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**An Economic Risk Assessment of the
Impact on Producers of Removing
Quarantine Restrictions***

by

Rob Fraser

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ABSTRACT

This paper contributes to the understanding of the impact of removing quarantine restrictions on the income risk of domestic producers. It develops a model of this impact on a producer's perception of income risk. Four effects of the introduction of imports on the perceived income risk of domestic producers are identified, as well as a range of factors which influence the magnitude of these effects. A numerical analysis evaluates the role of each of these factors in determining the producer's perception of income risk following the introduction of imports. This evaluation provides a range of conclusions relevant to quarantine policy.

INTRODUCTION

One of the key outcomes of the Nairn Review of Australia's quarantine policies was the proposal to establish "expert Working Parties to complete specific components of a detailed risk analysis" (Nunn, 1997, p567). In particular, there would be "Scientific Working Parties conducting detailed risk assessments and considering risk management options, and..... Economics Working parties examining the potential economic loss due to the introduction or establishment of any pests or diseases" (Nunn, 1997, p567). On this basis, there is a clear distinction maintained in the context of quarantine policy between the tasks of "risk assessment" and "economic assessment".¹ Moreover, this distinction has been perpetuated to a large degree by the existing economic literature relating to the assessment of quarantine policies. For example, the economic assessment of Newcastle Disease in chickens by Hafi, Reynolds and Oliver (1994) is conducted almost exclusively in terms of the impact of imported chickens and the disease on producer and consumer surplus. Only in the final chapter is it acknowledged that as estimated "the total cost of disease is only valid under strong assumptions of transition from a zero probability of a disease state with quarantine to one of certainty (without)" (p45). Hafi et al (1994) then proceed to consider briefly the role of the probability of a disease outbreak in determining the relationship between (expected) costs and benefits as measured by the changes in producer and consumer surplus. But at no point is an assessment of the impact of imports and the disease on a domestic producer's perception of income risk even contemplated. Similarly, James and Anderson (1998) undertake an economic assessment of Australia's quarantine policy of an import ban on bananas using estimated changes in producer and consumer surplus, thereby excluding any assessment of the impact of removing the policy on the income risk of producers.^{2,3}

This focus of the existing economics literature on the producer surplus (expected income) effects of quarantine policies is probably justified as a first-order approximation. But at the same time it is not appropriate to disregard economic consideration of the income risk effects on producers - especially when risk assessment is the central focus of scientific consideration of quarantine policy.

The aim of this paper is to modify the distinction between "economic assessment" and "risk assessment" by developing the understanding of the impact of removing quarantine restrictions on the income risk of domestic producers.⁴ In so doing I will show that removing an import ban has four separate effects on the income risk of producers: two of which are favourable, and two of which are unfavourable. Moreover, because of this conflict of effects I will show that a producer's perception of the overall effects on income risk of removing an import ban may be favourable or unfavourable depending on a range of factors largely beyond the control of the producer. Nevertheless, a characterisation of the role of these factors will help identify situations in which producers can be expected to perceive the impact of removing quarantine protection on their income risk as to their advantage or not.

The structure of the paper is as follows. Section 1 outlines the model used to represent the impact of removing an import ban on the income stream of a producer. It also distinguishes the four effects of introducing imports on income risk and identifies the range of factors which govern a producer's perception of the overall effect of imports on income risk. Section 2 undertakes a numerical analysis of this model, including an evaluation of the importance of each of the factors governing a producer's overall perception of the impact on income risk. The paper concludes with a discussion of policy implications.

SECTION 1: The Model

The model of a producer's uncertain income per period (I) assumes that this income is a product of uncertain price (p) and uncertain yield (y).

In the absence of imports, expected income ($E_o(I)$) is given by:

$$\begin{aligned} E_o(I) &= E(p_o y_o) \\ &= \bar{p}_o \bar{y}_o + \text{cov}(p_o, y_o) \end{aligned} \quad (1)$$

where: $\bar{p}_o$ = expected price in the absence of imports

$\bar{y}_o$ = expected yield in the absence of imports

$\text{cov}(p_o, y_o)$ = covariance between price and yield

Note that in the absence of imports the relationship between price and yield is assumed in what follows to be represented by a negative covariance. This assumption is consistent with a closed economy framework.

