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Optimal Restructuring Under a Political Constraint

A General Equilibrium Approach

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A General Equilibrium Approach*

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ABSTRACT
This paper considers the generalized second-best analytics of optimal restructuring under a political constraint, building on the modelling approach in Dehejia (1997). It is shown that the second-best optimum entails administering the terms of trade shock fully at the initiation of the reform, just as in shock therapy, but that this must be supplemented with interventions in domestic factor markets. The effects of these interventions are to speed up the exit of the politically affected factor, labour, and of retarding the exit of the other factor, capital, both of which serve to prop up the wages of workers in the declining sector and hence address the political constraint. The results are in the spirit of the neoclassical theory of distortions and welfare: the optimal intervention targets the affected margin directly, in consonance with the "targetting" principle of Bhagwati-Ramaswami-Johnson.

1 Introduction

One of the key issues in the new field of transition economics concerns the appropriate speed at which restructuring should take place. A related question concerns the appropriate speed at which policy reform itself should take place; this latter question is sometimes couched in terms of the choice between "shock therapy" and "gradualism".[1]

In another paper (Dehejia, 1997), I examine the second question in the context of a neoclassical model of adjustment and an explicit model of policy formation.[2] In such a model, it is known that the first-best optimum is shock therapy.[3] The chief finding of that paper is that, when the (preferred) shock therapy reform is politically infeasible, it is possible to construct a gradualist alternative.

The goal there being to demonstrate the *existence* of a gradualist alternative when shock therapy is unavailable, the paper does not consider what is in some ways a logically prior question: if shock therapy is infeasible, what is the second-best optimum reform policy? This in turn will determine the optimal speed of restructuring. This latter question is the one addressed in the present paper.[4]

2 The Central Planner's Problem

Consider first the policymaker's problem. We shall treat it in the first instance in the central planner's version, and consider later the appropriate way in which this solution may be decentralized.

The policymaker's objective function is assumed to be the maximization of the present discounted value of the economy's output streams, valued at world prices. The economy produces and consumes two (tradeable) goods, X

[1] For a discussion of the issues and related literature, see Dehejia (1996).

[2] The political economy model is based on an agenda-setting policymaker and majoritarian voting by a legislature, which must ratify the policymaker's choice, as against the alternative of the *status quo*.

[3] This result, sometimes known as the "Mussa proposition", is nothing other than an implication of the fundamental welfare theorems.

[4] Needless to say, we must rule out costless lump sum transfers, or equivalent mechanisms (for example, a uniform *ad valorem* consumption tax, which is non-distorting when factors are in fixed supply, as in this model), for the second-best problem to be interesting and non-trivial.

and Y. We suppose that the economy is small in the Samuelsonian sense, so that it takes the world relative price as given; assume that this price is constant, and normalize it to unity by an appropriate choice of units. The goods X and Y are produced using neoclassical production functions $F(L_X, K_X)$ and $G(L_Y, K_Y)$, respectively, where L_i and K_i denote the amounts of labour and capital employed in sector $i = X, Y$. We suppose that the total stocks of labour and capital are $\overline{L}$ and $\overline{K}$, respectively. It is assumed that capital is costlessly mobile between sectors. However, labour movement is subject to quadratic costs of adjustment, these costs assumed to require the use of part of the economy's mobile capital stock. The adjustment costs may be viewed as retraining or relocation costs for workers transiting between sectors.[5]

It is supposed as well that the policy reform in question is a tariff removal, in the context of an economy that is labour-abundant. Suppose without loss of generality that good X is labour-intensive. It follows that all workers are long-run beneficiaries of reform (by the Stolper-Samuelson theorem), but that Y-workers are short-run losers, while capitalists are almost certainly losers.[6]

So far, this is a description of a standard model à la Mussa (1978). The twist here is that the policymaker's optimization problem is subject to a political constraint, which requires that the present discounted value of the stream of wages of Y-workers be at least as great as their lifetime income under the *status quo* of no reform (equal to the annuitized value of the steady state wage obtaining in the *status quo*). This political constraint can be rationalized as the political equilibrium of an explicit model of policy formation with majority voting, exactly as in Dehejia (1997), or may be thought of simply as a "non-economic" objective, as in the neoclassical theory of commercial policy.

The policymaker's problem, therefore, is given by:

[5] "Labour" and "capital" in this model may be viewed as metaphors for those factors of production which are subject to costs of adjustment and those which are (relatively) mobile, respectively. Thus, for instance, "labour" might include sector-specific capital, and "capital" might include general labour which can switch easily between sectors. What is important for the model is not the nomenclature, but the assumption that some factors bear costs of adjustment, others not.

[6] The caveat "almost" derives from the "neoclassical ambiguity", which suggests that capitalists, while long-run losers, may be short-run winners if their consumption pattern is biased heavily towards the importable good, whose price has fallen. The net effect is therefore ambiguous in principle.

$$\max_{\{K_X(t),K_Y(t),I_X(t)\}} \int_0^\infty [F(L_X(t), K_X(t) + G(L_Y(t), K_Y(t))]e^{-rt}dt$$

$$\begin{aligned}
s.t. L_X(t) + L_Y(t) &= \overline{L} \\
K_X(t) + K_Y(t) + K_I(t) &= \overline{K} \\
K_I(t) &= \frac{1}{2}\beta I_X^2(t) \\
\dot{L}_X(t) &= I_X(t) \\
\Lambda(0) &\equiv \int_0^\infty \frac{\partial G(\cdot)}{\partial L_Y} e^{-rt}dt \geq \phi \\
& L_X(0) given
\end{aligned}$$

In the statement of the problem, $r > 0$ is the constant rate of time preference, $\beta > 0$ is a scalar multiplying the quadratic adjustment cost function, and $\phi \equiv (w_0/r)$ is the *status quo* lifetime income level, where w_0 denotes the constant wage rate consistent with the initial equilibrium at time 0.

The problem may be solved by writing down the (current-value) Hamiltonian H_0, where henceforth time arguments will be suppressed for brevity:

$$H_0 = [F(L_X, K_X) + G(\overline{L} - L_X, K_Y)] + \gamma(\overline{K} - K_X - K_Y - \frac{1}{2}\beta I_X^2)$$

$$+\lambda I_X + \mu(qe^{-rt} - \phi) + \nu(rq + G_L(\overline{L} - L_X, K_Y))$$

where a subscript to a function denotes a partial derivative, γ and μ are Lagrange multipliers, λ and ν are (current-value) costate variables corresponding to state variables L_X and q, respectively, and q has been introduced as an additional state variable to incoporate the political constraint.

