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Endogenous International ICT Spillovers in the APEC Region within the GTAP framework

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Abstract: This paper models international technology spillovers embodied in innovative electronic equipment traded across APEC economies. Spillovers are modelled as a function of the amount of electronic equipment traded as well as the absorption capacity of the recipient country. The Global Trade Analysis Project (GTAP) model is modified to link productivity variables of the different countries and to allow for a flow of recursive dynamic spillover effect. Bilateral electronic equipment trade data of GTAP are utilised and additional sets of commodities, countries and parameter files are introduced to highlight relationships among APEC economies. An index of technology absorption capacity is developed for each country on the basis of a number of Information and Communication Technology (ICT) and human capital measures. Numerical examples are provided from simulations for 21 regions including 19 APEC economies.

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1. Introduction

In the economics of growth and development, the term *technology* has a very specific meaning: *technology* is the way inputs to the production process are transformed into output (Jones 1998). In terms of a general production function $Y = F(K, L, \bullet)$ the technology of production is given by the function $F(\bullet)$. This production function explains how inputs are transformed into output.

The transformation of inputs into outputs is closely related to the concept of *productivity*, which builds on the circular income flow model introduced by Schumpeter (1934). In this context productivity is a scaling factor that allows factor income to equal total value of the goods produced if improvement in production technology occurs. "Output-over-input index" was first mentioned by Copeland (1937), and the first empirical implementation of output per unit input is attributed to Stigler (1947) (Hulten 2000).

These two concepts of *technology,* being represented by an aggregate production function on the one hand, and symbolising *productivity* on the other - were linked by the work of Solow (1957). This new productivity measure was further advanced by Jorgenson and Griliches (1967) and justified by Diewert (1976). Recently, Romer (1990) linked productivity and economic growth with R&D and innovation.

It is difficult to underestimate the importance of technology and productivity at the aggregate level. As Paul Krugman (1997)wrote: "*Productivity is not everything, but in the long run is almost everything".* Productivity is inevitably central to the long-term economic growth of nations, and economic growth in turn has positive effects on current living standards, which is what society ultimately cares about.

The correlation between R&D spending, resulting innovative activities and productivity increase has been well documented in the economic literature (Bernstein and Nadiri 1988; Coe and Helpman 1993; Bayoumi, Coe et al. 1996; Helpman 1997). R&D

spending, however, is not equally distributed among countries. Ninety six percent of the world's R&D is undertaken in a handful of industrial countries. The remaining four percent is performed in a large number of developing countries, of which only 15 undertake significant R&D (Coe and Helpman 1997). Innovative knowledge created in one country can, however, be transferred to other countries across national borders.

The substance of the transfer can take the form of purely disembodied knowledge transferred via scientific conferences, journal articles or patent information; it can be knowledge embodied in an innovative final product or an intermediate input used in production by the importing country; or it can be a mixture of both: applied innovative knowledge in the form of developed technology accompanied by disembodied information. A good example of such a comprehensive technology transfer is FDI.

A comprehensive framework for the study of international transfer of technology and its sub-components was developed by Ramanathan (1999). The extent to which countries that do little of their own R&D can nevertheless benefit from R&D performed by others depends on the amount of innovative knowledge available to those countries. The amount of knowledge transferred between two countries in turn is a function of the intensity and the nature of the relationship between those countries.

This paper examines embodied international technological spillovers as one of the mechanisms of technology transfer. It assumes knowledge developed by one region as a result of successful R&D is embodied in an innovative commodity, which is produced using innovative methods. This commodity, if exported, carries the innovative knowledge across national borders along international trade linkages. An importing region has a capacity to extract some of the innovative knowledge from imported goods, and use this knowledge to contribute to its own productivity improvement.

This study uses a dynamic Computable General Equilibrium model (a modified version of the static GTAP model) to simulate effects of endogenous electronic equipment spillovers between APEC's economies.

The remainder of the paper is organised as follows: section two overviews theoretical premises and the general concept of embodied spillovers, section three defines and models specific channels for spillover transmission, section four describes the setup of the experiment, section five reports results and section six concludes.

2. Theory

Technological change in one region can be linked to innovation in another region via transfer of knowledge embodied in traded goods (Coe and Helpman 1995; Tongeren and Meijl 1999). For that link to become effective several conditions have to be satisfied. Firstly the innovative knowledge has to be created. Innovative knowledge creation is assumed to be a result of the undertaken R&D expenditure/process. Secondly, created innovative knowledge has to be embedded in the product. This would happen if design and production processes employ newly created knowledge. As a result of utilizing new knowledge in production, the productivity of the sector in question can improve. Thirdly, this innovatively created commodity needs to become available to other regions. This can be satisfied as long as there is traffic of innovative products from the innovative to importing country. International trade in the commodity of interest has to exist for knowledge transfer to occur. Finally, the country importing innovative goods has to have capacity to extract and utilize innovative knowledge from the imported product. The final effects of the transmission process are improvements in the productivity of the relevant sector in the region which imports the innovative product.

The benefits for a destination region are not immediate. We assume that there is a lag between a source country's productivity improvement and resulting improvements for a destination country. The data on the volume of trade is annual and the model is solved in discrete time. A one year lag is allowed for the embedded knowledge to be transferred. Additionally there is time needed in the destination region for the process of 'extraction' of embodied innovative knowledge from imported goods and applying it for a region's own purposes.

The link between the source (innovative) country's productivity increase resulting from new knowledge creation and the destination (importing) country's productivity improvement resulting from utilization of part of this knowledge is formalized by the following equation proposed by Tongeren and Meijl (Tongeren and Meijl 1999)

$$\alpha_{Dk,t+1} = E_{S,Dk}{}^{1-\gamma_{S,Dk}} \alpha_{S,t} \quad where \;\; 0 \le E_{S,Dk} \le 1 \;\; and \;\; 0 \le \gamma_{S,Dk} \le 1 \tag{1.1}$$

Here $\alpha_{(\bullet,t)}$ represents productivity improvement in time t, S is the Source country (innovative region), $Dk = \{i, j...k\}$ is a set of destination regions, $E_{S,Dk}$ is the amount of innovative knowledge transferred between S and Dk, and $\gamma_{S,Dk}$ is Dk's ability to extract new knowledge embodied in the imported good and utilize this knowledge for its own productivity improvement purposes.

Thus productivity improvement in the destination region at time $t+1$, $\alpha_{Dk,t+1}$, is a function of (i) the amount of the knowledge transferred from source S region to destination region Dk ,E_{SDk}, between time t and $t+1$ via trade in innovative goods, (ii) initial productivity improvement of the sector of interest in the source region S at time t, $\alpha_{S,t}$, and (iii) the destination country's ability to extract new knowledge embodied in the imported good and utilize it to improve its own productivity, $\gamma_{S,Dk}$.

