_{\tau^*} = \frac{1}{1 - (T - \tau^*)E_{1Z}}[-m_1 + (T - \tau^*)E_{11}\phi_f^{'} + (\tau^* - \tau)\frac{R_{11}\phi_f^{'}}{(1 + \phi_h)^2}]$$

$$\eta_\alpha = \frac{1}{1 - (T - \tau^*)E_{1Z}}[(T - \tau^*)E_{11}]$$

$$\eta_s = \frac{1}{1 - (T - \tau^*)E_{1Z}}[(\tau^* - \tau)\frac{R_{11}}{(1 + \phi_h)^2}]$$

$$\eta_\tau = -\frac{1}{1 - (T - \tau^*)E_{1Z}}[\frac{R_1}{1 + \phi_h} + (\tau^* - \tau)\frac{R_1\phi_h^{'}}{(1 + \phi_h)^2} + (\tau^* - \tau)\frac{R_{11}\phi_h^{'}}{(1 + \phi_h)^3}(1 + \phi_f + s)\phi_h^{'}]$$

$$\eta_u = \frac{1}{1 - (T - \tau^*)E_{1Z}}[(T - \tau^*)E_{1u}].$$

Totally differentiating (2) we have

$$[E_u - \alpha E_{1u}]du + [E_Z - \alpha E_{1Z}]dZ + [m_1\phi_f^{'} - \alpha E_{11}\phi_f^{'} + s\frac{R_{11}}{(1+\phi_h)^2}\phi_f^{'}]d\tau^* - \alpha E_{11}d\alpha + s\frac{R_{11}}{(1+\phi_h)^2}ds$$

$$+[\frac{R_1}{(1+\phi_h)^2}(1+\phi_f+s)\phi_h^{'} - s\frac{R_1}{(1+\phi_h)^2}\phi_h^{'} - s\frac{R_{11}}{(1+\phi_h)^3}(1+\phi_f+s)\phi_h^{'}] = 0$$

At an optimum

Coefficient of $d\alpha$ equal to 0 implies

$\hat{\alpha} = E_Z(T - \tau^*)$

Coefficient of ds equal to 0 implies

$\hat{s} = E_Z(\tau - \tau^*)$

The domestic firm if subjected to a higher standard in an optimum receives an output subsidy or else is subjected to a production tax. The equilibrium tax/subsidy disappears if equal standards are applied on home and foreign firms.

Coefficient of $d\tau^* = 0$

$E_Z = \phi_f^{'}(\tau^*)$.

Coefficient of $d\tau = 0$

$$E_Z\frac{R_1}{1+\phi_h} = \frac{R_1}{(1+\phi_h)^2}(1+\phi_f+s)\phi_h^{'}.$$

Combining the equations above we get

$$\phi_f^{'}(1+\phi_h) = \phi_h^{'}(1+\phi_f) + \phi_h^{'}\phi_f^{'}(\tau - \tau^*)\,. \qquad (4)$$

If an output subsidy is applied in the case of linear cost, then the optimal policy results in a corner solution with the firm that has a higher cost of meeting the standard being made standards free and the firm with lower cost of meeting the standard set the highest possible standard. The relative levels of the standard however follows the relationship that higher costs of meeting the standards imply that firm being subjected to a lower standard. In the case of non linear cost functions, an interior solution is obtained. In the quadratic cost example for instance equation (4) converts to $a^*\tau^* = a\tau$. This implies the inverse relationship between costs of meeting the standards and the relative level of the standards.

A.2 Emissions tax and the optimal choice of the standards

Let us consider a situation where standards are produced at constant marginal cost under competitive conditions. Let τ denote the level of the standard and n denote the total number of the consumers. Let x denote the consumption of the non-numeraire good and c the consumption of the numeraire good. Let $e(\tau)$ denote the emissions intensity as a function of the standard. Here we consider a situation where production of the raw product and the standards takes place separately. Given the set up the utility of a

representative consumer is given by the utility function $u(c, x, \tau, nxe(\tau))$. The income of the consumers is fixed and denoted as y. The budget constraint is given as:

$$y = c + p_\tau \tau + p_x x$$

Thus the social planner's problem is given as:

Max $u(c, x, \tau, nxe(\tau)) + \lambda[y - c - p_\tau \tau - p_x x]$.

The choice variables for the social planner are c, x and τ

The first order conditions for a social optimum are given as:

$$u_c = \lambda \tag{5}$$

$$u_x + u_Z ne(\tau) = \lambda p_c \tag{6}$$

and

$$u_\tau + u_Z nx \frac{\partial e}{\partial \tau} = \lambda p_\tau . \tag{7}$$

Claim: If the government chooses the optimal tax on the level of emissions then the choice of the standard by the household is optimal.

The household's problem when an optimal tax t_e is applied to emissions

Household's problem

Max $u(c, x, \tau, nxe(\tau)) + \delta[y - c - p_\tau \tau - p_x x - t_e e(\tau) x]$

c, x, τ

The first order conditions are given as:

$$u_x = \delta \tag{8}$$

$$u_x = \delta p_x + \delta t_e \tag{9}$$

$$u_\tau = \delta p_\tau + \delta t_e x \frac{\partial e}{\partial \tau}. \tag{10}$$

If the tax selected on the emissions is Pigouvian then (5) and (8) imply

$\lambda = \delta$

Equating equation (7) to equation (10) we get,

$u_x + u_Z ne - \lambda p_x = u_x - \delta p_x - \delta t_e$

$t_e^* = -\frac{nu_Z}{\delta}$.

The optimal Pigouvian tax on emissions can be thought to capture marginal environmental damages per unit of emissions.

Now with this tax on emissions, the choice of the standard by the household matches that of the social planner. In order to see this: equation 10 that is the first order condition determining the choice of the standard by the households now becomes:

$u_\tau - \delta p_\tau + \delta \frac{nu_Z}{\delta} x \frac{\partial e}{\partial \tau} = 0$.

Thus the first order condition is identical to the one determining the standard by a social planner.

Now instead if the government does not choose an emissions tax but an output tax on consumption then the f.o.c. determining the choice of the standard by the household is given as:

$u_\tau - \delta p_\tau = 0$, which is different from the rule governing the choice of the social planner.

