Appendix 1: A model of control dynamics
In cooperation with César E. García-Díaz

1 A simple communication flow model
We present a communication flow model in which two parties, a boss B and a worker W, exchange information in the usual principal-agent context. We model a mutual interplay where the boss gives orders, the worker might give feedback, and noise makes information exchange imperfect. For details as to the theoretical background, we refer to this chapter’s main text. Here, we straightforwardly introduce our model and a number of illustrative simulation outcomes. The model’s starting point is that the boss gives orders to the worker and expects him to deliver some actions in line with the boss’ objectives. The information flow process is perturbed by a “garbling” factor. We investigate the effects of such noise perturbation on workers actions and, consequently, on organisational control. We show that, in presence of very small noise perturbations, communication (and, consequently, organisational control) may be significantly – and even dramatically — lost.

It is worth noticing that the literature has formally addressed different organisational information-processing issues in the presence of specific agents’ characteristics (cf. van Zandt, 1999). In fact, work on the formalisation of organisation control problems has earlier triggered the suggestion to use structural redundancies for the correction of information-transmission errors (Drenick, 1986). Mistakes in decision-making, for instance, may be minimized if specific organisational architectures are adopted (Sah and Stiglitz, 1986). Other approaches encourage to find the error source, and “to make a change for the better in the way the system operates” (Drenick, 1986: 190). The model in this Appendix adds another twist to this literature: the incidence and effect of control loss, as pioneered by Coase, Simon and Williamson (see this chapter’s main text).

The objective of the following model is just to illustrate, in absence of any structural view of the firm, how small noise perturbations may significantly degrade organisational control. Control is viewed as the “influence” the boss has over workers’ actions, in terms of pursuing behaviour instrumental to reach the
firm’s objective (which we assume to be the same as the boss’ objective, for simplicity’s sake). In that sense, we operationalize control as the level of W’s actions over time, A(t), and, accordingly, as the degree of information quality. The model may be summarized as follows:

a) Functions IB2W(t) and IW2B(t) represent the information levels available to the boss B and worker W at time t, respectively. We model IB2W(t), IW2B(t) ∈ [0,1]. Value of 1 means “perfect information”, a value of 0 implies pure white noise, and IB2W(1) = IW2B(1) = 1 are the initial conditions.

b) We introduce the coefficient 1-g(t), which represents the “noise effect” in the communication of information IB2W(t) from boss B to worker W and vice versa (IW2B(t)). The coefficient mg reflects the maximum reliability coefficient in information transmission. Therefore, we assume g(t), mg ∈ [0,1] and g(t) = 1-(e(1-mg)+mg), where e is a random number drawn from a uniform distribution ranging from 0 to 1.

c) Worker W receives OA(t) = K₁*IB2W(t), where K₁ = 1. OA(t) might be interpreted as the “appropriateness” of the orders (information) given to W, while K₁ represents the proportionality factor of such appropriateness.

d) Worker W takes total actions A(t+1) = (1-g(t))*OA(t)). Again, if A(t) = 1, it will imply that no information loss occurs (i.e., there is perfect managerial control) and that worker W acts totally under boss B’s command, completely in line with the firm’s objective.

e) B requests RI(t) information to W, based on the last piece of information received from W, so that RI(t) = K₂*IW2B(t-1), where K₂ = 1 is a proportionality factor. The information that B receives at time t+1 is IW2B(t+1) = min[(1-g(t))RI(t) + rr, 1]. Coefficient rr denotes the extra information B asks from W. We assume an initial condition RI(t) = 1.

f) Information available to B at time t+2 is IB2W(t+2) = min[IW2B(t+1)(1-g(t)), 1].
2 Simulation research design
Each simulation trial has 500 time periods. We ran six different scenarios for different values of mg: 0.98, 0.96, 0.94, 0.92, 0.90 and 0.60. For each scenario, we use values for variable rr ranging from 0.005 to 0.05 in steps of 0.0005 (we assume values for rr to be very small relative to the information stream between boss and worker). For each rr value, we ran the model 100 times and took averages of the results for each. In addition, we considered two alternative representations of the way W transmits information to B, IW2B(t). The total number of runs was 6 x 10 x 100 (first representation) + 2 x 10 x 100 (second representation) = 7,000 simulation trials. Constants used for the model are K_1 = K_2 = 1 (this makes control loss dependent on the noise perturbations only, which is the pure case we are interested in).