The amount of knowledge transferred between the two regions E_{SDk} is indexed by the importance of good imported from S in production of domestic good in D. This significance of imported goods is modeled differently for knowledge transferred in final goods, than it is for knowledge transmitted by intermediate products.

The ability of the region to extract and utilize knowledge embodied in the imported commodity, namely *absorption capacity* γ_{SD}, is proxied by the Networked Readiness of Nations Index (NRI) developed by the Internet Institute at Harvard University. The NRI returns a single index score for each of the countries in the ranking, and is constructed from a number of sub-indexes related to educational level, amount of IT equipment used, support of legislation, etc. For the purpose of this study we are adopting a specific sub-index, which describes the ICT readiness capability of the business sector. Focusing on the business sector is motivated by the observation that imitation and reverse engineering happens more on a business level than on an individual or governmental level.

The absorption capacity parameter γ_{SDk} is specific to a pair of regions, and is calculated as the antilog of the negative maximum of zero and the difference between NRI_S for source region *S* and NRI_{Dk} for destination region *Dk*.

$$\gamma_{SDk} = \exp[-\max[0, NRI_S - NRI_{Dk}]] \tag{1.2}$$

This prevents destination region benefits exceeding the source region's ones, i.e. $\alpha_D \leq \alpha_S$.

The behavior of the absorption capacity variable γ as a function of the ICT-related gap between the source and destination region (NRI_S-NRI_{Dk}) is depicted on Figure 2.1 below:

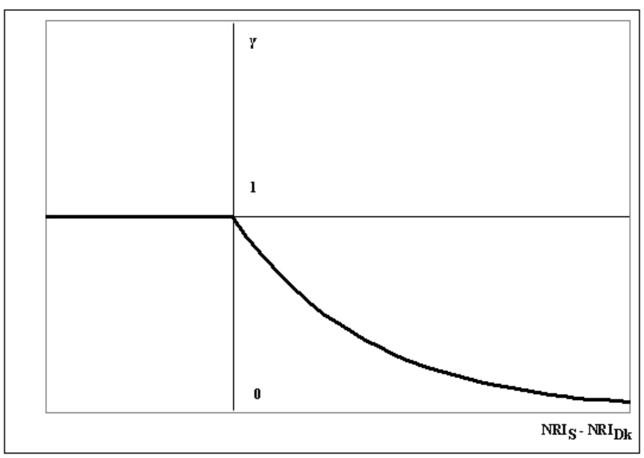


Figure 2.1. Absorption capacity γ as a function of NRI_S-NRI_{Dk}

The extent which the destination region *Dk* can benefit from knowledge developed in other regions is quantified by the spillover coefficient q, and is equal to the ratio of productivity improvements for relevant regions. From Equation(1.1):

$$q = \frac{\alpha_{Dk}}{\alpha_S} = E_{SDk}{}^{1-\gamma_{SDk}} \tag{1.3}$$

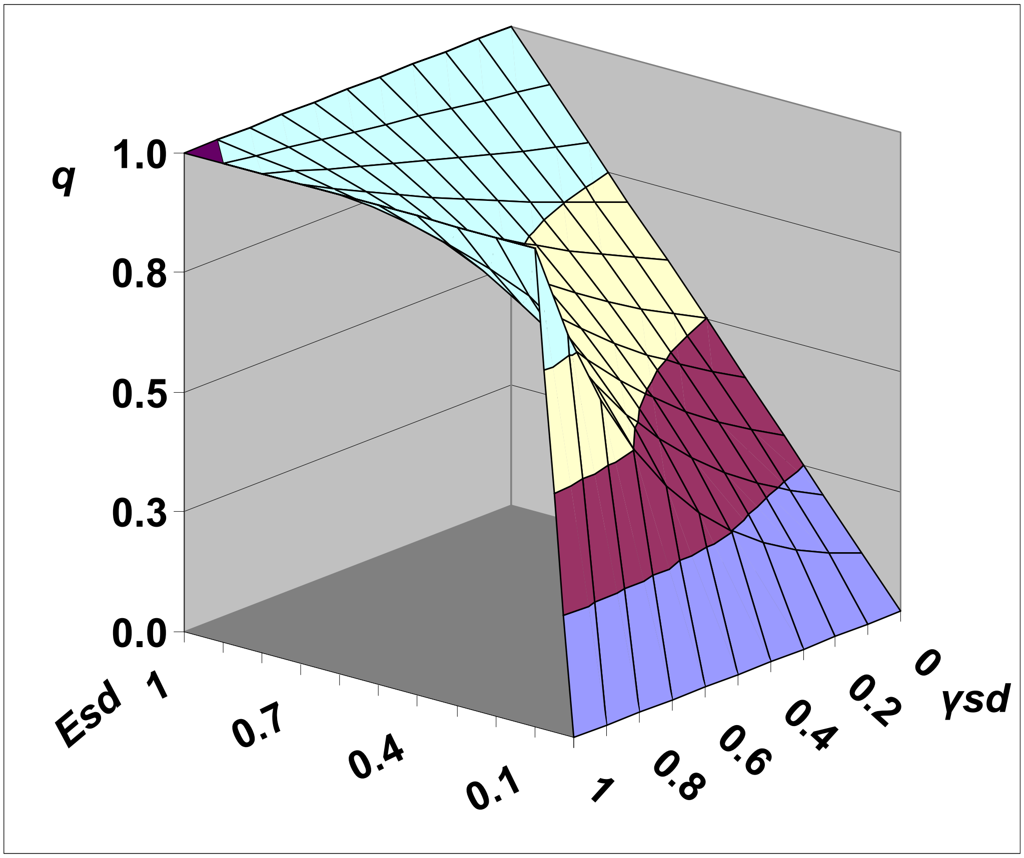


Figure 2.2. The value of the spillover coefficient q as a function of its arguments

Figure 2.3 pictures the value of the spillover coefficient *q* for two constant values of γ=0, and $\gamma=0.5$. When γ=0, i.e. the gap between ICT related development of the source and destination country is big, the productivity benefits received with imported electronic equipment are linearly dependent on the amount of knowledge transferred between those two partners. With the development gap between the two narrowing, the absorption capacity allows extraction of more knowledge from imported innovative goods and application of this knowledge for local needs. The benefits (*q*) increase at the highest rate for small E_{SD}, e.g. when trade is first initiated, and from that point they increase at a decreasing rate (Figure 2.3)