The first-order conditions for an optimum are given by:

$$\frac{\partial H_0}{\partial K_X} = F_K - \gamma = 0 \tag{1}$$

$$\frac{\partial H_0}{\partial K_Y} = G_K - \gamma + \nu G_{LK} = 0 \tag{2}$$

$$\frac{\partial H_0}{\partial I_X} = -\gamma\beta I_X + \lambda = 0 \tag{3}$$

$$\frac{\partial H_0}{\partial L_X} = F_L - G_L - \nu G_{LL} = -\dot{\lambda} + r\lambda \tag{4}$$

$$\frac{\partial H_0}{\partial q} = \mu e^{-rt} + \nu r = -\dot{\nu} + r\nu \tag{5}$$

There are also transversality conditions, given by:

$$\lim_{t \to \infty} \lambda(t) L_X(t) e^{-rt} = 0 \tag{6}$$

$$\lim_{t \to \infty} \nu(t) q(t) e^{-rt} = 0 \tag{7}$$

and a complementary slackness condition on the political constraint,[7]

$$\frac{\partial H_0}{\partial \mu} \mu = 0 \tag{8}$$

Eq. (5) can be integrated to yield:

$$\nu = \frac{\mu}{r} \tag{9}$$

which can be used to eliminate ν altogether. The relationship is intuitive, since it says that the shadow value of the state variable q representing the political constraint is just equal to the annuitized value of the Lagrange multiplier on the constraint itself. Eqs. (1) - (4) can be rewritten, using Eq. (9), as:

$$F_K = G_K + \frac{\mu}{r} G_{LK} = \gamma \tag{10}$$

$$I_X = \frac{1}{\beta\gamma} \lambda \tag{11}$$

$$\dot{\lambda} = r\lambda - [F_L - G_L - \frac{\mu}{r} G_{LL}] \tag{12}$$

If the constraint is not binding, so that $\Lambda(0) > \phi$, and $\mu = 0$, the model reduces to the standard case. Then, we know that shock therapy is the first-best optimum, since the decentralized equilibrium will replicate the central planner's optimum.[8] If the constraint is binding, so that $\Lambda(0) = \phi$, then $\mu > 0$, and it follows that the decentralized equilibrium is not efficient.

[7] The constraint on the capital stock is always binding, so that $\gamma > 0$ always holds.

[8] For details, see Dehejia (1997), esp. Appendix A.2.

Characterizing the nature of the optimal solution, and an appropriate decentralization, will be the next task.

The first question, of course, is determining when the constraint binds and when it does not. Analytically, this is an onerous task, because it involves computing the integral which defines $\Lambda(0)$ for all feasible paths consistent with Eqs. (10) - (12), and determining the functional dependence on μ and the underlying parameters. This is impractical, because a closed form solution for $\Lambda(0)$ under such general conditions is not available.

However, intuitively, it is easy to see that $\Lambda(0)$ depends negatively on β, a parameter of considerable interest in this context. As $\beta \to \infty$, the model approaches the Ricardo-Viner-Jones (RVJ) model, and, as $\beta \to 0$, it approaches the Heckscher-Ohlin-Samuelson (HOS) model. We know what $\Lambda(0)$ is under both extremes. In either case, as there are no dynamics, it is given by (w^*/r), where w^* is the new equilibrium wage for Y-workers after the policy change. By the "magnification effect", we know that $w^* > w_0$ for a labour-abundant country engaging in trade policy reform, in the HOS case, whereas $w^* < w_0$ will obtain in the RVJ case for a similarly endowed economy. Thus, $\Lambda(0) - \phi$ is positive for $\beta = 0$ and is negative as $\beta \to \infty$. By appealing to continuity and monotonicity, there presumably exists a finite, positive value of β, say β^*, at which $\Lambda(0) = \phi$. For economies characterized by $\beta > \beta^*$, the constraint is binding, whereas it is not binding for economies with $\beta \leq \beta^*$. For each value of $\beta > \beta^*$, there presumably exists an associated value of μ which will make the constraint just bind. Thus, in principle, one can find a function $\mu(\beta)$ such that $\mu = 0 \forall \beta \leq \beta^*$ and $\mu = \mu(\beta) > 0$ otherwise. One might conjecture that this function is monotonic, but that is not necessary for our purposes.

While it is difficult to establish this result analytically, it is easy to demonstrate its validity numerically. Consider Figure 1, which depicts a simulation of the model assuming Cobb-Douglas technology (details on the parameterization are contained in the Appendix). It is evident that $\Lambda - \phi$ behaves exactly as hypothesized. In addition, Figure 2 depicts $\Lambda - \phi$ as a function of μ, for a specific value of β slightly greater than β^*, and Figure 7 does this for a value of β that is higher still. In both cases, $\Lambda - \phi$ increases in μ, as one would expect, and is, indeed, monotonic. Thus, for a specific parameterization of the model, one can immediately determine the critical value, β^*, and find the value of μ necessary to ensure that the constraint just binds, for any value of β higher than the critical level. (Recall that one would simply set $\mu = 0$ in those cases in which the constraint is slack.)

Let us suppose, then, that we are considering an economy for which the political constraint binds, and that μ has accordingly been determined. With μ fixed, Eqs. (10) - (12) constitute a system of three equations in three variables. Eq. (10) is not dynamic; rather, it characterizes the momentary equilibrium in the capital market. Eqs. (11) and (12) constitute a system of ordinary differential equations which, along with Eq. (10), determine the optimal trajectories of the control and state variables.

Steady state is characterized by $\dot{\lambda} = 0$ and $I_X = 0$, which in turn imply that $\lambda^* = 0$ and $K_I^* = 0$ (where stars denote steady state values). These imply the following steady state conditions:

$$F_K^* = G_K^* + \frac{\mu}{r} G_{LK}^* = \gamma^* \quad (13)$$

$$F_L^* = G_L^* + \frac{\mu}{r} G_{LL}^* = w^* \quad (14)$$

where γ^* and w^* denote the steady state return to capital and labour, respectively.Eqs. (12) and (13) implicitly determine the steady state split of the capital stock and labour force, since they are two equations in two unknowns (recalling that $K_I^* = 0$).

Qualitative dynamics may be examined by constructing a phase diagram, as in Figure 0. There, L_X^* denotes the steady state level of employment in sector X. The $I_X = 0$ locus is the horizontal axis, and the $\dot{\lambda} = 0$ locus is downward-sloping in the (λ, L_X) plane. As is customary in such models, the equilibrium is a saddle point, with the stable arm (the saddle path), denoted by SS in the figure, also downward-sloping but flatter than the $\dot{\lambda} = 0$ locus.[9]

What conclusions emerge from this analysis? It is perhaps most useful to contrast the equilibium behaviour of the system with the situation in which the political constraint is absent, which is formally equivalent to setting μ equal to zero wherever it appears. The first thing to notice is that the political constraint alters the steady state of the economy. This is apparent from examining Eqs. (12) and (13). Without a political constraint, the returns to capital and labour are equalized across sectors in the steady state (in fact, the return to capital is always equalized). This is no longer the case. In particular, since $G_{LK} > 0$ for a neoclassical production function, it

[9]Technically, it is sufficient to assume that $(\mu/r)G_{LLL}$, if positive,is small in magnitude, to ensure that the equilibrium behaves locally as a saddle point, with the properties described.

follows that $F_K^* > G_X^*$, that is, the marginal product of capital is higher in sector X than in sector Y. Furthermore, this is true everywhere along the transitional path as well, from Eq.(10). Similarly, since $G_{LL} < 0$ (diminishing returns), it follows that $F_L^* < G_L^*$, that is, the marginal product of labour is lower in sector X than in sector Y. What does this imply about the steady state allocations of labour and capital? The partial equilibrium intuition that a higher marginal product implies a smaller share, while valid in an RVJ context, is not valid in an HOS context, which characterizes the steady state of the model. In fact, numerical simulations (see Figures 3-4 and 8-9, for low and high values of β, respectively) reveal that, under the political constraint, the steady state allocations of the labour force and capital stock are *both* biased toward sector X, the exportable.