3 Simulation results
i) Baseline model (absence of noise)
The result is trivial. Under absence of any garbling factor, no information loss can and will occur. This is clear from Figure A.1. Absence of any noise (mg = 1) implies perfect control: A(t) = 1 throughout the simulation run. This is our benchmark.

![Figure A.1](image-url)
ii) Control behaviour with $mg = 0.98$

The first move away from the above benchmark case without any noise is to assume slight losses of information during exchange (2%). Results show that control degrades significantly as workers’ effort to supply additional information drops down ($rr$). Control loss is dependent on $rr$ values. The plot in Figure A.2 shows that, under very low noise, boss B can keep control if coefficient $rr$ is high enough. However, small variations of $rr$ might lead to uncontrollableness. For instance, with $rr = 0.005$, $A(t)$ is almost halved after 500 periods.

![Figure A.2](image)

iii) Control behaviour with $mg = 0.96$

Next, we investigate control behaviour under a small increase of the value of $mg$ (from 0.98 to 0.96, implying an information loss increase from 2 to 4%). We observe in Figure A.3 how uncontrollability emerges from variations in $rr$ values. The effect of coefficient $rr$ is critical, again, to the extent that variations in $rr$ might turn out to generate significant control loss. As could be expected, the effect of a lower $rr$ is more dramatic now: e.g., with $rr = 0.005$, $A(t)$ collapses from 1 to about .25 in 500 periods.
iv) Control behaviour with $mg = 0.94$
With another small increase in $mg$ (from 0.96 to .94), the above pattern is further intensified. Control loss gradually increases, being, reinforced by decreasing $rr$ values, as can be seen in Figure A.4. For example, with $rr = 0.005$, $A(t)$ now collapses from 1 to about .15 in 500 periods.
v) Control behaviour with \( mg = 0.92 \) and \( mg = 0.90 \)

So, sensitivity of the control loss outcomes to \( rr \) values increases if information noise \( mg \) goes up. That is, changes in \( rr \) notably affect control loss, the more so if noise \( mg \) increases. In comparison with Figure A.1, \( rr \) values above 0.01 can still correct for noise to the extent that organisational control is sustained. This critical \( rr \) value increases with \( mg \), however. As is clear from Figures A.5 and A.6 (with \( mg = 0.92 \) and \( mg = 0.90 \), respectively), though, values of 0.01 are no longer enough to keep control if \( mg \) goes up even further: then only an \( rr \) value above 0.04 may produce a reasonable of control.
Figure A.5

Figure A.6
vi) Control behaviour under low reliability (mg = 0.60)
Under regimes with much information noise (i.e., low mg values),
the sensitivity to rr values turns from high to low, since the latter’s
effect on control becomes insignificant. Uncontrollability is totally
dominant: even an increased effort by W to correct for information
loss is no longer able to restore a reasonable control equilibrium, as
is witnessed by the dramatic control collapse cases in Figure A.7.

![Figure A.7](image)

4 Model with variation on IW2B(t)

Finally, we explore the simulation results using an alternative
representation for IW2B(t), in which we constrain the effect of rr
(the extra information worker W adds to the information level)
proportional to the level of B’s requested information, RI(t): IW2B(t) = min((1-g(t-1))*RI(t-1) + rr* RI(t-1),1). The overall pattern of control
loss observed is as above, but declines in control levels are more
sensitive to changes in mg and rr than in the previous experiments.
Figures A.8 and A.9 provides the results for different values of mg
and rr.
Figure A.8

Figure A.9
5 Conclusion
We summarize the results in this simulation exercise as follows:

a) Small changes in information reliability might lead to significant negative consequences in terms of organisational control.

b) Under rather high reliability values, information quality might critically depend on extra information (rr values) added by the worker. However, as reliability decreases, sensitivity to changes in rr increases, implying that its impact on control decreases.

c) Under rather low reliability values, effects of rr are non-significant and control becomes insensitive to changes in rr.
Appendix 2: The EFW-index as a proxy for the ratio between sheltered and exposed organisations

At the end of the first chapter the Sturm-de Haan paradox was described. It consists of the seeming contradiction between the lack of correlation between the level of the economic freedom index and economic growth on the one hand, and the strong correlation between increases of the economic freedom index and economic growth on the other.