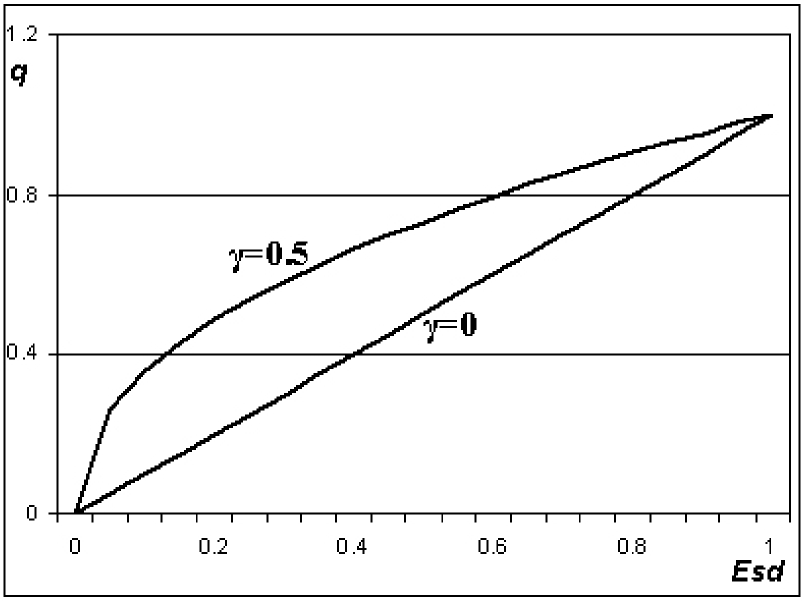


Figure 2.3. Curvature of the behavior of the spillover coefficient q for two constant values of γ=0, and $\gamma=0.5$

3 Modeling Spillovers

Innovative knowledge (*IK*) can be embodied in final products or intermediate inputs. Knowledge transferred by each of these channels impacts the sectoral productivity of the destination country in different ways.

Spillovers embedded in final innovative electronic equipment can only directly affect the productivity of the electronics industry, since only the ICT sector has the capacity to 'extract' and 'implement' innovative knowledge from imported goods. This kind of spillover is linked to imitation and reverse engineering, which is particularly true in the consumer electronics sector. Knowledge used in the design and production of the innovative electronic equipment, if extracted and utilized in another country, can be used to enhance the productivity of its own electronics sector. Thus the resulting technical change is of the Hicks-neutral or output-augmenting character.

In contrast, improved imported intermediate inputs can affect the productivity of any sector that uses them in the production process.

In a production function context, i.e. equation (1.4)

$$\frac{Y}{\delta} = f(x_1\beta_1, \ldots, x_e\beta_e, x_n\beta_n) \tag{1.4}$$

Y is an output, δ is an output scaling factor or efficiency parameter, $x_1..x_n$ is a set of inputs, and $\beta_1..\beta_n$ is a set of efficiency parameters affecting inputs. Knowledge received with imported final innovative electronics and applied for improvement of domestic electronics' sector productivity affects scaling factor δ. Thus initial improvements in productivity within the ICT sector α_s in source country S will be linked via spillover equation (1.1) with the efficiency parameter δ in the production of electronics in the recipient country D.

Improvements in imported intermediate products can affect any sector importing innovative electronic goods. Therefore spillover equation (1.1) links productivity improvements in the production of exported intermediate inputs in source country *S* with efficiency parameter β_e for this intermediate input in the destination country *Dk*.

3.1 Single and multiple sources of innovation

We assume one source region creates more ICT-related innovative knowledge than any other region under consideration. This superiority of knowledge capital results in increases in productivity within the electronics sector. All countries trading electronic equipment with the source region have some share of this knowledge made available to them via imported ICT, and the exact benefit for the destination county (α'_{Dk}) is quantified by spillover equation (1.1).

There is however, a possible scenario where a region does not import any electronic equipment from the source country. That, according to theory and equation (1.1) does not allow for any innovation to spill-over to this country. But this country can in turn benefit (by α''_{Dk}) from other regions, which have accommodated innovative knowledge from a source region and are now ready to become an origin of spillover themselves. In this case, countries trading with the source country would become 'intermediate parties' between the source country and a third country, which need not have direct trade links with that source country. This is depicted in Figure 3.

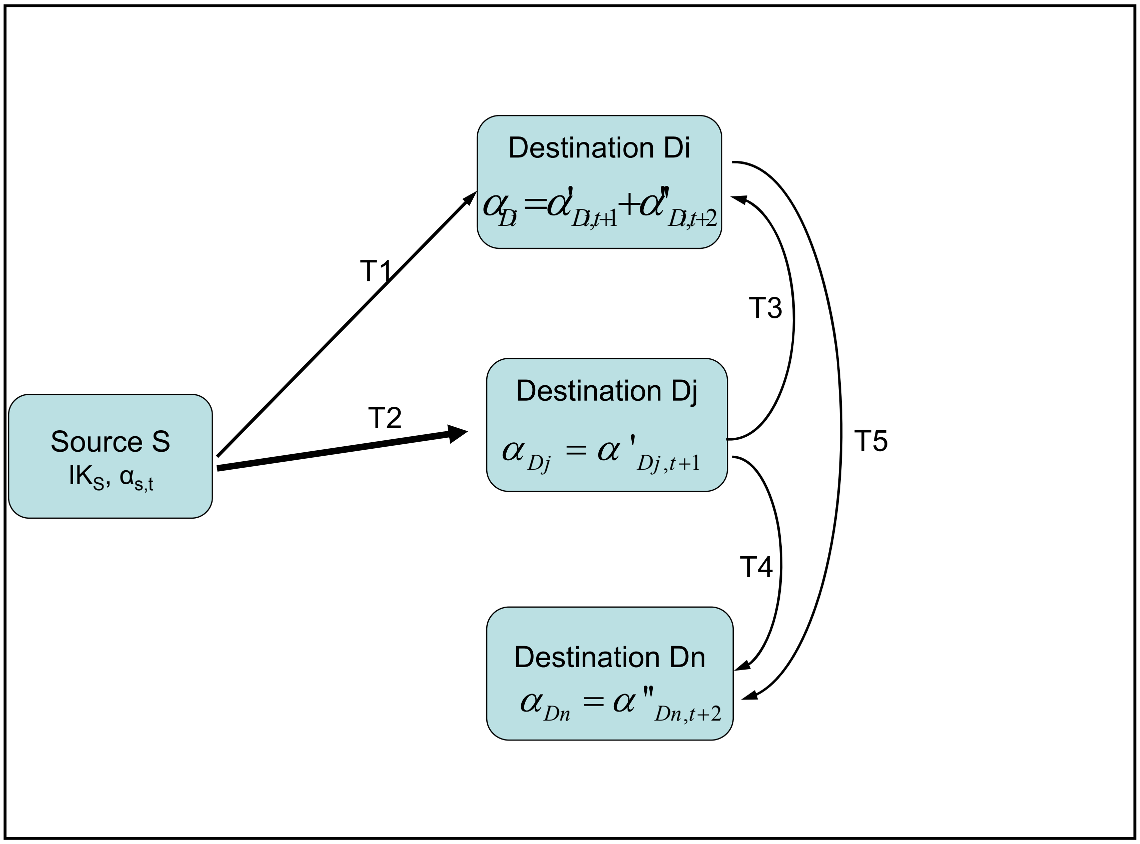


Figure 3. Destination region's productivity improvement α_{Dk} is a sum of productivity benefits spilling over from source country α'_{Dk} and from other destinations α''_{Dk}.