It is noteworthy that that the steady state allocations differ in the politically contrained optimum: the presence of the political constraint permanently alters the structure of production of the economy. Or, to put it another way, solving the political economy problem entails creating a byproduct distortion, since the economy does not wind up at the efficient production point in steady state. The model is characterized by a sort of "second-best optimal overshooting", whereby the allocations of labour and capital to the exportable sector exceed and permanently remain above the corresponding allocations in the politically unconstrained situation.[10]

What about the transitional dynamics? As mentioned, the marginal product of capital in sector X is always lower than in the absence of the political constraint. Furthermore, the $\dot{\lambda} = 0$ and therefore the SS loci are clearly steeper (which is obvious from inspection of Eq. (12)), which implies that λ is higher everywhere along the equilibrium trajectory than in the absence of the constraint. This is verified numerically in Figures 5 and 10, for low and high values of β, respectively.[11]

As for the optimal speed of restructuring, the presence of the political constraint has no *direct* effect on it, since Eq. (11) is identical to the corresponding equation in the standard model (because μ does not appear in it). However, in general equilibrium, the speed of restructuring will differ in the presence of the political constraint, due to two different effects. The first effect is that, from Eq (10), the equilibrium value of γ is higher; this will tend

[10]One might dub this a "political hysteresis" result.

[11]In the low β case (Figure 5), the trajectories of λ under the two scenarios are almost indistinguishable visually, but in fact λ is everywhere higher under the political constraint. In the high β case (Figure 10), it is clearly discernable.

to diminish the speed of restructuring, *cet. par.* The second effect is that λ is higher; this will lead to more rapid restructuring, *cet. par.* Therefore, one cannot say *a priori* whether restructuring is more or less rapid under the political constraint than in its absence. Numerical simulations reveal that these effects appear to wash out: consider Figures 3-4 and 8-9, for the time paths of L_X and K_X, and Figures 6 and 11, for the time path of G_L (the instantaneous wage in the Y-sector), in the low and high β cases, respectively.

As regards the total length of time that the adjustment takes, it depends on whether restructuring is more or less rapid. If it is less rapid, so that the first effect dominates, than adjustment will unambiguously take longer, since a slower adjustment speed will span a larger amount of restructuring (since the gap between the initial and steady state values of L_X and K_X is higher with the political consraint than without it, as established above in the simulations). If it more rapid, then one cannot say *a priori*,since adjustment will be more rapid, but there is more of it to be accomplished. Since, in the numerical simulations, the adjustment speed is unaffected, restructuring will unambiguously take longer when the political constraint needs to be reckoned with than in its absence.

What is the intuition behind these results? Recall the nature of the politcal constraint: it requires that the lifetime income of Y-workers not fall as a result of the reform. If the constraint binds, it follows that the deviations from the decentralized solution are working to prop up wages of these workers in the initial stages of reform, when they are lower than in the initial equilibrium. There are evidently two ways to do this: encourage a more rapid movement of labour out of sector Y, so that the wages of those left behind will rebound more quickly; and discourage the movement of capital out of sector Y, so that, once again, the wages of those left behind are higher. The optimal intervention entails doing both of these things, as is evident from an inspection of Eqs. (10) and (12). Eq. (10) essentially says that the social marginal product (SMP) of capital must be equated between sectors. The SMP of capital in sector X is just the private marginal product (PMP), F_K, but the SMP in sector Y is the sum of the PMP, G_K, and the marginal social value of an increment to the capital stock, measured in terms of its effect on the political constraint; this is given by the product of the increase in the wage of Y-workers induced by an incremental amount of capital, G_{LK}, and the social marginal value of that wage increase, (μ/r).

The intuition behind Eq. (12) is analagous. It is a version of the fundamental equation of asset pricing, in which λ measures the difference between the asset values of "installed" workers in the two sectors. The equation requires that the "dividend" term measure the difference between the SMPs of labour between sectors, where the SMP in sector Y is the sum of the usual PMP, G_L, and the social marginal cost of an increment to the labour force in sector Y, which is the product of the reduction in wages due to diminishing returns, G_{LL}, and the social marginal cost of that reduction, (μ/r).

3 Decentralizing the Optimal Solution

How might the central planner's solution be decentralized? The direct method would be write down a series of individual optimization problems for the various agents in the model, and compare the market equilibrium conditions with the central planner's equilibrium conditions. However, since we know that the optimal solution in the absence of the political constraint, that is, with $\mu = 0$, coincides with the decentralized equilibrium, we can take a short-cut by examining directly the central planner's equilibrium conditions, Eqs. (10) - (12), and determining the optimal Pigovian taxes-cum-subsidies. Consider first Eq. (10). In the decentralized equilbrium, individual optimization and perfect competition will lead to a situation in which the PMPs of capital are equalized at every instant between sectors, since private agents have no reason to take into account the "political externality" that the policymaker is reckoning with. Evidently, the policymaker can replicate the optimal solution by selecting an optimal capital tax-cum-subsidy, which serves to tax capital in sector X or subsidize capital in sector Y, or an appropriate combination thereof. Similarly, the dividend component of the asset pricing equation, Eq. (12), considers only the difference between PMPs in the decentralized equilibrium. The policymaker can replicate the optimal solution by an optimal dividend tax-cum-subsidy, which serves to tax labour in sector Y or subsidize labour in sector X, or an appropriate combination thereof.[12]

Since μ does not appear in Eq. (11), it follows that there is no need for the policymaker to intervene in the retraining sector of the economy; the two interventions in the factor markets are a sufficient set of policy instruments to decentralize the politically-constrained social optimum.

[12]Since there are two interventions, which can each be implemented either as a tax or subsidy (recalling the Lerner equivalence theorem), the package of interventions can be designed to be revenue-neutral; we do *not* need to assume that they are financed through lump sum taxes.

4 Discussion

This paper has considered the nature of optimal restructuring under a political constraint and in a general equilibrium framework. The key result is that optimal intervention takes place through an intervention in domestic factor markets, and not in the retraining sector *per se*. The results are strongly reminiscent of the Bhagwati-Ramaswami-Johnson theorem (the "targetting" principle) of neoclassical commercial policy,[13] in that the optimal interventions target the source of the market failure (in this case, a "political market failure") directly. If the political constraint is to ensure that workers in the declining sector do not suffer a decline in their lifetime income, then then this is carried out through intervening in the capital and labour markets by means of appropriate Pigovian taxes-cum-subsidies. In particular, since the retraining sector is not in itself distorted, there is no reason to intervene directly there. In general equilibrium, however, intervention in the factor markets will affect the optimal speed of restructuring. Since there are two conflicting effects, it is impossible to say *a priori* whether the political constraint will speed up or slow down the pace of restructuring, nor is it possible to say whether the reform itself will take longer to accomplish. Numerical simulations reveal that the speed of restructuring appears to be unaffected, implying an unambiguously longer adjustment period (since there is a greater gap between the initial and eventual allocations of labour and capital to the exportable sector, with the political constraint than without it).[14]

Returning to the questions with which we began, it becomes clear that, while gradualism may be a feasible alternative to shock therapy when the latter is unavailable, it is clearly not the true second-best optimum. The second-best optimum entails administering "shock therapy" insofar as the tariff reform itself is concerned,[15] but then intervening with two distinct instruments in domestic factor markets to ensure that the political constraint it satisfied. This result is very much in the spirit of the neoclassical theory of distortions and welfare.