The solution presented in 2.8.2 depends on the assumption that behaviour of the Economic Freedom of the World-index (the EFW-index) coincides with the ratio between sheltered and exposed organisations.

When evaluating the EFW-index as a proxy for the E/S ratio, a distinction must be made between i) data that relate to the total size of sheltered organisations as compared to the total size of exposed organisations, ii) data that relate to the protective value of incumbency, thereby increasing survivability and iii) elements of the EFW-index that show no such relationship.

However judicious, this distinction can never be more than an extremely rough approximation. In order to avoid an appearance of precision, the distinction is presented digitally, and no component is allowed to straddle more than one category.

The structure of the index used in Economic Freedom of the World: 2003 Annual Report is as follows:

The index measures the degree of economic freedom present in five major areas:

- Size of Government: Expenditures, Taxes, and Enterprises
- Legal Structure and Security of Property Rights
- Access to Sound Money
- Freedom to Exchange with Foreigners
- Regulation of Credit, Labor, and Business

Within the five major areas, 21 components are incorporated into the index but many of those components are themselves made up of several sub-components. Counting the various sub-components, the EFW-index utilizes 38 distinct pieces of data. Each component
and sub-component is placed on a scale from 0 to 10 that reflects the distribution of the underlying data. The component ratings within each area are averaged to derive ratings for each of the five areas. In turn, the summary rating is the average of the five area ratings.

The Areas and Components of the EFW-Index

1 Size of Government: Expenditures, Taxes, and Enterprises
A General government consumption spending as a percentage of total consumption
B Transfers and subsidies as a percentage of GDP
C Government enterprises and investment as a percentage of GDP
D Top marginal tax rate (and income threshold to which it applies)
   i Top marginal tax rate (excluding applicable payroll taxes)
   ii Top marginal tax rate (including applicable payroll taxes)

2 Legal Structure and Security of Property Rights
A Judicial independence: the judiciary is independent and not subject to interference by the government or parties in disputes
B Impartial court. a trusted legal framework exists for private businesses to challenge the legality of government actions or regulation
C Protection of intellectual property
D Military interference in rule of law and the political process
E Integrity of the legal system

3 Access to Sound Money
A Average annual growth of the money supply in the last five years minus average annual growth of real GDP in the last ten years
B Standard inflation variability in the last five years
C Recent inflation rate
D Freedom to own foreign currency bank accounts domestically and abroad

4 Freedom to Exchange with Foreigners
A Taxes on international trade

Gwartney and Lawson (2003: 8).
i Revenue from taxes on international trade as a percentage of exports plus imports
ii Mean tariff rate
iii Standard deviation of tariff rates

B Regulatory trade barriers
i Hidden import barriers. No barriers other than published tariffs and quotas
ii Costs of importing. The combined effect of import tariffs, licence fees, bank fees, and the time required for administrative red-tape raises the costs of importing equipment

C Actual size of trade sector compared to expected size

D Difference between official exchange rate and black market rate

E International capital market controls
i Access of citizens to foreign capital markets and foreign access to domestic capital markets
ii Restrictions on the freedom of citizens to engage in capital market exchange with foreigners
.index of capital controls among 13 IMF categories

5 Regulation of Credit, Labor, and Business

A Credit Market Regulations
i Ownership of banks. Percentage of deposits held in privately owned banks
ii Competition. Domestic banks face competition from foreign banks
iii Extension of credit. Percentage of credit extended to private sector
iv Avoidance of interest rate controls and regulations that lead to negative real interest rates
v Interest rate controls. Interest rate controls on bank deposits and/or loans are freely determined by the market

B Labor Market Regulations
i Impact of minimum wage. The minimum wage, set by law, has little impact on wages because it is too low or not obeyed
ii Hiring and Firing practices. Hiring and firing practices of companies are determined by private contract
iii Share of labor force whose wages are set by centralized collective bargaining
iv Unemployment Benefits. The unemployment benefits system preserves the incentive to work
v Use of conscripts to obtain military personnel
C Business Regulations
i Price controls. Extent to which businesses are free to set their own prices
ii Administrative conditions and new businesses. Administrative procedures are an important obstacle to starting a new business
iii Time with government bureaucracy. Senior management spends a substantial amount of time dealing with government bureaucracy
iv Starting a new business. Starting a new business is generally easy
v Irregular payments. Irregular, additional payments connected with import and export permits, business licenses, exchange controls, tax assessments, police protection, or loan applications are very rare.