An output tax per se does not create the incentives for the household to adopt cleaner goods for consumption. The additional term in the choice of the social planner that does not appear in the choice of the households is the effect standards has on the emissions intensity of consumption (the cleanliness of the good)

A.3 Globally optimal standards regime in the absence of the consumption tax

The equilibrium for the global economy is represented by the following set of equations. (We suppress the market clearing condition and the emissions technology)

$$E(q,1,u,Z) = R(\frac{q}{1+a\tau}) - \Omega \tag{11}$$

$$\overline{E}^* = R^*(\frac{q}{1+a^*\tau^*}) + \Omega \tag{12}$$

$$dZ = \frac{-m_1}{[1-(T-\tau^*)E_{1Z}} d\tau^* + [(T-\tau^*)E_{11} + \frac{(\tau^*-\tau)R_{11}}{(1+a\tau)^2}]dq - [\frac{R_1}{1+a\tau} + (\tau^*-\tau)\frac{R_1 a}{(1+a\tau)^2} + (\tau^*-\tau)\frac{R_{11}qa}{(1+a\tau)^3}]d\tau$$

$$dZ = \eta_q dq + \eta_{\tau^*} d\tau^* + \eta_\tau d\tau + \eta_u du \ , \tag{13}$$

where the terms are defined as in Chapter 1.

$$dq = \frac{\Psi_{\tau}}{\Delta} d\tau + \frac{\Psi_{\tau^*}}{\Delta} d\tau^* \tag{14}$$

Using the equations above we have:

$$\frac{E_Z \eta_q \Psi_{\tau^*}}{\Delta} + E_Z \eta_{\tau^*} = \frac{R_1^* q a^*}{(1 + a^* \tau^*)^2} \tag{15a}$$

$$\frac{E_Z \eta_q \Psi_{\tau}}{\Delta} + E_Z \eta_{\tau} = \frac{R_1 q a}{(1 + a \tau)^2}. \tag{15b}$$

Dividing equation (15a) by (15b) and rearranging terms we get:

$$\begin{aligned} &\frac{\theta R_1^* R_{11} q a a^*}{1 + a\tau} - \frac{\theta R_1 R_{11}^* q a a^*}{1 + a^* \tau^*} + \frac{\theta E_{1Z} R_1^* R_1}{[1 + (T - \tau^*) E_{1Z}]} (a - a^*) + \Delta R_1^* R_1 (a^* - a) \\ &- \theta \frac{E_{1Z} (\tau^* - \tau)}{[1 + (T - \tau^*) E_{1Z}]} \frac{R_1^* R_{11} q a a^*}{1 + a\tau} + \Delta (\tau^* - \tau) \frac{R_1^* R_{11} q a a^*}{1 + a\tau} = 0 \end{aligned}, \tag{16}$$

where $\theta = (T - \tau^*) E_{11} + (\tau^* - \tau) \frac{R_{11}}{(1 + a\tau)^2}$

Expanding and rearranging terms we have

$$\begin{aligned} &\frac{(\tau^* - \tau) R_{11}^* R_{11} q a a^* E_1}{(1 + a\tau)(1 + a^* \tau^*)} - [E_{11} - \frac{R_{11}}{(1 + a\tau)^2} - \frac{R_{11}^*}{(1 + a^* \tau^*)^2}] R_1^* R_1 (a^* - a) = -(T - \tau^*) E_{11} [\frac{R_{11}^* R_1 q a a^*}{(1 + a^* \tau^*)} + \frac{R_1^* R_{11} q a a^*}{(1 + a\tau)} \\ &(\tau^* + \tau) E_{11} \frac{R_1^* R_{11} q a a^*}{(1 + a\tau)} \end{aligned} \tag{17}$$

Equation (17) implies that the relationship between the relative costs and the optimal standards regime is same as in case of a small open economy.

Appendix B

Details of the simulated model

Consumer and producer prices

$$q(\tau^*, \alpha) = 1 + a^* \tau^* + \alpha$$

$$p(\tau^*, \tau) = \frac{1 + a^* \tau^*}{1 + a\tau}$$

Demand Function

$$x(\tau^*, \alpha) = \delta 0 - \delta 1 * q$$

Utility Function

$$u(\tau^*, \alpha) = \delta + \frac{\delta 0}{\delta 1} * x - \frac{1}{2\delta 1} x^2$$

Consumer Surplus Function

$$\theta(\tau^*, \alpha) = u - q * x$$

Profit Function

$$\Pi(\tau^*, \tau) = \beta 0 + \frac{\beta 1}{2} * p^2 - \beta 2 * p$$

Domestic Supply Function

$$S = \frac{d\Pi}{d\tau^*} \frac{1}{a^*}$$

Pollution function

$$Z(\tau, \tau^*, \alpha) = (T - \tau^*) * x + (\tau^* - \tau) * S$$

Welfare function

$$W(\tau, \tau^*, \alpha) = \theta + \Pi - \frac{0.01}{\sigma} * (Z)^2 + \alpha * x$$

Welfare function under politics

$$W(\tau, \tau^*, \alpha) = \theta + \gamma\Pi - \frac{0.01}{\sigma} * (Z)^2 + \alpha * x$$

Table 4.1. Sustained Growth Experiences in Africa, 1960-1998

Country	Start	End	Length of Period	Average Growth Rate	PPP GNP per Capita (in US dollars; 1998)	Ranking (out of 174)
South Africa	1960	1974	14	5.1	8,296	49
Mauritius	1980		18+	5.4	8,236	50
Gabon	1965	1976	11	13.1	5,615	63
Botswana	1965		33+	9.1	5,796	65
Namibia	1961	1979	18	6.4	5,280	75
Ghana	1983		15+	4.7	1,735	129
Lesotho	1970	1982	12	9.9	2,194	133
Cote d'Ivoire	1960	1978	18	9.5	1,484	134
Cameroon	1967	1986	19	7	1,395	138
Togo	1960	1974	14	6.8	1,352	145
Uganda	1986		10+	6.1	1,072	152
Kenya	1961	1981	20	6.7	964	156
Mozambique	1986		12+	7.1	740	162
Etiopía	1960	1972	12	4.5	566	170
Malawi	1964	1979	15	6.6	551	172
Tanzania	1961	1975	14	5.7	483	173
Sub-Saharan Africa					1,607	

Sources: Berthelemy and Soderling (2001); UNDP, Human Development Report.