In addition, the variance of income in the absence of imports ($\text{Var}_o(I)$) can be approximated by:⁵

$$\text{Var}_o(I) \approx \bar{y}_o^2 \text{Var}(p_o) + \bar{p}_o^2 \text{Var}(y_o) + 2\bar{p}_o \bar{y}_o \text{cov}(p_o, y_o) \quad (2)$$

where: $\text{Var}(p_o)$ = variance of p_o

$\text{Var}(y_o)$ = variance of y_o

It is further assumed that yield uncertainty can be represented by the multiplicative form:⁶

$$y = \theta \bar{y} \quad (3)$$

where: $E(\theta) = 1$

$$\begin{aligned}\text{Var}(y) &= \bar{y}^2 \text{Var}(\theta) \\ \text{Var}(\theta) &= \text{variance of } \theta\end{aligned}$$

In considering the impact of the removal of the import ban, it is anticipated that both the expected price ($\bar{p}_1$) and the variance of price ($\text{Var}(p_1)$) with imports will be lower:⁷

$$\begin{aligned}\bar{p}_1 &< \bar{p}_o \\ \text{Var}(p_1) &< \text{Var}(p_o)\end{aligned}\tag{4}$$

In addition, it is anticipated that the negative covariance between price and yield will be eliminated:⁸

$$\text{Cov}(p_1, y_1) = 0\tag{5}$$

Finally, expected yield in the presence of imports ($\bar{y}_1$) may be lowered by the impact of disease:

$$\bar{y}_1 \leq \bar{y}_o\tag{6}$$

Note that the presence of disease is assumed not to affect the seasonal factors governing the variability of yield:

$$\text{Variance}(\theta_1) = \text{Variance}(\theta_o),\tag{7}$$

and so combining equations (3) and (6) shows that:

$$\text{Var}(y_1) \leq \text{Var}(y_o)\tag{8}$$

On this basis, expected income in the presence of imports $E_1(I)$ is given by:

$$E_1(I) = \bar{p}_1 \bar{y}_1\tag{9}$$

and the variance of this income ($\text{Var}_1(I)$) can be approximated by:

$$\text{Var}_1(I) \approx \bar{p}_1^2 \text{Var}(y_1) + \bar{y}_1^2 \text{Var}(p_1)\tag{10}$$

A comparison of equations (1) and (9) gives:

$$E_1(I) - E_o(I) = (\bar{p}_1 \bar{y}_1 - \bar{p}_o \bar{y}_o) - \text{cov}(p_o, y_o)\tag{11}$$

Based on equations (4) and (6) the first term on the right-hand-side of (11) is clearly negative while the second term is positive as specified. Consequently, equation (11) is analytically ambiguous, although it is anticipated that in virtually all cases the magnitude of the first term will dominate that of the second and that overall the producer's expected income will be lower in the presence of imports than in its absence:

$$E_1(I) < E_0(I) \quad (12)$$

A comparison of equations (2) and (10) gives

$$\begin{aligned} \text{Var}_1(I) - \text{Var}_0(I) = & (\bar{p}_1^2 \text{Var}(y_1) - \bar{p}_0^2 \text{Var}(y_0)) + (\bar{y}_1^2 \text{Var}(p_1) - \bar{y}_0^2 \text{Var}(p_0)) \\ & - 2 \bar{p}_0 \bar{y}_0 \text{cov}(p_0, y_0) \end{aligned} \quad (13)$$

On the basis of equations (4), (6) and (8), the first two terms on the right-hand-side of (13) are negative, while the third term is positive as specified. The first term represents the decline in income risk with imports due primarily to the lower expected price, while the second term represents the decline associated primarily with less price variability. Note also that the magnitude of both these terms is larger if disease affects expected yield ($\bar{y}_1 < \bar{y}_0$). In contrast, the third term represents the increase in income risk which follows the removal of the negative covariance between domestic price and yield associated with the introduction of imports. It follows that the overall impact of the introduction of imports on the variance of income is analytically ambiguous.