The source region (*S*) creates new Innovative Knowledge (*IK*) which if applied results in productivity improvement α_S. *IK* is transferred to destinations *Di* and *Dj* along trade paths *T1* and *T2*. Resulting productivity benefits $\alpha'_{Di,t+1}$ and $\alpha'_{Dj,t+1}$ for *Di* and *Dj* respectively from importing electronics from *S,* are a function of the initial productivity increase $\alpha_{S,t}$, the intensity of trade between *S* and *Di* and *Dj* ($E_{S,Di}$ and $E_{S,Dj}$ respectively) and absorption capacities of the destinations regions $\gamma_{S,Di}$ and $\gamma_{S,Dj}$ (Equation (1.5))

$$\begin{aligned}\alpha'_{Di,t+1} &= f(\alpha_{S,t}, E_{S,Di}, \gamma_{S,Di}) \\ \alpha'_{Dj,t+1} &= f(\alpha_{S,t}, E_{S,Dj}, \gamma_{S,Dj})\end{aligned} \tag{1.5}$$

The third destination *Dn* does not trade with *S*, so there is no direct vehicle for spillovers to occur. *Dn*, however, imports electronics from *Di* and *Dj*, which have already benefited from *IK* developed in *S*. Therefore *IK* can be transferred along trade paths *T4* and *T5* from *Di* and *Dj* into *Dn*. In this case there are multiple sources of innovative knowledge, and the final productivity benefit for *Dn* is a function of *Di*'s as well as *Dj*'s characteristics (Equation (1.6)).

$$\alpha''_{Dn,t+2} = f(\alpha'_{Di,t+1}, \alpha'_{Dj,t+1}, E_{Di,Dn}, E_{Dj,Dn}, \gamma_{Di,Dn}, \gamma_{Dj,Dn}) \tag{1.6}$$

The modeling of spillovers received from multiple sources is discussed below, separately for traded final products and for traded intermediate inputs.

Another possible scenario can be identified in the case of *Di*. *Di* benefits by $\alpha'_{Di,t+1}$ from trade with *S* thanks to the link *T1*. *Di* also imports electronics from *Dj*, with a possible 'additional' impact on the performance of *Di* (Equation (1.7)).

We assume that *Di* can benefit from trade with *Dj* on top of the benefits received from *S*, only if *Dj* can 'offer more' to *Di* than *Di* has already received from *S*. That is however, only if $\alpha'_{Dj} > \alpha'_{Di}$. Modeling of this formation is elaborated in section below.

$$\alpha''_{Di,t+2} = f(\alpha'_{Di,t+1,}\ \alpha'_{Dj,t+1}, E_{Dj,Di}, \gamma_{Dj,Di}) \tag{1.7}$$

3.2 Spillovers embodied in final products

To adopt equation (1.1) for spillovers transferred in electronic equipment traded internationally, the amount of knowledge transferred with innovative final electronic products (EF_{eSDk}) to a particular destination is proxied by the share of exports of ICT equipment to this destination (XF_{eSDk}) in total exports of ICT equipment from source country to all destinations (ΣXF_{eSDg}).

$$EF_{e,S,Dk} = \frac{XF_{e,S,Dk}}{\sum_{Dg} XF_{e,S,Dg}} \quad so \quad 0 \le EF_{e,S,Dk} \le 1 \quad and \quad \sum_{Dk} EF_{e,S,Dk} = 1 \tag{1.8}$$

This formula implies that all new knowledge is distributed among destination countries according to export shares of ICT equipment.

The corresponding spillover equation is then:

$$\delta'_{e,Dk} = EF_{e,S,Dk}^{\;1-\gamma_{e,S,Dk}} \alpha_{e,S} \tag{1.9}$$

This equation links output augmenting technical change in the electronics sector of destination D_i ($\delta'_{e,Dk}$) with productivity increases in the electronics sector in the source region $\alpha_{e,S}$.

Multiple source case

If a region imports electronics from multiple countries, it can benefit from trade links with countries which have experienced a higher productivity benefit, as a result of ICT spillovers, from the source region than the importing country itself. As depicted on Figure 3, trade link *T3* will be beneficial for *Di* only if $\alpha'_i < \alpha'_j$. Additionally, to avoid double counting of the benefits resulting from absorbing the same innovative knowledge from multiple countries, potential benefits for the importing country are to be share weighted by the importance of imports from particular sources in total imports of electronics by this destination. This scenario takes a special form of Equation (1.10) below:

$$\delta''_{e,Dj} = \sum_i (\theta M_{e,Di,Dj} \times EF_{e,Di,Dj}^{\;1-\gamma_{Di,Dj}} \times \max\{0, \alpha'_{Di} - \alpha'_{Dj}\}) \tag{1.10}$$

Where $\theta M_{e,Di,Dj}$ represents the share of imports of electronics by *Dj* from *Di* in total imports of electronics by *Dj*.

$$\theta M_{e,Di,Dj} = \frac{M_{e,Di,Dj}}{\sum_{Dk} M_{e,Dk,Dj}} \tag{1.11}$$

And $\max\{0, \alpha_{Di} - \alpha_{Dj}\}$ represents the difference in innovative knowledge adoption and implementation between regions *Di* and *Dj*.

3.3 Spillovers embodied in intermediate inputs

In the case of imported innovative electronic equipment used in production the relevant shares used for equation (1.1) are shares of imported electronics from Source region *S* used by sector *h* in destination *Di* ($M_{e,h,S}$) in total use of electronics by sector *h* in region *Di* ($V_{e,h,Di}$).

$$\theta MV_{e,h,S,Di} = \frac{M_{e,h,S}}{V_{e,h,Di}} \tag{1.12}$$

The corresponding spillover equation is:

$$\beta'_{e,h,Di} = \theta MV_{e,h,S,Di}{}^{1-\gamma_{S,Di}} * \alpha_S \tag{1.13}$$

Equation (1.13) links the efficiency of electronics used by sector j in destination *Di* ($\beta'_{e,h,Di}$) with improvements in the sector producing innovative electronics in region *S* (α_S).