[13]See Bhagwati (1971) for a discussion of this and related propositions.

[14]Needless to say, these results are subject to the usual *caveat* of being model-dependent. One would need to determine the fit between the model's assumption and the characteristics of an actual reforming economy before using the model as a basis for policy advice.

[15]That is, the domestic terms of trade is set equal to the world terms of trade at time 0, by the instantaneous elimination of the tariff.

5 References

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6 Appendix

For the numerical simulations of the model, it is assumed that the production functions are of the Cobb-Douglas type:

$$\begin{aligned} F(L_X, K_X) &= L_X^{\alpha_1} K_X^{1-\alpha_1} \\ G(L_Y, K_Y) &= L_Y^{\alpha_2} K_Y^{1-\alpha_2} \end{aligned}$$

where it is supposed that $\alpha_1 = 0.55$ and $\alpha_2 = 0.45$ (so that X is labour-intensive, as assumed in the text). The normalization $\overline{L} = \overline{K} = 100$ is used. We suppose (as discussed in the text) that the world relative price of the importable is normalized to unity. It is assumed that the initial distorting *ad valorem* tariff is 0.5 per cent, so that the initial domestic relative price of the importable is 1.005. These values imply that the initial steady state allocations are given by: $L_X(0) = 42.34$ and $K_X(0) = 32.96$. Under the assumption that the political constraint is absent or not binding (corresponding to $\mu = 0$), the final steady state values are given by: $L_X^* = 55$ and $K_X^* = 45$. It is supposed that the pure rate of time preference is given by $r = 0.01$.

Under these assumptions, β^* is approximately 2878 (see Figure 1). The low and high values of β that are subsequently used are 3000 and 30,000 (in both cases, the political constraint binds). In the $\beta = 3000$ case, the optimal μ, μ^*, is slightly less than 0.0002 (see Figure 2): the value 0.0002 is used in the subsequent Figures (3 - 6). In the $\beta = 30,000$ case, μ^* is slighly less than 0.0056 (see Figure 7): the value 0.0056 is used in the subsequent Figures (8 - 11).

Details on the numerical simulation procedure, and a copy of the codes that were used, along with accompanying explanatory text, are available from the author upon request.

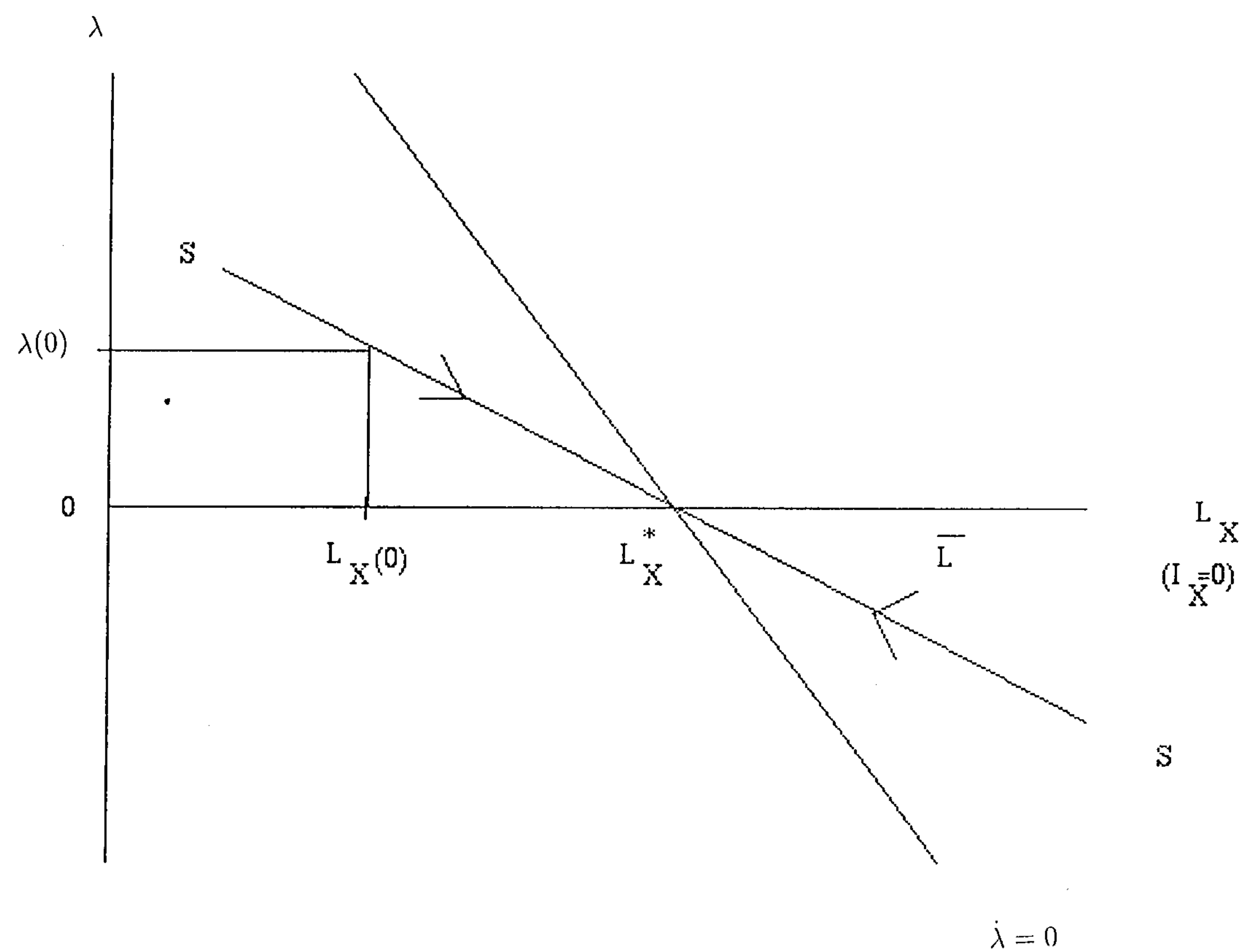
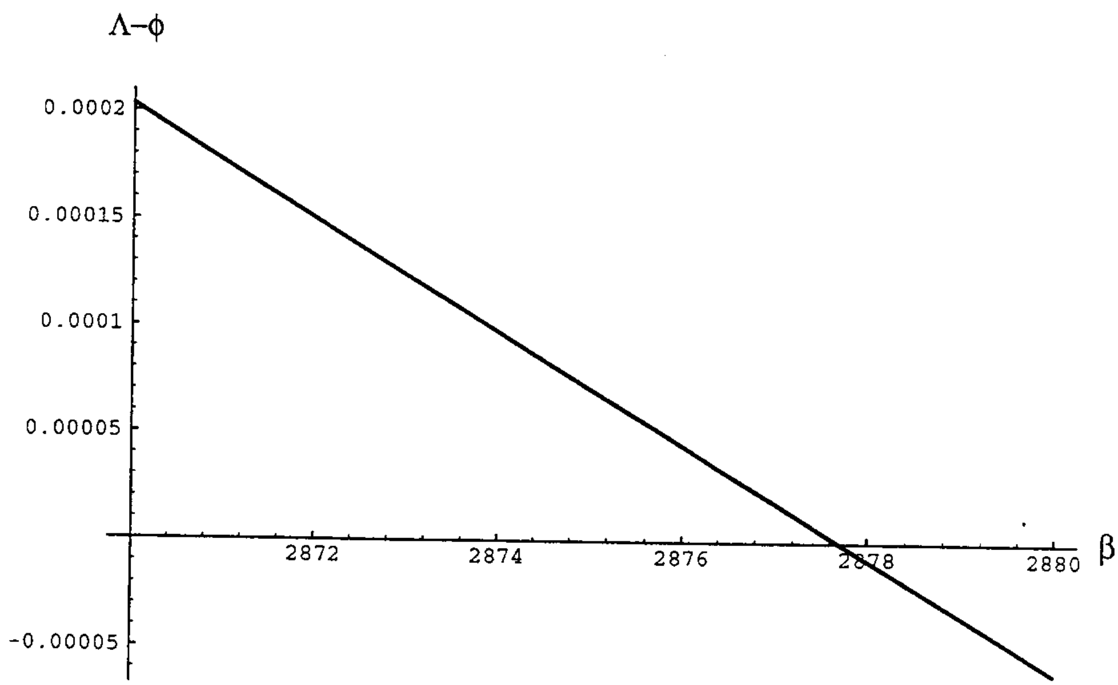