Moreover, these three terms do not represent all of the components of the overall impact of introducing imports on the producer's perception of income risk. A fourth component can be seen by approximating the producer's expected utility of income ($E(U(I))$) as follows:⁹

$$E(U(I)) \approx U(E(I)) + \frac{1}{2} U''(E(I)) \cdot \text{Var}(I) \quad (14)$$

The second term on the right-hand-side of equation (14) shows that a producer's perception of whether the impact of the introduction of imports has been to make income risk ($\text{Var}(I)$) "better" or "worse", depends also on that producer's attitude to risk as represented by the second derivative of the utility function:

$$U''(E(I))$$

Note that this term is negative for a risk averse producer. Based on equation (12), it is anticipated that the introduction of imports will decrease the producer's expected income. Consequently, the associated change in $U''(E(I))$ depends on whether:

$$U'''(E(I)) \begin{matrix} < \\ > \end{matrix} 0 \quad (15)$$

The standard assumption in this context is that the third derivative of the utility function is positive, which is consistent with empirically-supported functional forms such as the constant relative risk aversion form:¹⁰

$$U(I) = \frac{I^{1-R}}{1-R} \quad (16)$$

where: R = coefficient of relative risk aversion.

On this basis, because of the anticipated decline in $E(I)$ associated with the introduction of imports, it follows that the (negative) term $U''(E(I))$ will be larger in magnitude, and that as a consequence the producer will perceive (from a lower expected level of income) an unchanged level of income risk as "worse".

In summary, it can be seen that there are four components to the overall impact of introducing imports on a producer's perception of income risk. Three of these are contained

in equation (13) and relate to direct effects of introducing imports on the variance of income, while the fourth is contained in equation (14) and relates to the indirect effect of the associated decline in expected income on the perception of a given level of income risk. Moreover, two of the components in equation (13) are negative, suggesting an improvement in the producer's perception of income risk, while the third component in this equation and the fourth relating to the indirect effect suggest a worsening in the perception of income risk. It follows that, as with the impact on the variance of income, a producer's overall perception of the impact of introducing imports on income risk is also analytically ambiguous.

Nevertheless, based on equations (13) and (14) it is possible to identify a range of factors which are likely to play a role in determining whether the producer's overall perception of income risk is worsened or improved with the introduction of imports:

- (i) the strength of the negative covariance between price and yield in the absence of imports ($\text{cov}(p_o, y_o)$). For a producer this strength will depend on the correlation between individual and aggregate production
- (ii) the domestic elasticity of demand for the product. This elasticity will determine the extent to which yield fluctuations in the absence of imports generate domestic price fluctuations, with a more elastic demand associated with less price variability ($\text{Var}_o(p)$)
- (iii) the level of world price variability ($\text{Var}(p_1)$). This level will determine the extent to which domestic price variability is reduced by the introduction of imports
- (iv) the relative level of the average domestic price in the absence of imports to the average world price. This level will determine the extent to which a producer's expected price decreases with the introduction of imports ($\bar{p}_o/\bar{p}_1$)

- (v) the level of yield variability associated with uncertain seasonal conditions ($\text{Var}(\theta)$). This factor, together with the expected yield determine the variance of yield ($\text{Var}(y)$)
- (vi) the impact of disease on expected yield ($\bar{y}_1/\bar{y}_0$). This factor will determine the extent to which both the producer's expected level and variance of yield declines with the introduction of imports ($\text{Var}(y_1)/\text{Var}(y_0)$)
- (vii) the producer's attitude to risk ($U''(E(I))$). This factor, as explained previously, will govern the extent to which the anticipated decline in expected income associated with the introduction of imports affects the producer's perception of income risk.

The next section reports the findings of a numerical analysis of the model developed in this section, including an evaluation of the role of these seven factors in determining whether a producer's perception of income risk is improved or worsened with the introduction of imports.