In the following table the second column (W) denotes the weight, the third (GS) whether the (sub-) component correlates with governmental sheltering, the fourth (IC) whether it protects incumbents against new-comers and the fifth (NI) if no correlation is expected.

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<th>W</th>
<th>GS</th>
<th>IC</th>
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<td>General government consumption spending</td>
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<td>Transfers and subsidies as a percentage of GDP</td>
<td>5.0%</td>
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<td>Government enterprises and investment as a percentage of GDP</td>
<td>5.0%</td>
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<td>Military interference in rule of law and the political process</td>
<td>4.0%</td>
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<td>Category</td>
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<td>Hidden import barriers, no barriers other than published tariffs and quotas</td>
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<td>Irregular payments</td>
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<td>100%</td>
<td>53%</td>
<td>34%</td>
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</table>
1A  General government consumption spending as a percentage of total consumption. Even if a varying percentage of government consumption is acquired in the market, the correlation with the number of people employed in government, an important group of sheltered organisations. Category 1

1B  Transfers and subsidies as a percentage of GDP. As far as can be gleaned from the actual data, this item is mainly based on social security, on food distribution etc. As this money is spent in the market, its relationship with the E/S ratio is vague. Category 3.

1C  Government enterprises and investment as a percentage of GDP. It is plausible that this item has a high correlation with the number of people employed in state owned enterprises, which are sheltered organisations. Category 1

1Di  Top marginal tax rate (excluding applicable payroll taxes). No logical relationship with the E/S ratio. The size of sheltered organisations can be small, while the government is still actively redistributing incomes. Category 3.

1Dii  Top marginal tax rate (including applicable payroll taxes). Idem, category 3.

2A  Judicial independence. the judiciary is independent and not subject to interference by the government or parties in disputes If the government can easily interfere in the judiciary, it will use this influence to shelter organisations from market forces. Category 1.

2B  Impartial court. a trusted legal framework exists for private businesses to challenge the legality of government actions or regulation idem, category 1.
2C  *Protection of intellectual property.* There is little reason to suppose this item systematically favours sheltered organisations versus exposed organisations or vice versa. It is debatable if it favours incumbents. A dubious category 3.

3D  *Military interference in rule of law and the political process.* This very much depends on the politics entertained by the military. If they are proponents of change (Pinochet) is could even be a “minus category 1” and “minus category 2”. But if the military are conservatives this index would be very much a category 1. After some consideration this author placed it in category 1, but is open to any argument to put it in category 3.

3E  *Integrity of the legal system.* Incumbent organisations are usually greatly favoured when the legal system is corrupt. A firm category 2.

3A  *Average annual growth of the money supply in the last five years minus average annual growth of real GDP in the last ten years.* Generalizing, it can be stated that inflation is more of a problem for start-ups than for incumbent organisations. The main reason is that due to high interest rates, loan amortisation is front loaded. Moreover, in industries characterized by long depreciation periods as compared to amortisation periods acceptable in the capital market, remaining liquid in a inflationary climate is difficult for start-ups as compared to incumbents, who have had the time to profit from inflationary erosion of the value of repayment obligations. A strong category 2.

3B  *Standard inflation variability in the last five years.* Idem, strong category 2.

3C  *Recent inflation rate.* Idem. Strong category 2.

3D  *Freedom to own foreign currency bank accounts domestically and abroad.* Restrictions of this category allow governments to manipulate economic outcomes, thereby sheltering both its own organisations and “market”
organisations (that can thereby be sheltered). But one can also submit that incumbent firms are able to save an illicit foreign currency nest egg. Choosing between categories 1 and 2 was difficult, and the coin flipped to category 1.