Multiple sources case

Similarly as in the case of spillovers embodied in the final products, we assume that the region can benefit only from countries that possessed more innovative capacity from the Source country than the region of interest itself. And if a region receives spillovers from multiple sources, their value is a share weighted sum, with shares representing the importance of the exporting region in the importing region's composition of imports. Thus using shares (1.11) and (1.12) the relevant spillover equation becomes:

$$\beta''_{e,h,Di} = \sum_{i} \theta M_{e,Di,Dj} \times \theta MV_{e,h,Di,Dj}{}^{1-\gamma_{Di,Dj}} \times \max\{0, \alpha'_{Di} - \alpha'_{Dj}\}) \tag{1.14}$$

3. Methodology

3.4 The sample

The research is conducted for 19 APEC economies (Australia, New Zealand, China, Hong Kong, Japan, Korea, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam, Canada, USA, Mexico, Peru, Chile, Taiwan and Russia). Because the simulation utilises GTAP database which covers 87 countries, the remaining countries are aggregated into two regions: European Union (EU) and Rest of the World (ROW).

3.5 The model

The analytical framework used in this study is the recursive dynamic Computable General Equilibrium model. The dynamic capability of the employed model is achieved by conducting simulations using a specially modified version of the static CGE GTAP model within the RunMONASH environment. The original model, its modifications and the application within RunMONASH are described below.

The starting point for the final model used in this study is GTAP model version 6.2. In the model, the fictional regional household receives all income generated in the economy and net tax income revenue. Expenditures by this household are governed by an aggregate Cobb Douglas utility function across three broad categories: private consumption, government consumption and savings. Cost minimising producers supply the goods that are purchased by private and government consumption and saved for future consumption. Private consumption is governed by a non-homothetic Constant Difference of Elasticities utility function. Government consumption is governed by a Cobb Douglas function. The firms rent endowments from the regional household, which is the source of the regional income. Investment in the model is savings driven. The total savings from all of regions are collected in the 'global fund' and than allocated across regions according to each region's elasticity of rate of return on capital with respect to change in capital stock. In the static model investment does not change current period's production capacity, but it does affect total activity in the economy.

The model is supported by a version 6 database providing details for 87 regions and 57 sectors.

In order to allow for multi-period simulations we added an extension to the model that updates the stock of capital after each simulated period. This modification allows the subsequent period's simulation to take account of changes in the previous period, and therefore all simulation periods can be linked into the consequent cause-effect series of results.[1]

The model is simulated in the RunMONASH environment, which is tailored for carrying out forecasts and policy deviations with recursive dynamic models. Thanks to its user-friendly windows interface, RunMONASH allows for automated carrying out of a number of simulations for a set of years in sequence. It allows for constructing a base case and policy deviations (in response to additional policy shocks) from the base case. The model is solved on a year-to-year basis starting from initial data. For each subsequent year the staring point is the updated data produced by the previous simulation. Finally the software provides measures of deviations for all the variables in the model between the base case and policy scenario. For a more detailed description of RunMONASH see Harrison and Wittwer (2004).

3.6 The experiment

The experiment consists of two series of simulations and analysis of the deviations between results which each series yields. Each series of simulations is carried over the three periods of time of the length one year each. The simulations begin in year Y0 i.e. when the initial database reflecting global economy in year 2004 is used. Each period of simulation produces set of results for years Y1, Y2 and Y3. The first series of simulations (base case) reflects the development of the APEC economies as a result of the imposed

[1] The author thanks Peter Dixon and Maureen Rimmer for assistance with the dynamic coding.

shock to the US economy, but in the absence of spillover effects. The shock assumes 3 percent improvement in productivity of the electronic equipment sector in the USA in year Y0. The second series of simulations (policy scenario) allows not only for improvement in productivity of electronics sector in the USA, but also allows for other countries to benefit from spillovers from US electronics in the subsequent periods. In the destination regions the spillovers received directly form the USA become productive in Y1, therefore they effect are reflected by results in Y2. The spillovers diffused via intermediate countries need another period to be utilised in Y2, therefore they are reflected in results for Y3. The paths for the two series of simulations are schematically graphed in Figure 3.1.

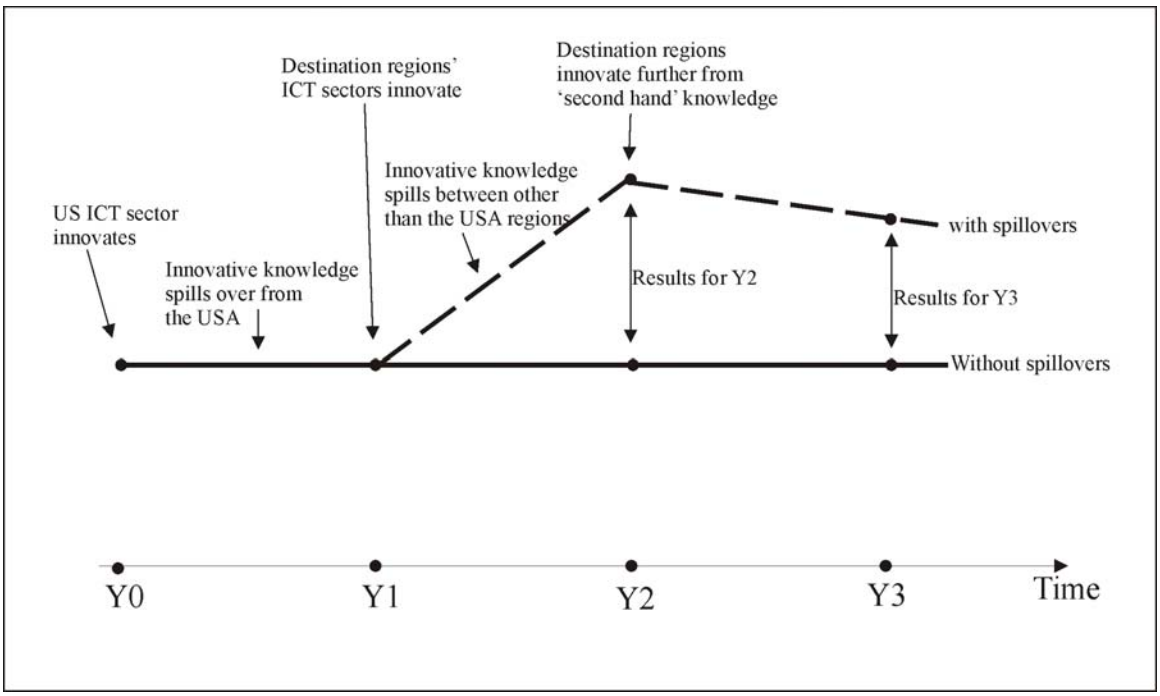


Figure 3.1. Graphical representation of the base case and policy scenario.