SECTION 2: Numerical Analysis

In order to undertake a numerical analysis of the model developed in Section 1 it is necessary to specify a particular form for the producer's utility function as well as values for the parameters of the model. In what follows use is made of the constant relative risk aversion form of utility function referred to in the previous section:

$$U(I) = \frac{I^{1-R}}{1-R} \quad (16)$$

In addition, the following parameter values are assumed to represent a Base Case before the introduction of imports:

$$\begin{aligned} \bar{p}_o &= 10 \\ \sigma_{p_o} &= 3 \quad (\text{Var}(p_o) = 9) \\ \sigma_\theta &= 0.3 \quad (\text{Var}(\theta) = 0.09) \\ \bar{y}_o &= 100 \end{aligned}$$

Following the introduction of imports the Base Case values are assumed to be:

$$\begin{aligned} \bar{p}_1 &= 6.1 \\ \sigma_{p_1} &= 0 \\ \bar{y}_1 &= 100 \end{aligned}$$

Note that $\bar{p}_1$ has been specified at a level such that 90% of the probability distribution of p_o would exceed it. This assumption is subject to a sensitivity analysis in what follows, as are the assumptions of zero world price variability ($\sigma_{p_1} = 0$) and zero impact of disease on expected yield ($\bar{y}_1 = 100$). Other sensitivity analysis relates to the assumed values for σ_{p_o} and σ_θ .

Table 1 contains details of the Base Case results of producer perception of the impact of introducing imports on income risk for a range of attitudes to risk (R) and of correlation coefficients between price and yield in the absence of imports.¹¹ Note that the value of this coefficient is based on the specification:¹²

$$\text{Cov}(p_o, y_o) = \rho \sigma_{p_o} \sigma_{\theta} \bar{y}_o \quad (17)$$

In addition a perception index of improvement or worsening of income risk is specified as follows:

$$\frac{U(E_o(I)) - U(E_1(I))}{E_o(U(I_o)) - E_1(U(I_1))} \begin{matrix} > \\ < \end{matrix} 1 \quad (18)$$

This specification is derived by combining and rearranging equation (14) for the pre- and post- import situations.¹³

The results in Columns (3) and (4) of Table 1 show that, in general terms, a producer is more likely to view the impact of introducing imports on income risk as an improvement the smaller the magnitude both of the (negative) correlation coefficient (ρ) and of the producer's risk aversion coefficient (R). The first of these findings can be explained by reference to the diminished role of the negative covariance as a pre-import stabiliser of income for lower values of ρ . Consequently, the reduction in income risk associated with imports is more powerful for smaller ρ as shown by the results in column (2) of Table (1). Moreover, the second finding is explained by the indirect impact of reduced expected income (see column (1)) on the perception of income risk (the $U''(E(I))$ term in equation (14)). In particular, the increase in magnitude of $U''(E(I))$ caused by the decline in $E(I)$ is smaller for a less risk averse producer. This means that a given decline in $E(I)$ and $\text{Var}(I)$ is more likely to be perceived as representing an improvement in income risk by a less risk averse producer. Finally in relation to Table 1, it should be noted that for all values of ρ between -0.57 and

-0.81 for $R = 0.8$, and between -0.37 and -0.81 for $R = 1.6$, the producer's perception of income risk is that it has worsened with the introduction of imports, despite the fact that:

$$\text{Var}_1(I) < \text{Var}_0(I) \quad (19)$$

for all these values of ρ .¹⁴

Consider now a sensitivity analysis of the Base Case assumptions with a view to further evaluating the role of the factors outlined at the end of Section 1. Table 2 contains details of the results for a more elastic domestic demand as represented by a smaller level of pre-import price variability ($\sigma_{p_0} = 2$ rather than 3). A comparison of column (2) in Table 1 with column (1) in Table 2 shows that this change results in a weaker tendency for the introduction of imports to reduce the variance of income. In particular, for a producer with a value of $R = 0.8$ and a value of $\rho = -0.5$, the introduction of imports in this situation is perceived as worsening income risk whereas it was perceived as improving income risk for the situation of less elastic demand in Table 1. Moreover, Table 2 shows that, compared with Table 1, for producers with either level of risk aversion there is a smaller range of values of ρ for which a decrease in the variance of income is perceived as an improvement in income risk.