Figure 0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2874
2876
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2880
β

Figure 1:

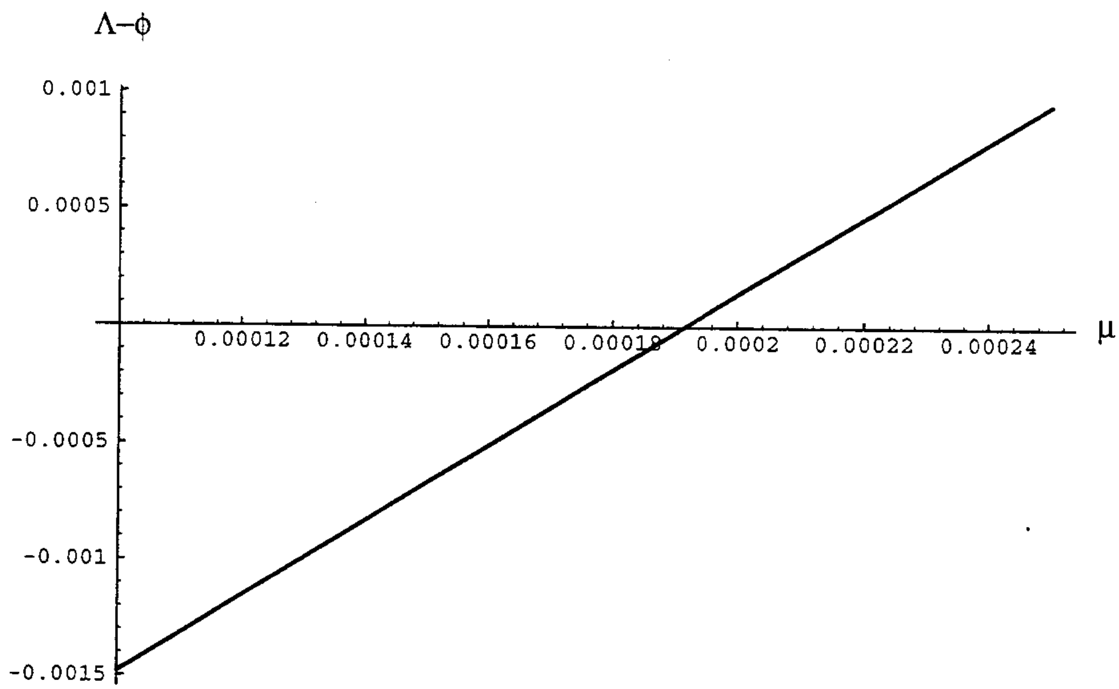

Figure 2: ($\beta = 3,000$)

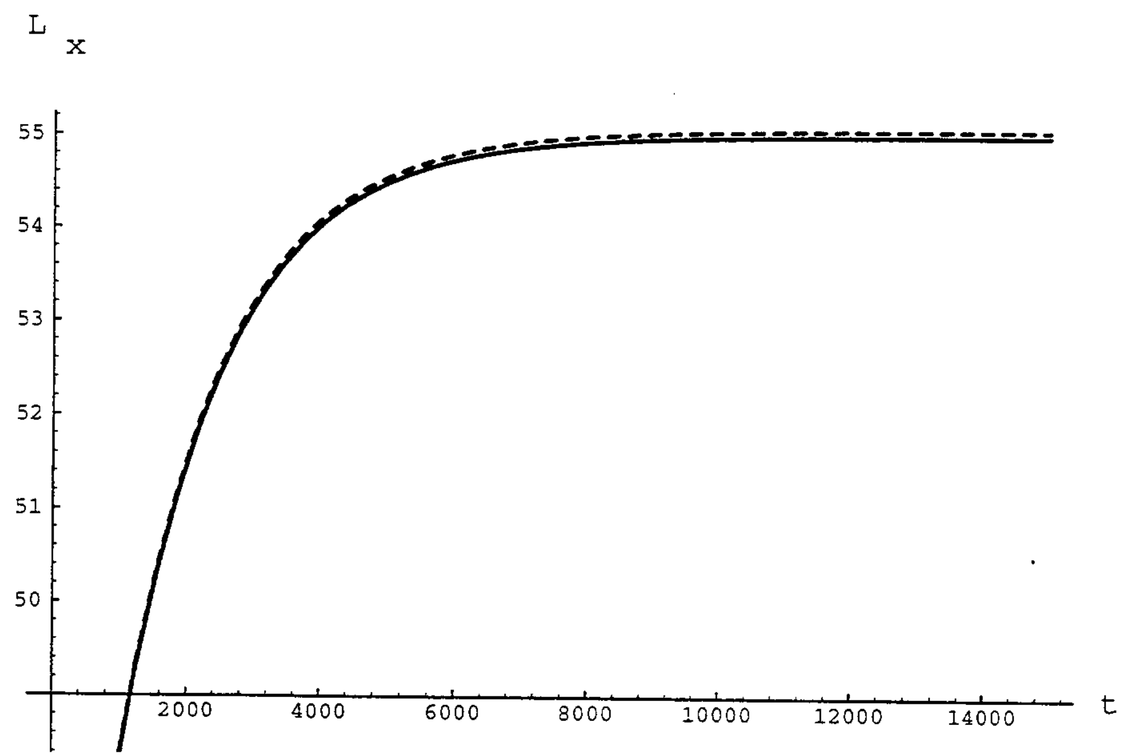

Figure 3: ($\beta = 3,000$) ($\mu = 0$: solid) ($\mu = 0.0002$: dashed)