Firstly equations (1.9) and (1.13) are estimated to calculate direct effects of the initial productivity improvement in source region $\alpha_{S,y0}$ on destination regions' output augmenting tech change for the ICT sector ($\delta'_{e,Di,y1}$) and input augmenting tech change for all sectors ($\beta'_{e,h,Di,y1}$).

$$\delta'_{e,Di,y1} = EF_{e,S,Di}^{\;1-\gamma_{e,S,Di}} * \alpha_{e,S,y0} \tag{1.9}$$

$$\beta'_{e,h,Di,y1} = \theta MV_{e,j,S,Di}^{\;1-\gamma_{S,Di}} * \alpha_{S,y0} \tag{1.13}$$

Secondly, we use those initial estimates of $\alpha'_{Di,y1}$ and equations (1.10) and (1.14) to estimate secondary spillover effects resulting from the follow-up of innovative knowledge within the destination group of regions. This is again completed for output augmenting tech change ($\delta''_{e,Dj,y2}$) and input augmenting tech change ($\beta''_{e,h,Dj,y2}$).

$$\delta''_{e,Dj,y2} = \sum_{D=j}^{n} (\theta M_{e,Dj,Di} * EF_{e,Dj,Di}^{\;1-\gamma_{Dj,Di}} * \max\{0, \alpha'_{Dj,y1} - \alpha'_{Di,y1}\}) \tag{1.10}$$

$$\beta''_{e,h,Dj,y2} = \sum_{D=j}^{n} (\theta M_{e,Dj,Di} * \theta MV_{e,Dj,Di}^{\;1-\gamma_{Dj,Di}} * \max\{0, \alpha'_{Dj,y1} - \alpha'_{Di,y1}\}) \tag{1.14}$$

4 Results

The reported results are the deviations between base simulation (without spillovers effect) and policy simulation (with spillovers effect). Therefore the results reported below provide the measure of benefits for the APEC member economies resulting from embodied electronic equipment spillovers, *cateris paribus*.

We report results for second and third period of the simulations (Y2 and Y3) only. The results for first year Y1 are omitted because there is no deviation between base case and policy scenario for this year. This lack of divergence for results in Y1 exists because it takes one period for innovative knowledge developed in the USA to diffuse and become productive in other regions, hence the paths of base case and policy case *begin* to diverge after Y1 and the first differentiated results are available for Y2 (graph 3.1).

This section is organized in two parts. The first part analyses spillover mechanisms by evaluating how an initial perturbation in the productivity of the electronics sector in the USA impacts upon the productivity of electronics sectors in other countries. The second part looks at the macro- and microeconomic effects of the spillovers at the global and at the regional level.

Results for aggregated regions: the EU and ROW should be treated with caution. Although the European Union is an economic agglomeration into some extent, and it may behave as an economic identity in some situations, ROW is an artificial aggregation of countries which do not exhibit any form of unification, neither economical nor geographical. Therefore its behavior in the model would be difficult to interpret as representative for any for the aggregated countries.

4.1 Spillovers diffusion

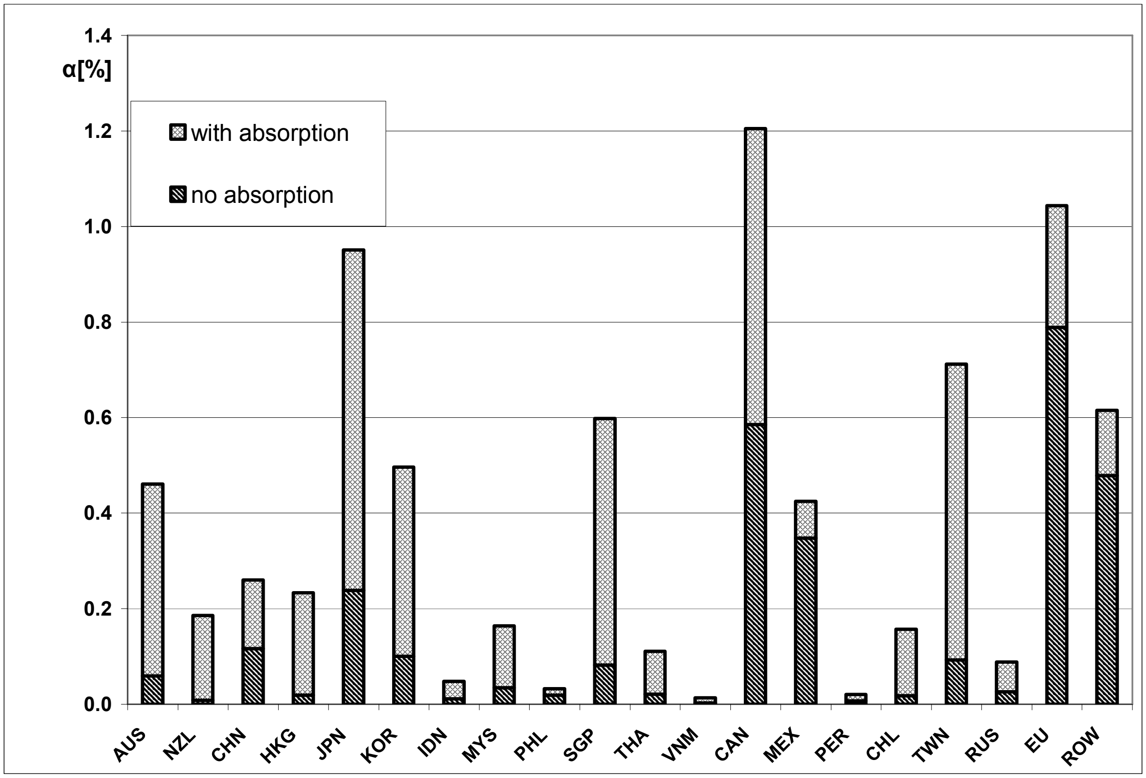
In this section we look firstly at the absorption capacity parameter and at the value of the spillover coefficient q. Than we analyze how absorption capacity impacts productivity benefits in the destination regions. Finally we look at the spillovers transferred directly from the USA and from intermediate countries.

Spillover coefficient q

The spillover coefficient q controls the extent to which the destination region can utilize knowledge available through international trade. The spillover coefficient q is a function of the absorption capacity γ and the volume of trade in electronics between the source and the destination region. The value of q is calculated according to equations 1.2 and 1.3. The full matrix of absorption capacities γ is in Table 7.1. Import and export shares of electronic equipment are reported in Table 7.5 and 7.6 in Appendix A.

Absorption capacity γ

The total productivity benefits received directly from the USA as well as from intermediate countries are pictured in graph 5.1 and in Table 7.2 in Appendix A. The graph shows productivity benefits resulting from embodied spillovers *with no absorption effect* allowed (bottom part of each bar, γ=0 in Equation 1.1), and additional gains *with an absorption effect* allowed (upper part of each bar, γ takes its parametrical values).