Next consider a situation of greater seasonal variability (σ_0). Table 3 contains details of results for a value of $\sigma_0 = 0.5$ (Base Case: $\sigma_0 = 0.3$). A comparison of the results in Tables 2 and 3 shows that the impact of greater seasonal variability is similar to that of a more elastic demand. In both cases the change results in a weaker tendency for the introduction of imports to reduce the variance of income. As a consequence, in Table 3 there is for both levels of risk aversion a smaller range of values of ρ for which a decrease in the variance of income is perceived as an improvement in income risk. The essential difference between the two cases is that, whereas for a more elastic demand there is a smaller absolute gain in terms of reduced

price variability, for greater seasonal variability there is a smaller gain in reduced price variability relative to total income variability.

Table 4 contains details of the results of a sensitivity analysis of the impact of import-induced disease on expected yield. The Base Case assumed that the introduction of imports had a zero impact on expected yield ($\bar{y}_1 = 100$). The results in Table 4 are based on an assumption that disease introduced by imports causes a 15% decrease in expected yield ($\bar{y}_1 = 85$).¹⁵ Compared with columns (1) and (2) in Table 1, columns (1) and (2) of Table 4 show a more powerful impact of imports both on expected income and the variance of income. The first of these impacts strengthens the negative perception of the impact of imports on income risk (via $U''(E(I))$) while the second strengthens the positive perception by directly reducing the variance of income. As a consequence, there is to a large extent a neutralising of these conflicting effects, and the general pattern of results in columns (3) and (4) of Table 4 is similar to that for Table 1. More specifically, there is no change in the range of values of ρ for which a producer with $R = 0.8$ perceives the impact of imports on income risk to be favourable ($\rho \leq -0.57$), while there is a small reduction in this range for $R = 1.6$ suggesting a dominance of the indirect effect on $U''(E(I))$ in this case. But perhaps more significantly, the results of this sensitivity analysis suggest that an absence of precise information about the likely impact on expected yield of disease associated with introducing imports is unlikely to affect significantly the extent to which producers perceive imports as improving or worsening income risk. This finding contrasts powerfully with the significance of this information in determining the impact on expected income.

Table 5 contains details of the results of a sensitivity analysis of the assumed level of world price variability ($\text{Var}(p_1)$). The Base Case assumes zero world price variability whereas the

results in Table 5 are based on a coefficient of world price variation of 10% ($\sigma_{p_1} = 1$). The results in this table are very similar to those in Table 2 and reflect a similar situation of a smaller absolute reduction in income variability attributable to a reduction in price variability. It follows that the more variable is the world price of the product in question the less likely a producer is to perceive the introduction of imports as improving income risk.

Finally, Table 6 contains details of the results of a sensitivity analysis of the assumed expected level of world price. Whereas the Base Case featured an expected world price which 90% of domestic prices (in the absence of imports) would exceed, the results in Table 6 are based on an expected world price ($\bar{p}_1 = 7.48$) which only 80% of domestic prices would exceed (in the absence of imports). A comparison of columns (1) and (2) in Tables 4 and 6 shows that this change has the opposite impact on the expected level and variability of income with imports to that of a reduction in expected yield associated with disease. As a consequence, conflicting impacts are once again created on the producer's perception of income risk. But unlike the results in Table 4, the results in Table 6 show a clear distinction from those in Table 1 at both levels of producer risk aversion. In particular, the range of values of ρ for which an improvement in income risk is perceived decreases for both types of producers. Therefore, this finding suggests that the lower is the expected world price relative to the expected domestic price in the absence of imports, the more likely it is that producers will perceive an improvement in income risk with the introduction of imports.

CONCLUSION

The aim of this paper has been to develop understanding of the impact of removing quarantine restrictions on the income risk of domestic producers. In so doing it is intended that the existing distinction between "economic assessment" and "risk assessment" in the analysis of quarantine policy be diminished.