Table4.2. Sources of Growth: Mauritius and other Developing Countries

	GDP per Worker	Total Factor Productivity
Mauritius		
1982-99	2.5	0.7
1982-90	1.0	0.6
1991-99	3.5	1.4
Other developing countries (1984-94)		
East Asia	4.4	1.6
Latin America	0.1	-0.4
Middle East	-1.1	-1.5
South Asia	2.7	1.5
Sub-Saharan Africa	-0.6	-0.4

Sources: Authors' estimates for Mauritius and Collins and Bosworth (1996) for other developing

Table 4.3. Inheritance: Mauritius Versus Rest of World[47]

	Mauritius	Africa	Fast-Growing Economies	All other Developing Economies
Inheritance				
Catch-up[48]	8.72	7.29	7.90	7.85
Life expectancy in years (circa 1970) (human capital)	60.40	41.60	57.10	51.9
Ethnolinguistic fractionalization[49]	0.58	0.64	0.42	0.32
Population growth[50]	0.97	-0.09	0.82	0.33
Share of primary exports in total exports	0.29	0.18	0.09	0.12
Geography				
Fraction of area in tropical climate	1.00	0.89	0.69	0.59
Landlocked [51]	0	0.33	0	0.11
Remoteness from economic Center of the world (Kms)[52]	11,249	9,183	9,464	8,633

[47] The fast-growing countries -Thailand, Malaysia, Indonesia, China, Hong Kong SAR and Singapore.
[48] Log of real GDP per economically active population in 1965.
[49] Probability that 2 randomly selected people from a country will not belong to the same ethnic or linguistic group.
[50] Growth of working age population minus growth of total population between 1965 and 1990.
[51] 1 if it is landlocked, 0 if it is not. For a group it depicts the fraction of countries landlocked.
[52] Remoteness of a country is its average distance to trading partners, weighted by shares in the world GDP.

Table 4.4. Mauritius: Estimates of Effective Protection, 1980 and 1990(In percent)

	1980	1990
Beverages and tobacco	123	182
Textile yarn/fabrics	77	11
Apparel	99	4
Leather products	269	8
Footwear	158	88
Wood products	191	38
Furniture	130	241
Paper products	131	57
Printing/publishing	75	7
Chemical products	38	21
Rubber products	125	144
Plastic products	89	59
Non-metallic products	77	48
Iron/steel	154	73
Fabricated metal products	156	48
Machinery	62	3
Electrical machinery	179	181
Transport equipment	23	4
Optical goods etc.	266	9
Average	127	65
Memorandum item:		
Share of imports under licenses	57	

Source: Milner and McKay (1996).

Table 4.5. Openness of Mauritius and Africa

Criteria	Mauritius	Africa Average
Parallel market premia (index of foreign exchange restrictions) (1996)	4.0	2.8
Discrimination against imports in excise taxes (average rate of taxation) (1996)	219.0	27.4
Maximum trade taxes on imports (includes statutory tariff rates plus surtaxes and the ad valorem equivalents of specific duties)	80.0	78.3
Exemptions as percentage of dutiable imports	13.2	18.9
Unweighted average tariff rate	26.4	17.2
Import weighted average tariff rate	20.3	12.4
Tariff collections as percent of GDP	6.0	2.6
Import weighted average tariff on consumer goods	25.2	19.7
Unweighted average import tariff on inputs	19.3	11.0
Unweighted average import tariff on capital goods	15.9	7.7
Indicators of effective protection in agriculture	19.5	18.2
Indicators of effective protection in Manufacturing	150.2	82.7

Source: Hinkle and Herrou-Aragon (2001).

Table 4.6. Rents to Mauritius from Apparel Exports[53]

	1984				1996				1999			
	EU*		USA*		EU*		USA*		EU*		USA*	
	ETE	Rent	ETE	Rent	ETE	Rent	ETE	Rent	ETE	Rent	ETE	Rent
Shirt knitted	*3*	0.01	*15*	0.00	*28.3*	3.40	*57.8*	2.55	*18.1*	4.33	*37.6*	4.88
T-shirts knitted	*3*	0.02	*17*	0.00	*28.3*	40.95	*0.8*	0.29	*14.7*	45.31	*7.6*	0.97
Shirts not knitted	*5*	0.09	*27*	0.29	*12.6*	9.54	*50.8*	27.77	*10.6*	6.95	*42.9*	36.62
Trousers	*20*	0.79	*20*	1.41	*9*	9.85	*31.6*	19.81	*11.6*	9.81	*25.7*	23.56
Ladies' Blouses etc.	*10*	0.18	*17*	0.62	*4.4*	0.62	*8.4*	0.35	*9.9*	1.05	*12.1*	1.30
Jerseys, pull-overs, cardigans etc.	*3.1*	0.20	*25.6*	1.39	*1.8*	3.07	*1.6*	0.10	*8*	12.20	*12.7*	1.62
Total rent	1.29		3.71		67.44		50.87		79.65		68.96	
Rent/GDP (%)	**0.49%**				**2.91%**				**3.54%**			

Source: Authors' Calculations.

*** Rents are in millions of current US dollars.**
Export tax equivalents (ETE) are in %.

[53] The percent of apparel exports covered for the EU and USA for the three-time periods are 45 and 68, 93 and 84 and 80 and 94 percent, respectively.

Table 4.7. Import Tax and Offsetting Export Subsidies[1] (In percent)

Period	Import Protection[2]	Subsidy to the export sector	
		Case A	Case B
1980s	**127**	32	39
1990s	**65**	7	20

Source: Authors' calculations.

[1] Subsidy from domestic policy refers to the difference between the EPZ wage and the wage in the non-EPZ manufacturing (Case A) and in the economy (Case B).

[2] To capture the resource allocation effects, protection is measured in effective rather than nominal terms.

Table 4.8. Total Factor Productivity in EPZ Sector in Mauritius

	%GDP	%K	%L	Labor Share	TFP
1982-99	10.2%	9.5%	5.4%	0.69	3.5%
1982-90	19.0%	24.1%	17.5%	0.67	-0.8%
1991-99	5.7%	0.7%	0.0%	0.71	5.4%

Source: Authors' calculations.

Table 4.9. Mauritius and other Countries with Respect to Indices of Institutions

Institutional Quality Index	Mauritius[1]	Africa	Fast-Growing Countries	Other Developing Countries
CRGE[2]	7.23	4.54	6.86	4.29
Protection against expropriation[3]	8.06	5.75	8.54	6.47
Democracy[4]	0.75	0.25	0.47	0.51
Participation index[4]	0.80	0.30	0.49	0.44

[1] For ICRGE and Protection Against Risk of Expropriation, Mauritius has fitted values.