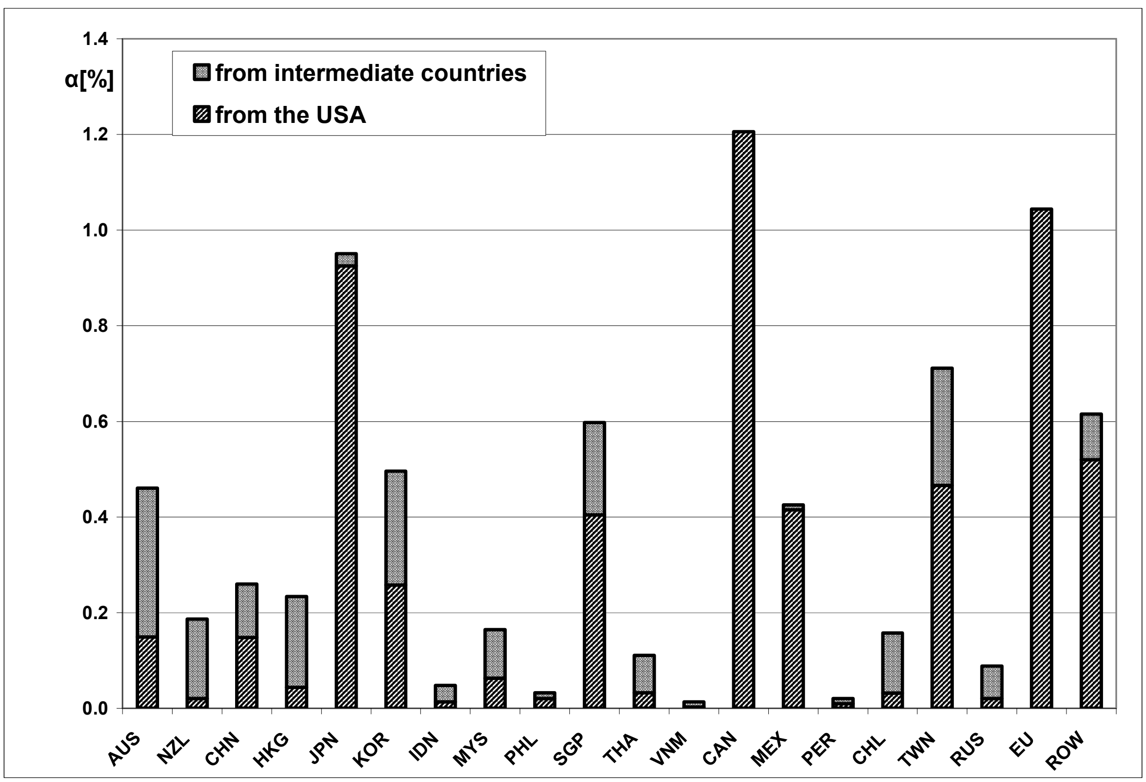


Graph 5.1 ICT sector productivity benefits with and without absorption effect.

When the absorption effect is switched off, the resulting benefits (the ‘base level’ benefits) are plainly a function of the amount of trade between the two countries. The amplification effect of the absorption capacity for each region depends on its ICT-related characteristics and varies from region to region. For example, China’s base level improvement in ICT sector productivity is 0.12 percent and Australia’s is 0.06 percent. Allowing for absorption capacity to magnify benefits, the resulting productivity improvements for China and Australia are 0.14 and 0.40 percent respectively. This occurs because absorption capacity for China is lower than for Australia. Therefore Australia, even though importing less innovative electronics than China, can benefit from trade to a higher extent due to its greater ability to extract embodied innovative knowledge from imported electronics. Another interesting example is Mexico and Singapore. Their respective base level improvements in ICT sector productivities are 0.35 percent for Mexico and 0.08 percent for Singapore. Taking absorptive ability into account changes the effective improvement in productivity of the ICT sector in Singapore to 0.59 percent, a staggering 650 percent increase, whereas Mexico improves by roughly 20 percent to the value of 0.42 percent. Japan, having the highest absorption capacity in the sample of the destination regions, improves its initial spillover benefit from 0.23 percent to 0.95 percent.

Direct and indirect spillovers

Each region can receive spillovers directly from the USA (δ') and indirectly from intermediate regions (δ''). The productivity improvements in electronics sector received via these two mechanisms are pictured on Graph 5.2 and in Table 7.2 in Appendix A. Detailed disaggregation of spillovers received from intermediate countries is collected in Tables 7.3 and 7.4 in Appendix A.



Graph 5.2 Productivity benefits from US and other intermediate regions.

Some regions benefit entirely (Canada) or almost entirely (Mexico, Japan, EU) from trade with the USA. Canada and Mexico, being close trade partners of the USA, together import a third of US exports of electronics, thus there is a significant direct transfer of innovative knowledge to these two countries. Canada, which imports 72 percent of electronics from the USA (see Table 7.6 in Appendix A), receives the most out of the spillovers directly from the USA, therefore there are no other regions with higher productivity benefit, in the following period, for Canada to benefit from. Mexico receives additional minor spillovers from the aggregated regions EU and ROW. Australia and Hong Kong benefit more from trade with other countries than from trade with the USA. Australia's main source of innovation is the EU. A 0.27 percent improvement in productivity in ICT sector in Australia is attributed to the spillovers received with imports from the EU, followed by the USA (0.15 percent) and Japan (0.012). For Hong Kong, the productivity rise is attributable mostly to the EU (0.10 percent), China (0.05) and the USA (0.04). China's 0.26 percent improvement in ICT sector performance is attributable 0.15 percent to the USA, 0.05 percent to the EU and 0.04 percent to Japan.