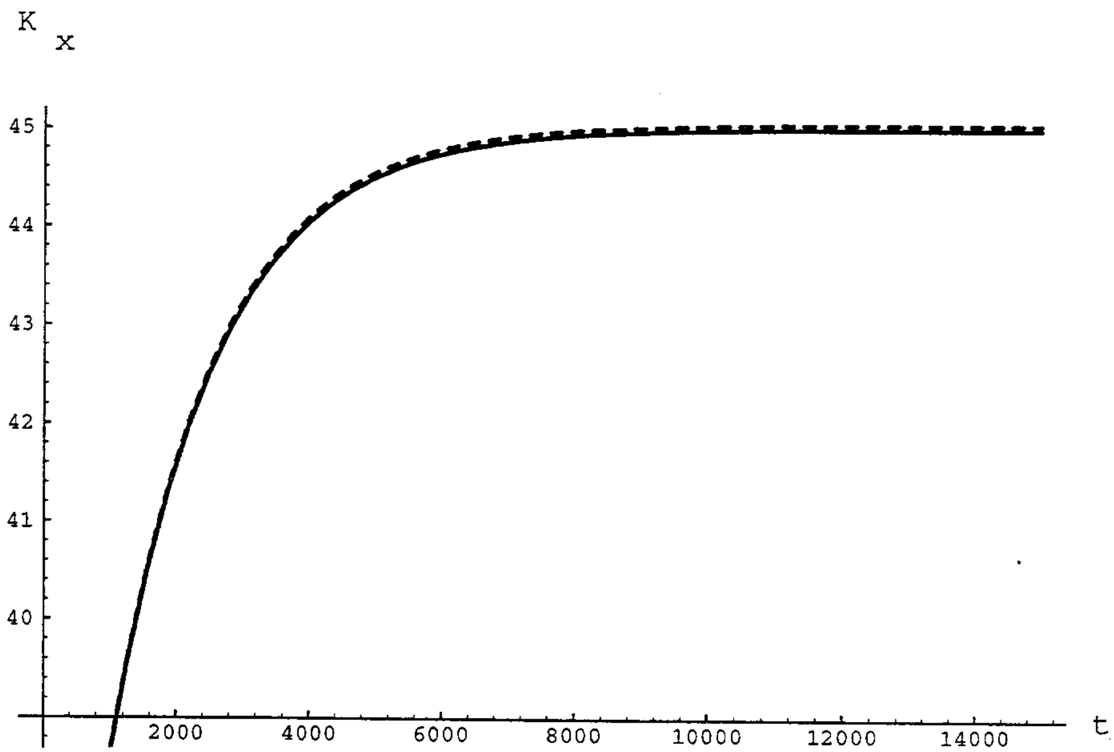

Figure 4: ($\beta = 3,000$) ($\mu = 0$: solid) ($\mu = 0.0002$: dashed)

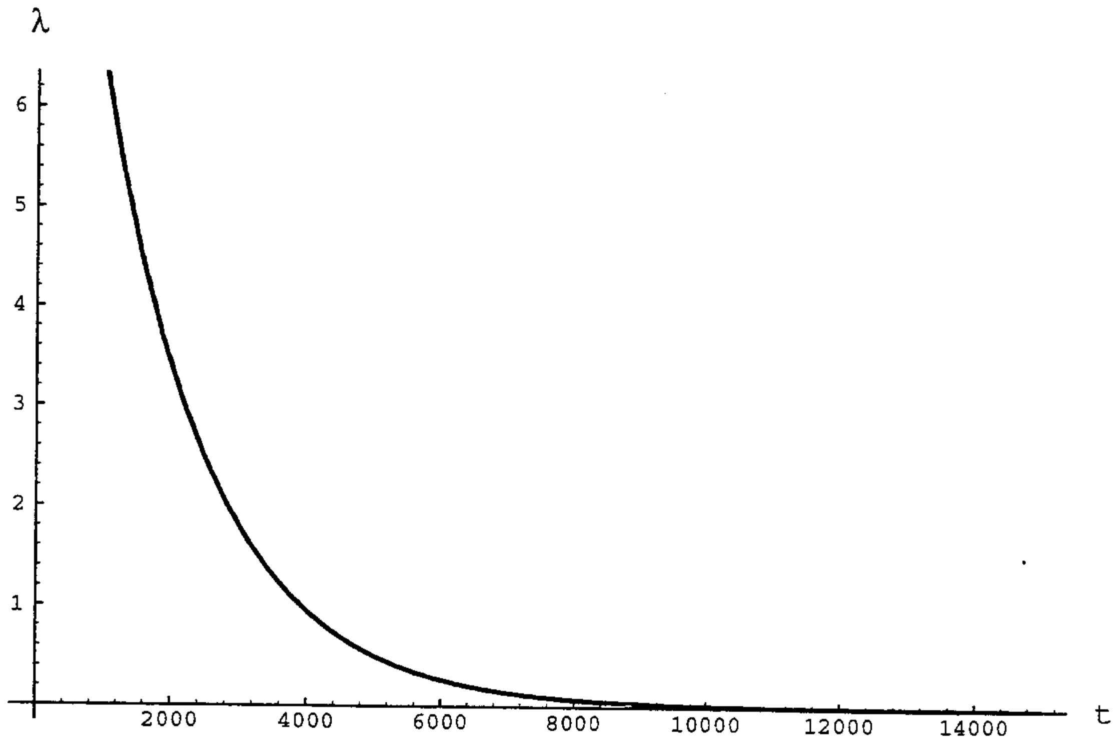

Figure 5: ($\beta = 3,000$) ($\mu = 0$: solid) ($\mu = 0.0002$: dashed)

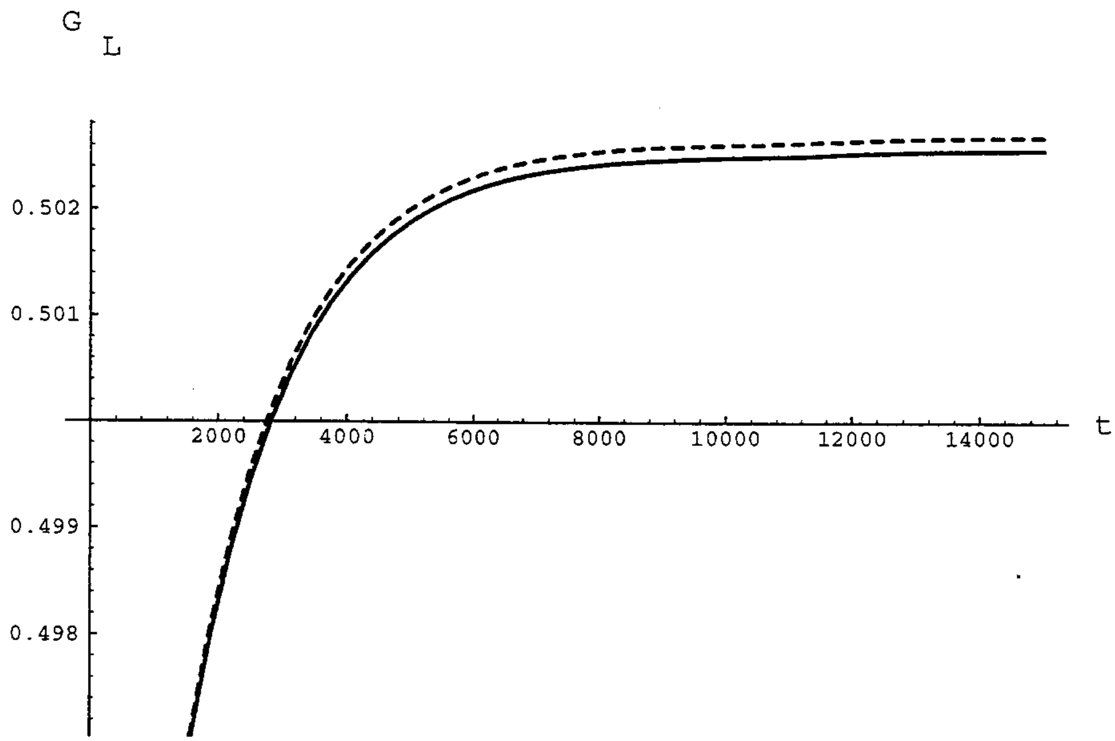

Figure 6: ($\beta = 3,000$) ($\mu = 0$: solid) ($\mu = 0.0002$: dashed)