[2] ICRGE (International Country Risk Guide) index is a measure of institutional quality that contains aspects of government that affect property rights or the ability to carry out business. It is published by a private firm that provides consulting services to international investors.

[3] For ICRGE index and index of protection against the risk of expropriation the scale is between 0-10, with higher values indicating better institutional quality.

[4] Participation measures the extent of competitiveness of political participation. This index is taken from the Polity III dataset of Jaggers and Gurr (1995), who define it as the "extent to which non-elites are able to access institutional structures for political expression" (it is rescaled to range from 0 to 1 in Rodrik (1999). The democracy index also ranges from 0 to 1.

Table 4.10. Cross-Country Growth Regression as in Sachs-Warner (1997)[54]

Dependent Variable—Growth Rate Between 1965–90	OLS	2SLS
Log of initial GDP	-1.44*	-1.79*
	(-6.45)	(-5.73)
Openness x log of GDP	-1.18*	-0.27
	(-3.5)	(-0.57)
Openness (fraction of years open according to Sachs Warner 95)	11.85*	3.21
	(4.25)	(0.79)
Landlocked dummy variable	-0.61*	0.39
	(-2.71)	(0.38)
Log life expectancy circa 1970	45.47*	111.14***
	(2.71)	(1.82)
Square of log life expectancy	-5.37**	-13.81***
	(-2.32)	(-1.79)
Central government saving 1970-90	0.11*	0.11**
	(5.17)	(2.31)
Dummy for tropical climate	-0.82*	0.52
	(-2.92)	(0.66)
Institutional Quality Index (ICRGE)	0.34*	
	(4.14)	
Expropriation index instrumented		1.41***
		(1.72)
Natural resource exports/GDP 1970	-3.82*	-5.64*
	(-3.97)	(-3.94)
Growth in economically active population – pop growth	0.74**	-0.46
	(2.16)	(-0.38)
Mauritian dummy	**1.46****	**1.89****
	(1.94)	**(1.88)**
Constant	-83.26**	-216.43***
	(-2.46)	(-1.76)
R Squared	0.87	0.83
Adj R squared	0.85	0.78
Number of observations	85	52

Source: Authors' estimates.
Figures in brackets represent *t* ratios.

[54] *-significant at 99%**, significant at 95%, ***-significant at 90%.

Table 4.11. Breakdown of Mauritian Growth[55]

Difference in Explanatory Variable	Mauritian Growth from Baseline Growth of Africa	Fast-Growing Countries	Other Developing Countries
Catch-up	-2.33	-1.33	-1.41
Life expectancy	1.51	0.29	0.68
Landlocked	0.19	0	0.06
Tropical climate	-0.09	-0.26	-0.34
Natural resource abundance	-0.35	-0.65	-0.55
Etholinguistic feactionalization	0.01	-0.03	-0.05
Total inheritance	**-1.06**	**-1.98**	**-1.61**
Openness	-0.20	-1.93	-0.47
Central government savings	-0.43	-0.53	-0.08
Average national savings ratio	-0.001	-0.02	-0.006
Institutional Quality	0.75	0.10	0.82

Source: Authors' calculation.

Inheritance Variables

Policy Variables

[55] Estimates are based on the Sachs and Warner (1997) basic regression.

Table 4.12: Undertraders, Average Traders and Super Traders (Coefficient on country dummies in a gravity model[56])

Country	1997-98
Angola	0.975
Burundi	-1.804*
Congo, Dem. Rep. Of	-1.617*
Ethiopia	-1.650*
Kenya	-1.103*
Madagascar	-0.945**
Malawi	-1.361*
Mauritius	0.252
Mozambique	-1.654*
Rwanda	-1.939*
Seychelles	-0.325
Tanzania	-1.901*
Uganda	-2.066*
Zambia	-1.416*
Zimbabwe	-0.974*
Indonesia	0.086
Malaysia	1.569*
Thailand	0.819*
China, P.R., Hong Kong SAR	1.505*
Korea	0.764*
Singapore	1.852*
Taiwan Prov. Of China	1.292*

Source:Authors' estimates, *--Denotes significant at the 5% level.

**-- Denotes significant at the 10% level.

[56] Negative and significant coefficient implies under trader while positive and significant coefficient implies overtrade.

Table 4.13. Cross-Country Regressions of Change in Growth (Rodrik (1999))

East Asia dummy	2.41* (-3.26)	2.11* (-3.06)	
Latin America dummy	-2.16* (-4.56)	-1.77* (-3.7)	
SSA dummy	-2.11* (-3.38)	-2.09* (-3.6)	
Growth 1960-75	-0.77* (-7.11)	-0.72* (-6.41)	-0.83* (-5.41)
Log GDP/capita 1975	-0.90* (-3.02)	-0.87* (-2.91)	-2.03* (-4.54)
External shocks	-0.03 (-1.05)	-0.07* (-2.84)	-(0.04) (-1.26)
Democracy	1.73** (2.18)		
Institutional quality (instrumented for index of protection against risk of expropriation)			1.85* (5.41)
Index of participation		2.02* (2.57)	
Ethnolinguistic fractionalization	-1.65* (-2.38)		
Dummy for Mauritius	**3.68** (2.19)**	**4.30** (2.49)*	**3.91** (2.29)**
Constant	8.55* (3.94)	7.44* (3.11)	3.95** (1.98)
R squared	0.6039	0.6051	0.54
Adjusted R squared	0.5629	0.5741	0.49
Number of observations	97	97	59

Figure 3.1: With consumption tax: Ratio of welfare under discrimination to under NT(small open economy)