Section 1 developed a model of the impact of removing import restrictions on a producer's perception of income risk. This model development identified four separate effects of the introduction of imports on the perceived income risk of domestic producers, as well as a range of factors which influence the magnitude of the various effects. Section 2 undertook a numerical analysis of the model developed in Section 1 and evaluated the role of each of the factors identified as influencing the producer's perception of the impact of imports on income risk.

On the basis of this numerical analysis the following conclusions have been reached. In particular, a producer is more likely to perceive the introduction of imports as improving income risk:

- (i) the weaker is the negative correlation between the producer's price and yield in the absence of imports
- (ii) the less risk averse is the producer
- (iii) the less elastic is the domestic demand for the product in question
- (iv) the lower is the producer's level of seasonal variability
- (v) the lower is the level of world price variability of the product in question
- (vi) the lower is the level of expected world price relative to the expected domestic price in the absence of imports of the product in question.

Finally, the numerical analysis showed that, in contrast to its significance in determining the impact on expected income, information about the impact on expected yield of disease associated with introducing imports is unlikely to affect significantly the extent to which producers perceive the introduction of imports as improving or worsening income risk.

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FOOTNOTES

- ¹ See also Tanner (1997) and Tanner and Nunn (1998).
- ² Although, like Hafi et al (1994), James and Anderson (1998) acknowledge the role of the probability of a disease outbreak (pp431-2) as a form of risk.
- ³ Such economic analyses are reminiscent of the "hidden gains and losses" literature in Australia relating to the use of price stabilisation policies in the Australian wool industry (e.g. Campbell, Gardiner and Hazler, 1980), where the focus on producer and consumer analysis overlooked the essential point that a price stabilisation policy is ostensibly a device for reducing the income risk of producers (Newbery and Stiglitz, 1981).
- ⁴ The (favourable) risk implications for consumers are fairly straightforward. In particular, the introduction of imports is likely to stabilise both the domestic price and quantity available of the product in question, with imports making up for any shortfall of domestic production due to disease or seasonal conditions.
- ⁵ See Mood, Graybill and Boes (1974, p180).
- ⁶ See Newbery and Stiglitz (1981, p65).
- ⁷ See James and Anderson (1998).
- ⁸ This specification is based on the assumption that domestic production is unrelated to world production. This assumption seems reasonable where world production is very large relative to domestic production.
- ⁹ See Newbery and Stiglitz (1981, p90).
- ¹⁰ See Pope and Just (1991).
- ¹¹ See Newbery and Stiglitz (1981, p105) for details of empirical evidence to support these values of R.
- ¹² See Mood, Graybill and Boes (1974, p154).

- ¹³ More generally, an improvement or a worsening of income risk is characterised by:
- $$U''(E_1(I)) \cdot \text{Var}_1(I) \begin{matrix} > \\ < \end{matrix} U''(E_o(I)) \cdot \text{Var}_o(I)$$
- where it should be recalled that the second term on the right-hand-side of equation (14) is negative.
- ¹⁴ Note that for values of ρ nearer to -1 the role of the negative covariance as an income stabiliser becomes dominant, and so its removal with imports results in increased income variability (see equation (13)).
- ¹⁵ See Hafi et al (1994).

Table 1

Base Case Results of the Perception of the
Impact of Introducing Imports on
Income Risk

	Perception Index ^b			
	(1)	(2)	(3)	(4)
	$E_1(I)/E_0(I)$	$Var_1(I)/Var_0(I)$ ^a	$R = 0.8$ ^c	$R = 1.6$ ^d
Correlation Coefficient (ρ)				
-0.25	0.62	0.25	1.06	1.03
-0.5	0.64	0.37	1.02	0.97
-0.75	0.65	0.74	0.97	0.90

Notes: a: $Var_1(I)/Var_0(I) = 1$ for $\rho = -0.81$

b: Perception of Improvement: > 1
Perception of Worsening: < 1

c: No change in perception: $\rho = -0.57$

d: No change in perception: $\rho = -0.37$

Table 2

Perception of the Impact of Introducing

Imports on Income Risk:

More Elastic Demand^a

	Perception Index		
	(1)	(2)	(3)
	$\text{Var}_1(I) / \text{Var}_0(I)$ ^b	$R = 0.8$ ^c	$R = 1.6$ ^d
Correlation Coefficient (ρ)			
-0.25	0.49	1.03	0.99
-0.5	0.70	0.98	0.92
-0.75	1.23	0.94	0.85

Notes: a: $\sigma_{p_0} = 2$ (Base Case: $\sigma_{p_0} = 3$)b: $\text{Var}_1(I) / \text{Var}_0(I) = 1$ for $\rho = -0.67$ c: No change in perception: $\rho = -0.39$ d: No change in perception: $\rho = -0.20$

Table 3

Perception of the Impact of Introducing

Imports on Income Risk:

Greater Seasonal Variability^a

	Perception Index		
	(1)	(2)	(3)
	$\text{Var}_1(I) / \text{Var}_0(I)$ ^b	$R = 0.8$ ^c	$R = 1.6$ ^d
Correlation Coefficient (ρ)			
-0.25	0.35	1.06	0.94
-0.5	0.49	0.99	0.86
-0.75	0.81	0.91	0.76

Notes: a: $\sigma_\theta = 0.5$ (Base Case: $\sigma_\theta = 0.3$)b: $\text{Var}_1(I)/\text{Var}_0(I) = 1$ for $\rho = -0.82$ c: No change in perception: $\rho = -0.47$ d: No change in perception: $\rho = -0.02$

Table 4

Perception of the Impact of Introducing

Imports on Income Risk:

Disease Reduces Expected Yield^a

	Perception Index			
	(1)	(2)	(3)	(4)
	$E_1(I)/E_o(I)$	$Var_1(I)/Var_o(I)$ ^b	$R = 0.8$ ^c	$R = 1.6$ ^d
Correlation Coefficient (ρ)				
-0.25	0.53	0.18	1.04	1.01
-0.5	0.54	0.27	1.01	0.97
-0.75	0.56	0.54	0.98	0.92

Notes: a: $\bar{y}_1 = 85$ (Base Case: $\bar{y}_1 = \bar{y}_o = 100$)

b: $Var_1(I)/Var_o(I) = 1$ for $\rho = -0.87$

c: No change in perception: $\rho = -0.57$

d: No change in perception: $\rho = -0.29$

Table 5

Perception of the Impact of Introducing

Imports on Income Risk:

Greater World Price Variability^a

	Perception Index		
	(1)	(2)	(3)
	$\text{Var}_1(I) / \text{Var}_0(I)$ ^b	$R = 0.8$ ^c	$R = 1.6$ ^d
Correlation Coefficient (ρ)			
-0.25	0.32	1.03	0.98
-0.5	0.48	0.99	0.92
-0.75	0.97	0.95	0.86

Notes: a: $\text{Var}(p_1) = 1$ (Base Case: $\text{Var}(p_1) = 0$)

b: $\text{Var}_1(I) / \text{Var}_0(I) = 1$ for $\rho = -0.76$

c: No change in perception: $\rho = -0.46$

d: No change in perception: $\rho = -0.16$

Table 6

Perception of the Impact of Introducing

Imports on Income Risk:

Higher Average World Price^a

	Perception Index			
	(1)	(2)	(3)	(4)
	$E_1(I)/E_0(I)$	$Var_1(I)/Var_0(I)$ ^b	$R = 0.8$ ^c	$R = 1.6$ ^d
Correlation Coefficient (ρ)				
-0.25	0.77	0.45	1.06	1.04
-0.5	0.78	0.67	0.99	0.93
-0.75	0.80	1.34	0.91	0.80

Notes: a: $\bar{p}_1 = 7.48$ (Base Case: $\bar{p}_1 = 6.1$)b: $Var_1(I)/Var_0(I) = 1$ for $\rho = -0.67$ c: No change in perception: $\rho = -0.48$ d: No change in perception: $\rho = -0.34$