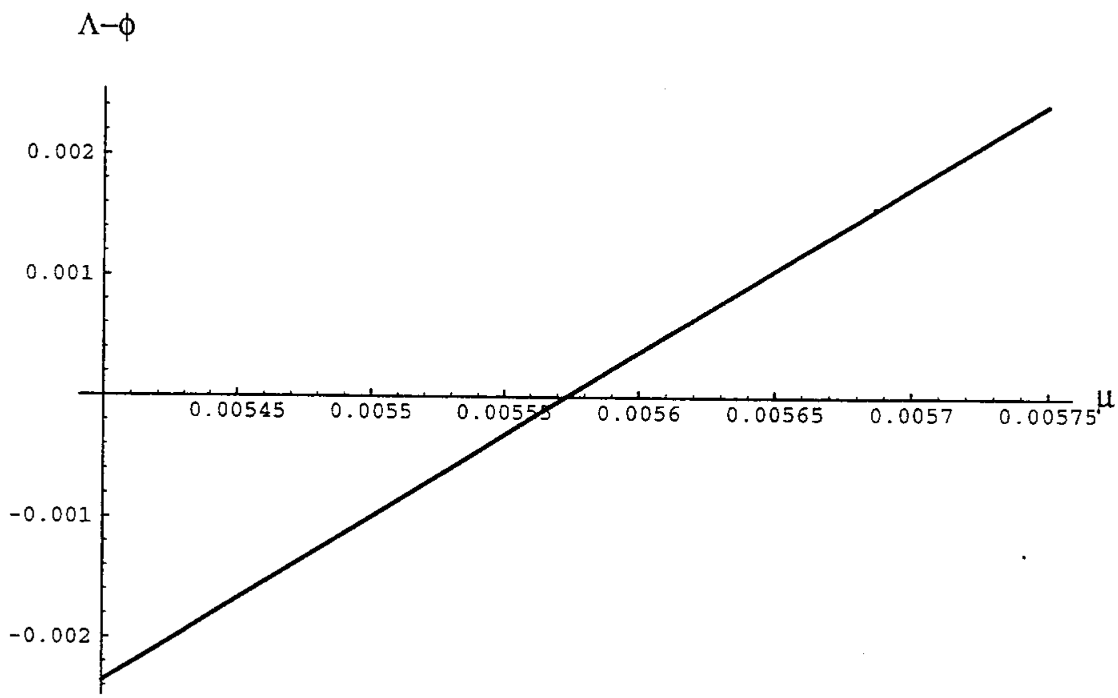

Figure 7: ($\beta = 30,000$)

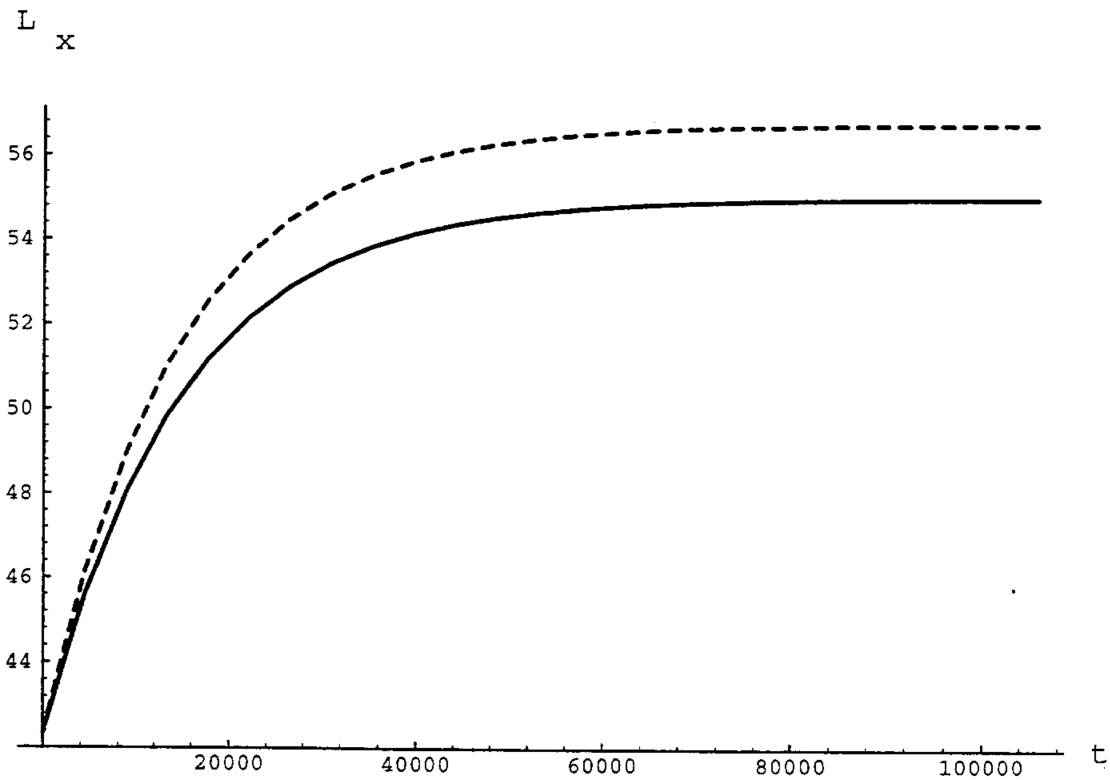

Figure 8: ($\beta = 30,000$) ($\mu = 0$: solid) ($\mu = 0.0056$: dashed)