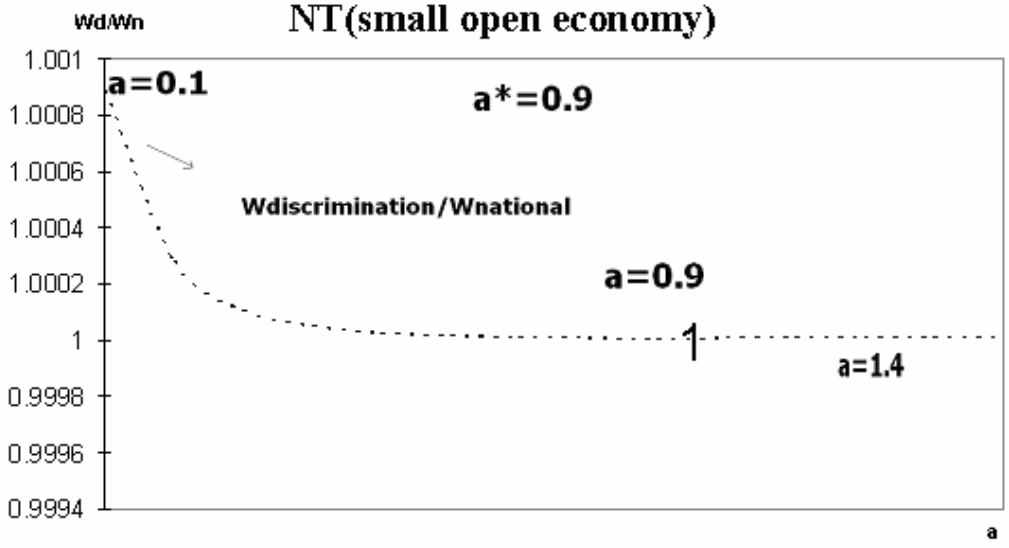


Figure 3.2: In the absence of consumption tax : Ratio of welfare under discrimination to welfare under NT: (Case of small open economy)

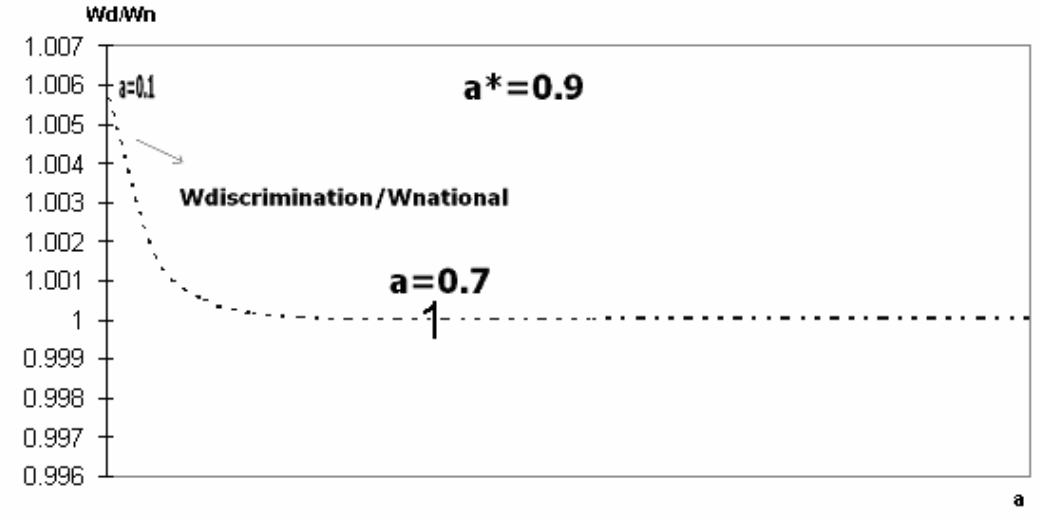


Figure 3.3: Variation in social welfare with politics: Under discrimination and under national treatment (Case of small open economy):

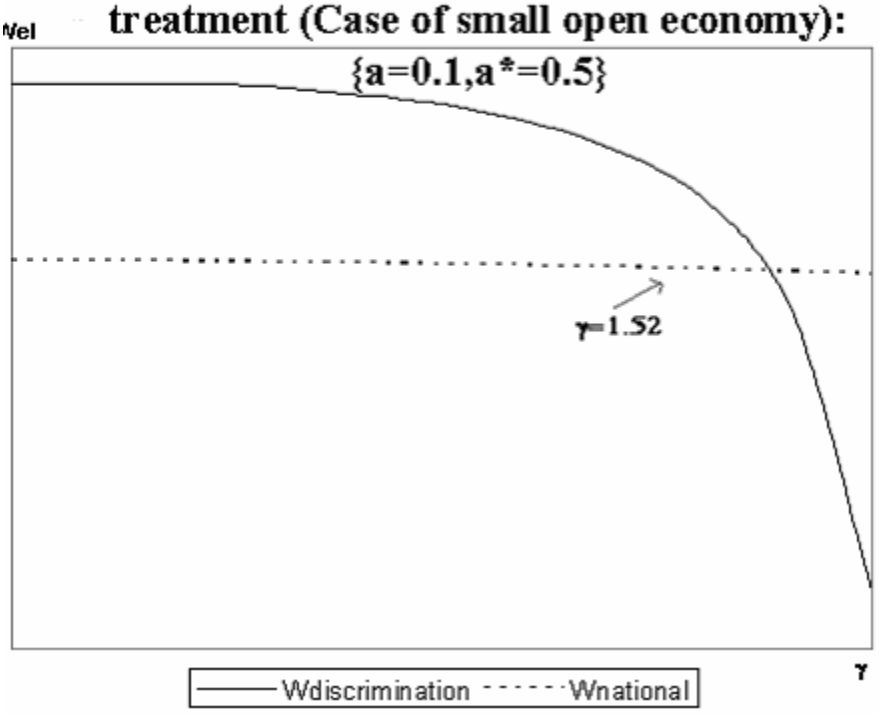


Figure 3.4: Variation in welfare with politics: Under discrimination and under NT (small open economy): {a=0.1,a*=0.3}