4Ai  *Revenue from taxes on international trade as a percentage of exports plus imports.* In smaller economies international trade increases competition, thereby threatening survival of failing commercial organisations. In large market economies this effect is much smaller. Still it seems reasonable to put this component in category 2. Allocative damage is at least as important.

4Aii  *Mean tariff rate.* Idem. Category 2.

4Aiii  *Standard deviation of tariff rates* Few measures enable a government to shelter certain sectors more “efficiently” and less visibly than the judicious use of tariff rates. Firmly in category 1.

4Bi  *Hidden import barriers. no barriers other than published tariffs and quotas.* Idem, perhaps even more strongly category 1

4Bii  *Costs of importing. the combined effect of import tariffs, licence fees, bank fees, and the time required for administrative red-tape raises the costs of importing equipment* The right category for this component depends on the question if an economy contains equipment manufacturing or not. If such an industry exists, category 1 would be appropriate. If not, this type of red costs is very much easier to evade for incumbents than for start-ups. We put it in category 2.

4C  *Actual size of trade sector compared to expected size* This component runs parallel to component 4Ai; we therefore put in category 2.
4D  *Difference between official exchange rate and black market rate* The government can shelter certain organisations through licenses, without going through a budgetary process. Category 1.

4Ei  *Access of citizens to foreign capital markets and foreign access to domestic capital markets.* An excellent field through which the authorities can shelter organisations. Therefore category 1.


5Ai  *Ownership of banks. percentage of deposits held in privately owned banks* Idem, category 1.

5Aii  *Competition. domestic banks face competition from foreign banks,* Idem, category 1.

5Aiii  *Extension of credit. percentage of credit extended to private sector* Idem, category 1.

5Aiv  *Avoidance of interest rate controls and regulations that lead to negative real interest rates* Due to paper trails a government can, if it wants to reduce this behaviour. Selective enforcement is an excellent instrument in ensuring banks follow governmental “guidance”; therefore an alternative to actually owning the bank. Firmly in category 1.

5Av  *Interest rate controls. interest rate controls on bank deposits and/or loans are freely determined by the market.* Category 2 has its attractions for this component, as incumbents have more entries to receive credit than start-ups. However, because another effect of this component is to strengthen the hand the government has in banking, the main effect will probably be that government has yet another instrument to shelter organisations.
5Bi  *Impact of minimum wage.* The minimum wage, set by law, has little impact on wages because it is too low or not obeyed. This component does not influence the E/S ratio.

5Bii  *Hiring and Firing practices.* Hiring and firing practices of companies are determined by private contract. Labour restrictions favour incumbents, because they increase costs during the start-up of a new organisation. Therefore 2.

5Biii  *Share of labour force whose wages are set by centralized collective bargaining.* As incumbent organisations are represented on both sides of the table) during the negotiations, and start-ups are not, this component strengthens the hands of incumbent organisations. Category 2.

5Biv  *Unemployment Benefits.* The unemployment benefits system preserves the incentive to work. No influence, therefore category 3.

5Bv  *Use of conscripts to obtain military personnel.* No influence, therefore category.

5Ci  *Price controls.* Extent to which businesses are free to set their own prices. Price controls are mainly used to protect consumer interests, and not to shelter organisations. However, when price controls threaten to strangle organisations producing essential goods or services - which is often the case when price controls are involved - governments will often ensure survival of the organisation (but not its effectiveness) through other means. We therefore put this component in category 1.

5Cii  *Administrative conditions and new businesses.* Administrative procedures are an important obstacle to starting a new business. Obviously a clear category 2.

5Ciii  *Time with government bureaucracy.* Senior management spends a substantial amount of time dealing with government bureaucracy. Obviously a category 2.
Starting a new business is generally easy. Obviously a clear category 2.

Irregular payments. Irregular, additional payments connected with import and export permits, business licenses, exchange controls, tax assessments, police protection, or loan applications are very rare. Well connected organisations (=organisations controlled by the governing clique) have much less trouble with corruption than organisations not so well connected. It is not outrageous to consider the first as quasi-state organisations. Contrary to their effectivity, the survival of public organisation is not endangered by corruption. All in all, corruption should elevate the E/S ratio.