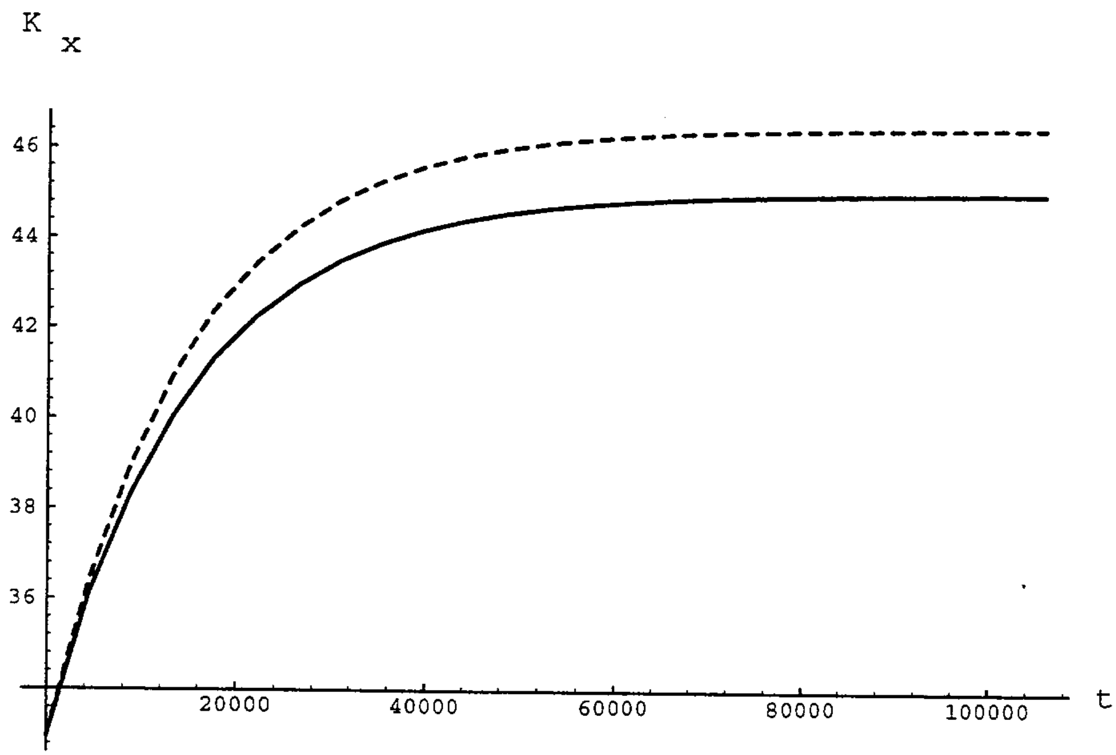

Figure 9: ($\beta = 30,000$) ($\mu = 0$: solid) ($\mu = 0.0056$: dashed)

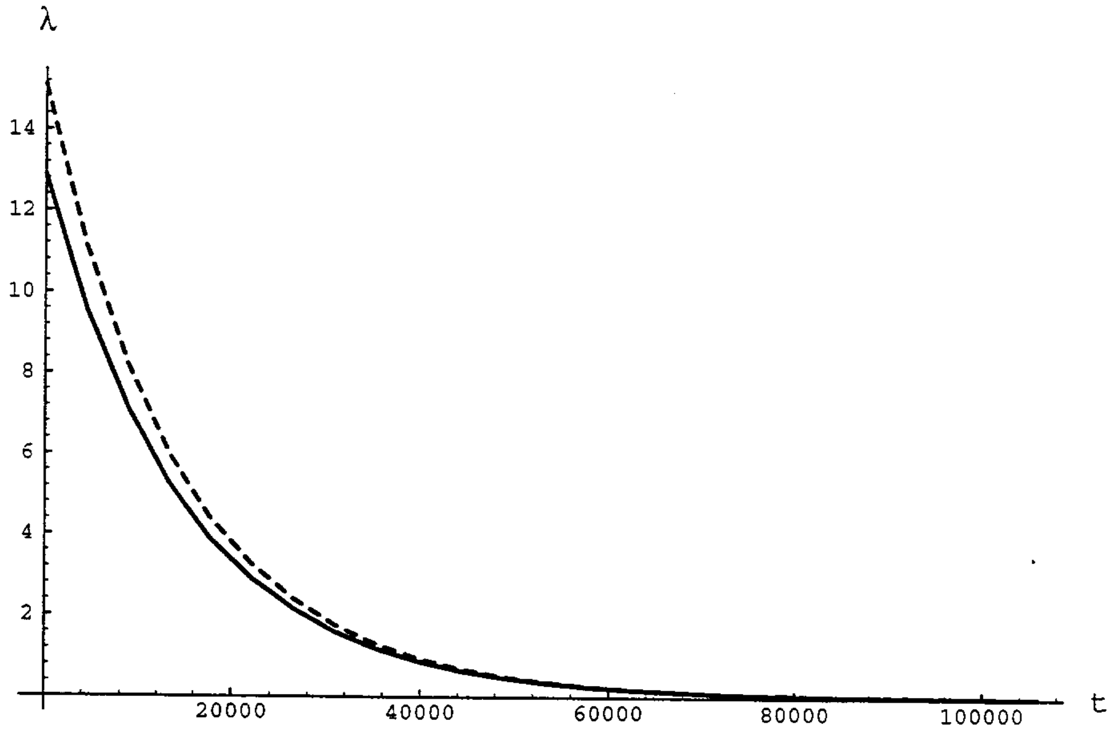

Figure 10: ($\beta = 30,000$) ($\mu = 0$: solid) ($\mu = 0.0056$: dashed)

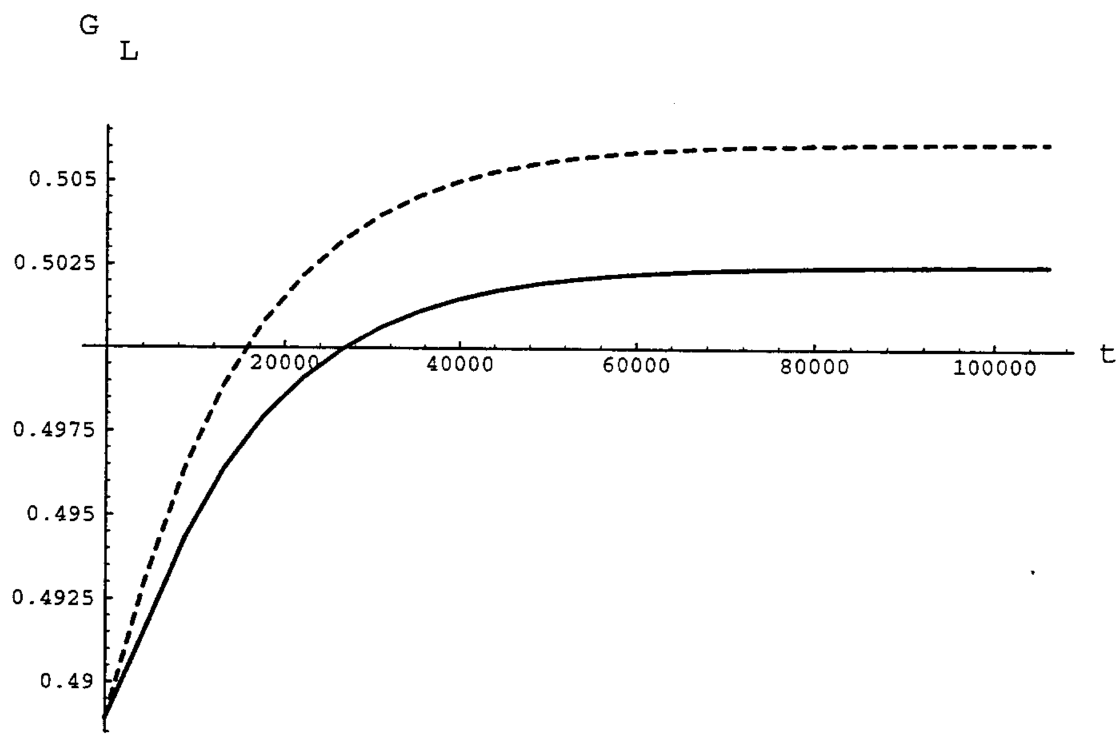

Figure 11: ($\beta = 30,000$) ($\mu = 0$: solid) ($\mu = 0.0056$: dashed)