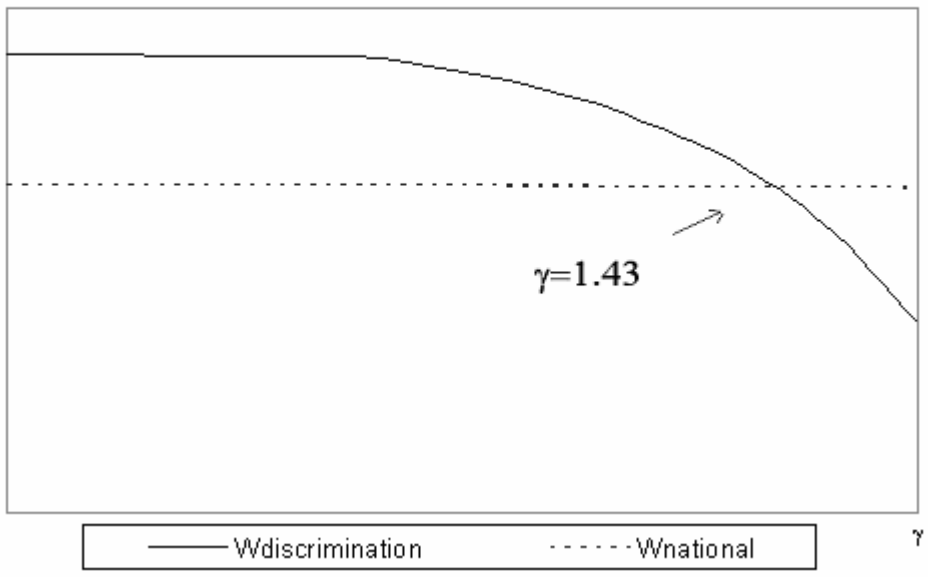


Figure 4.1. Per Capita Income Growth Rate: 1976-99 Versus 1961-75

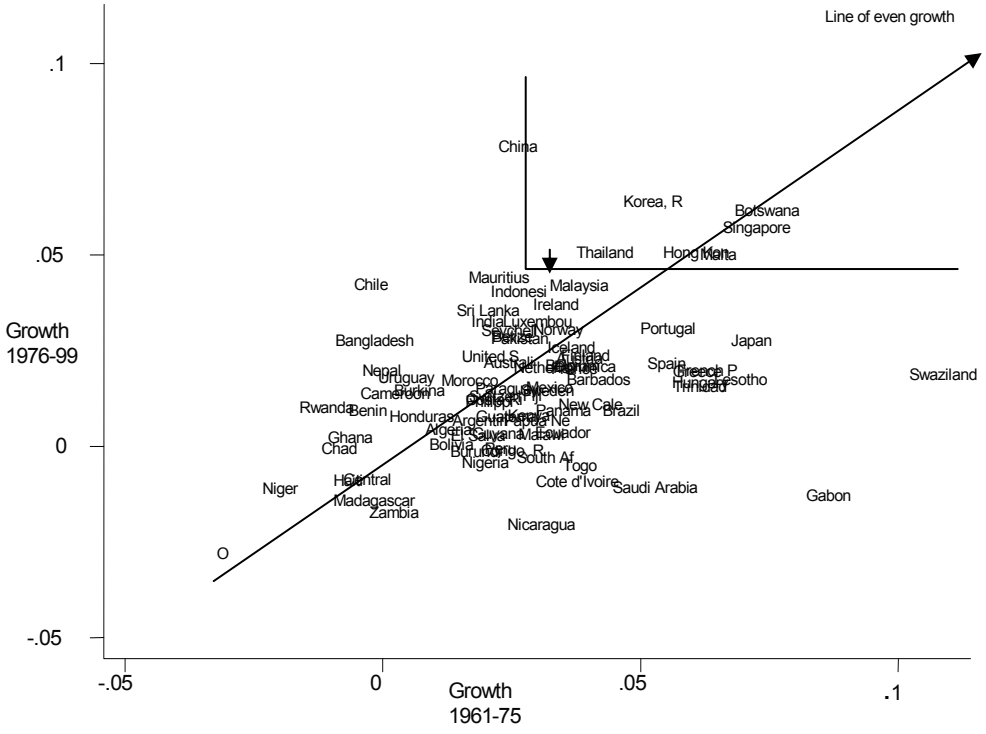
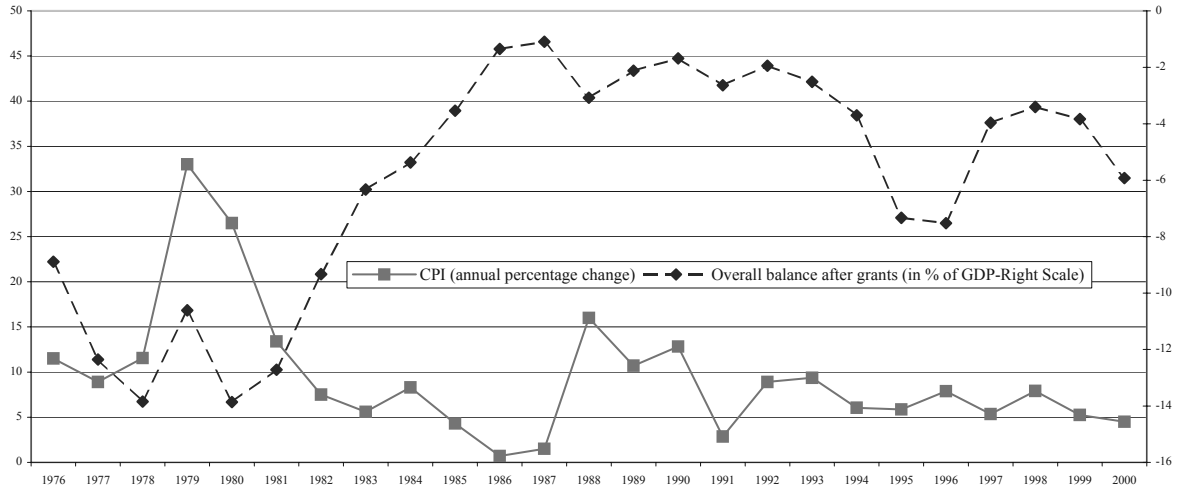
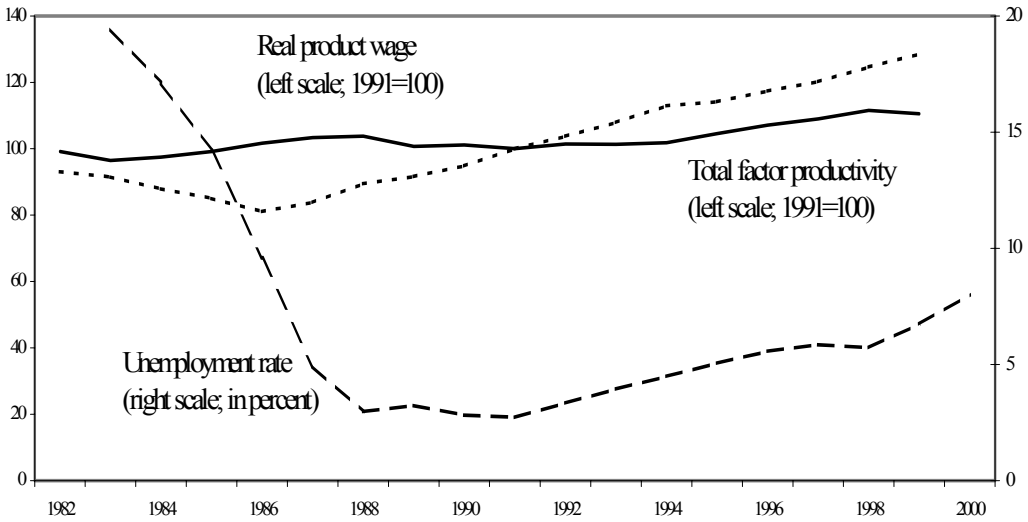


Figure 4.2. Mauritius:Budget Deficit and Inflation, 1976-2000



Source: Authors' calculations.

Figure 4.3 Mauritius: Real Product Wage, Factor Productivity and Unemployment Rate



Source: Authors' calculations

Figure 4.4. Catch-Up: Mauritius Versus Africa

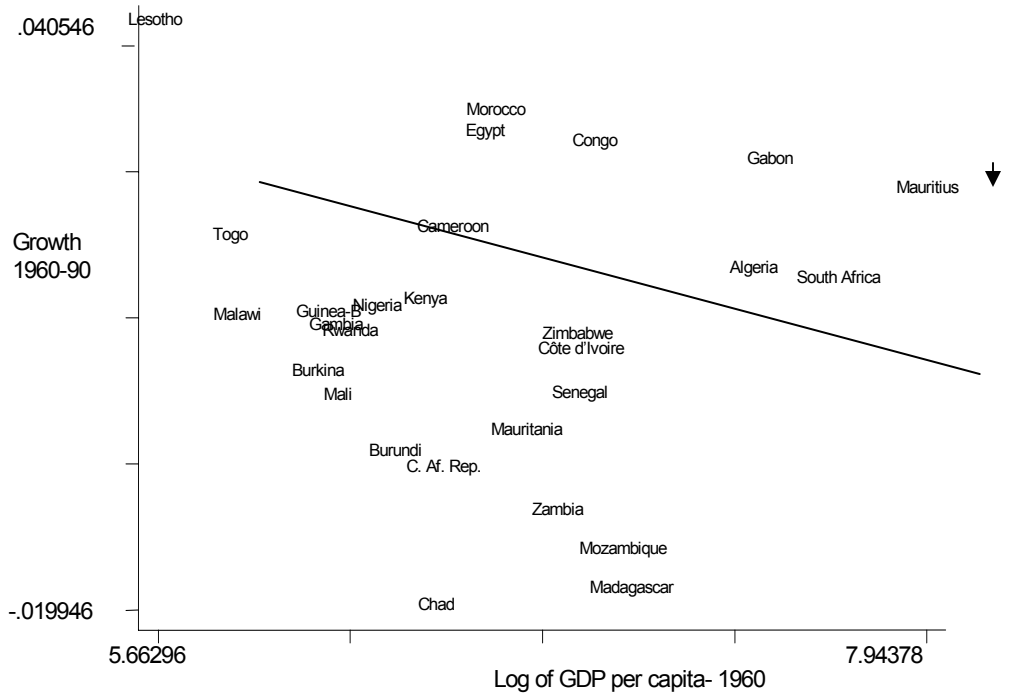
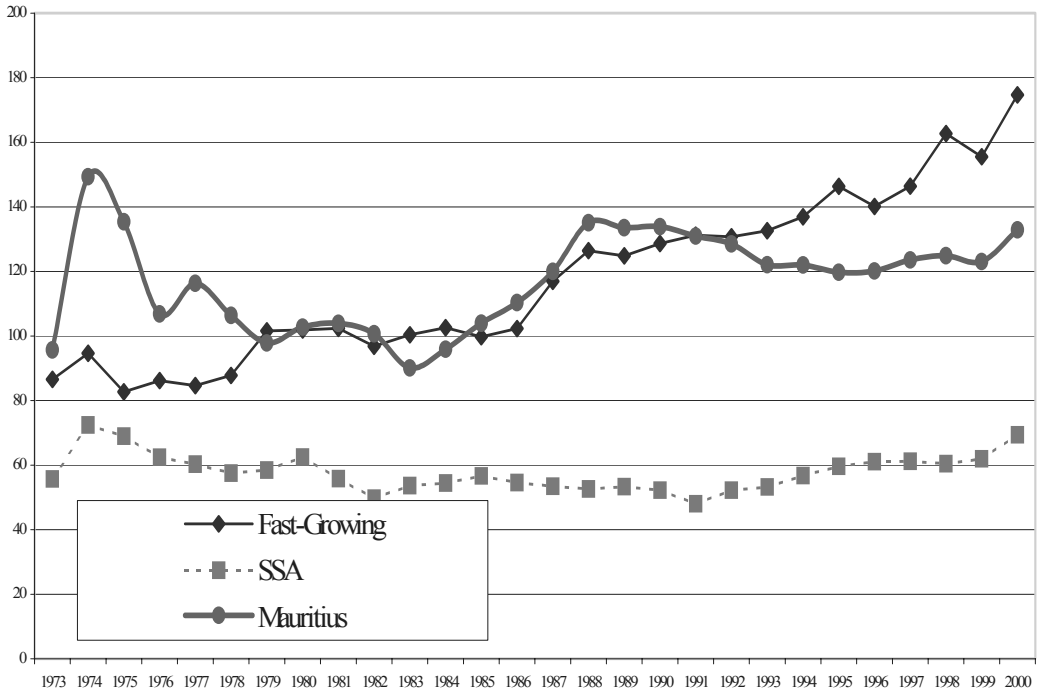


Figure 4.5. Mauritius: Sub-Saharan Africa and the Fast Growing Economies: Openness Ratio, 1973-2000(Exports plus imports of goods and services in % of GDP)



Source: World Economic Outlook.

Figure 4.6. EPZ Wage in Mauritius Compared to other Wages

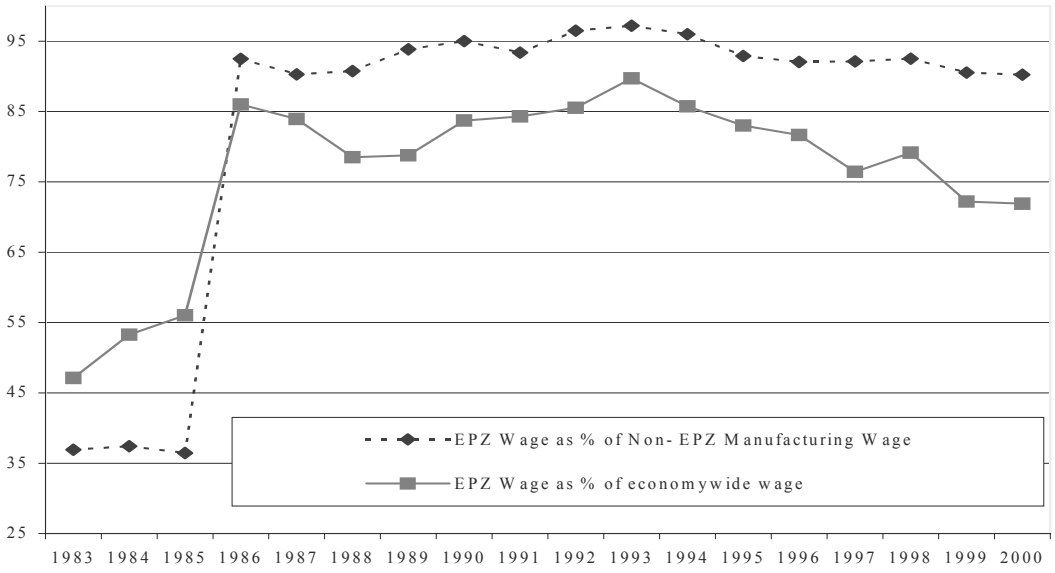
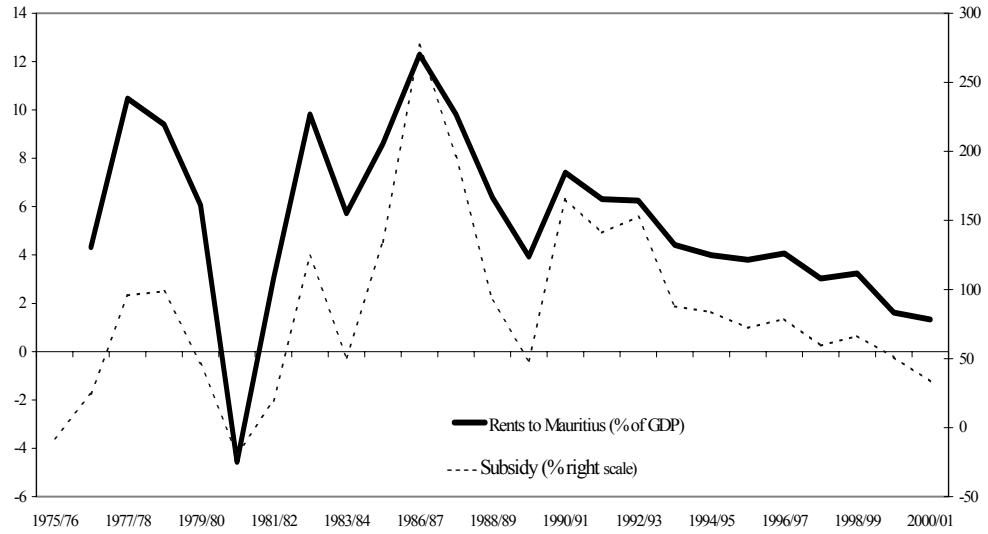
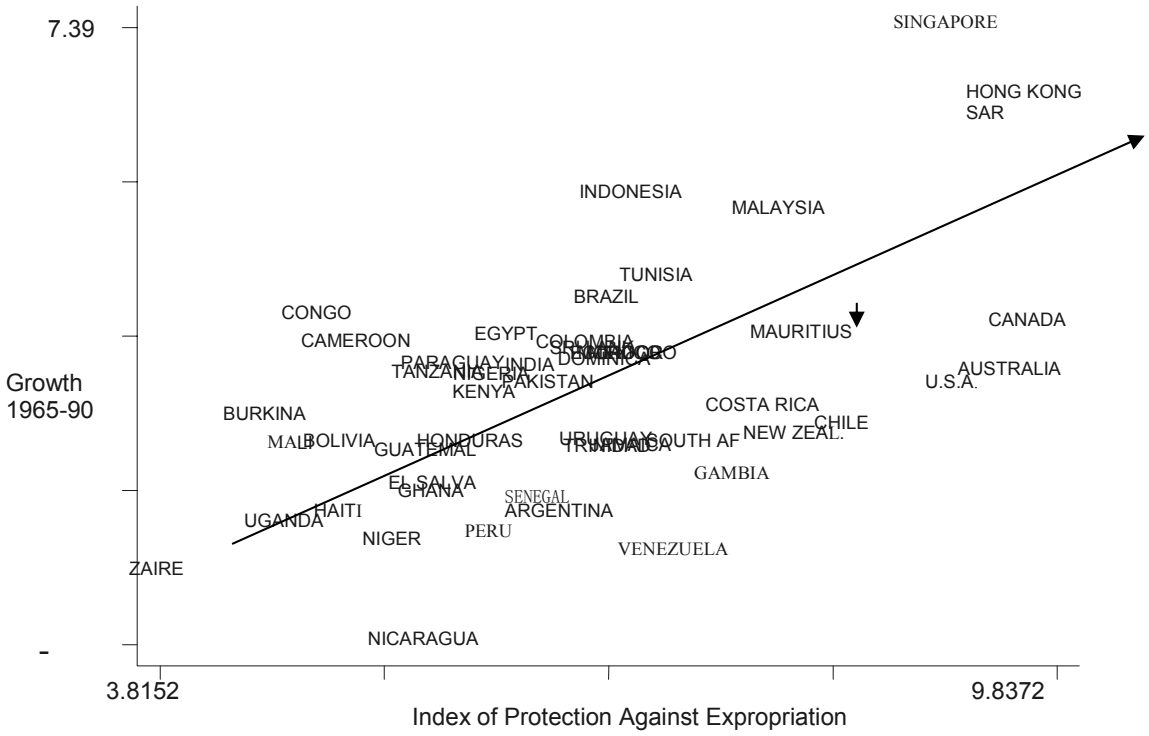


Figure 4.7. Mauritius: Benefits from Preferential Access to EU Sugar Market



Source: Fund staff calculations.

Figure 4.8. Growth and Institutional Quality



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