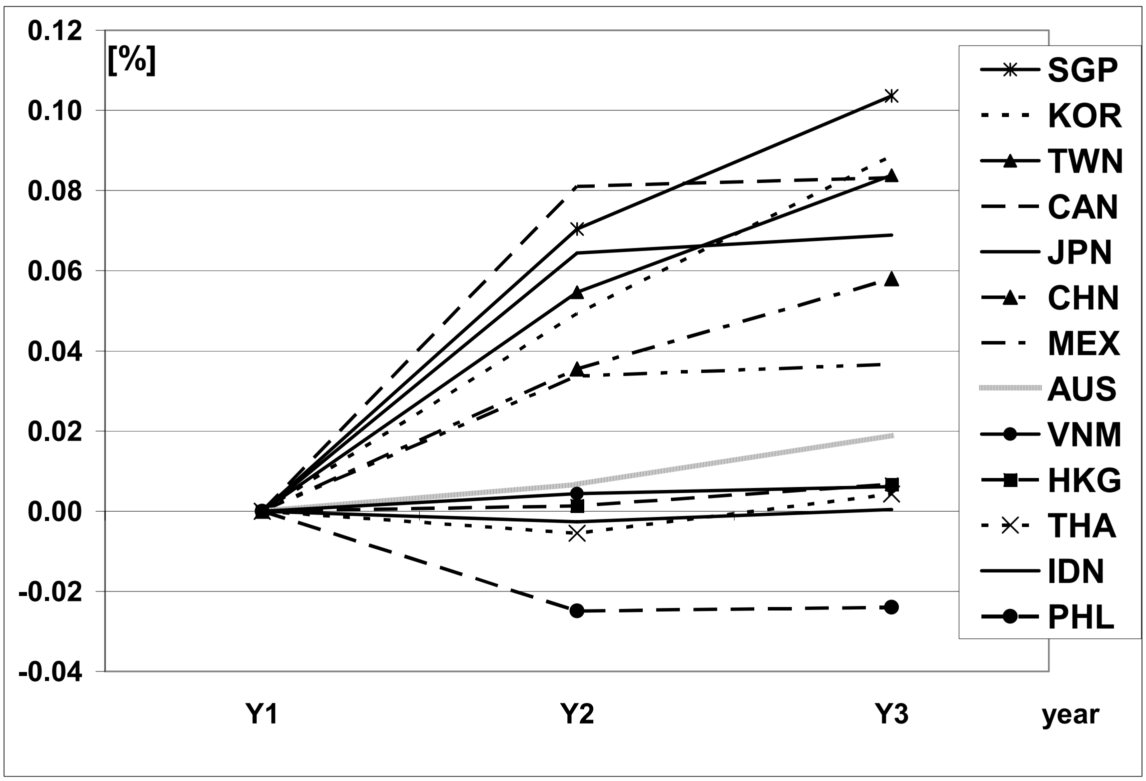
4.2 Macro- and micro effects

We can distinguish three stages of spillovers diffusion within the sample group of regions. In the first stage (year one, Y1) there is an initial perturbation in productivity of ICT sector in the USA. In the second stage (year two, Y2), the innovative knowledge embodied in traded electronics is transferred to the destination regions and leads to productivity improvements in these sectors. During the third stage (year three, Y3), the countries which have recently absorbed new knowledge via trade with the USA in second stage, become themselves the sources of spillovers and pass on innovative knowledge when exporting electronic equipment.

In this section we analyze how the technology transferred via spillovers affect regional income, than we look at the changing pattern of final demand and the reallocation of global investment. Finally we look at the regional composition of international trade.

4.2.1 Change in GDP

As a result of technological advancement there is more output produced from the same amount of inputs, which leads to an increase in real GDP. Those changes are depicted on graph 5.3 below.



Graph 5.3 Cumulative changes in real GDP by country

Change in GDP

As a result of direct spillovers from the USA the greatest initial increase in GDP is experienced by Canada (0.08 percent) followed by Singapore (0.07 percent), Japan (0.06 percent), Taiwan (0.055 percent) and Korea (0.05 percent). A period later however, when indirect spillovers from other countries take effect the situation changes. Singapore's real GDP increases by another 0.03 percent to a cumulative change of 0.104 percent. Canada's and Japan's GDP level off and do not change significantly. Taiwan and Korea keep experiencing growth in GDP to total change of 0.084 percent and 0.089 percent respectively.

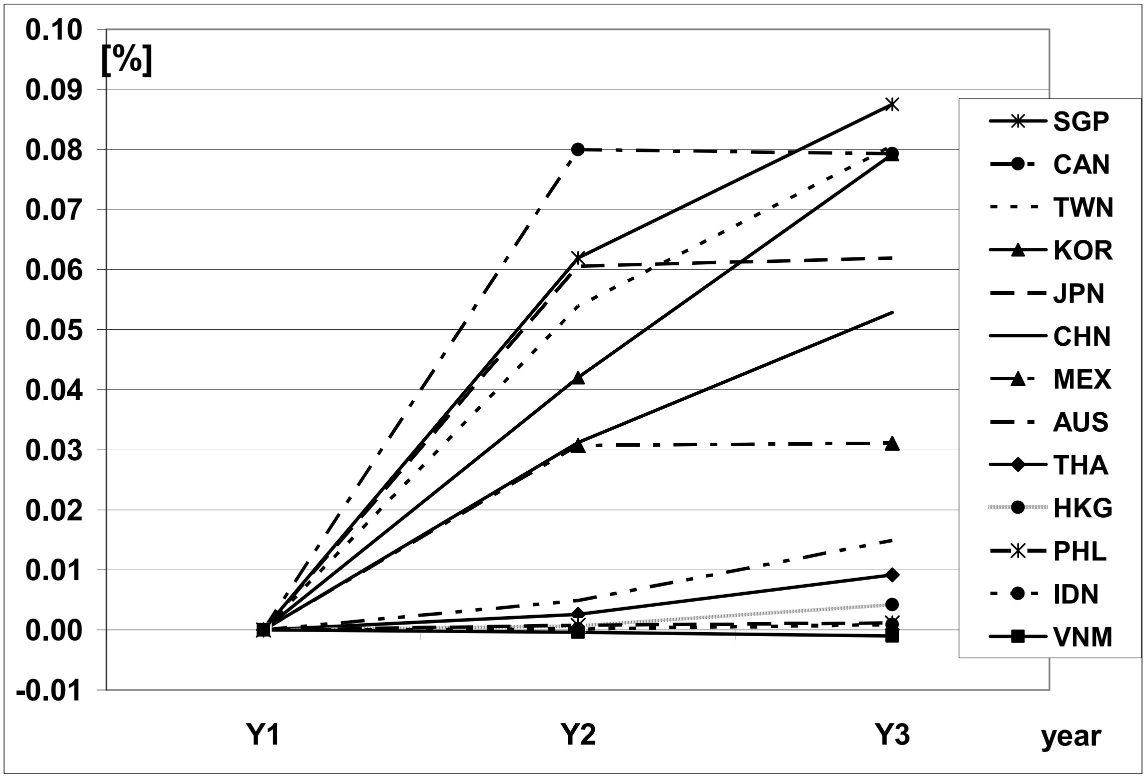
At the lower end Philippines GDP goes down by 0.025 percent in the second stage and than levels off. Thailand first loses 0.006 percent of the GDP in the second period, but than gains 0.008 percent in the third period to experience positive increase by 0.004 percent.

How can the movements in the real GDP be explained? Because the simulation is evaluated dynamically, with the capital stock free to adjust over time, the change in GDP can be due to: (i) change in capital stock resulting from previous year investments, (ii) technical change resulting from spillover effect and (iii) indirect taxes payments resulting from change in the composition of the regional economy.

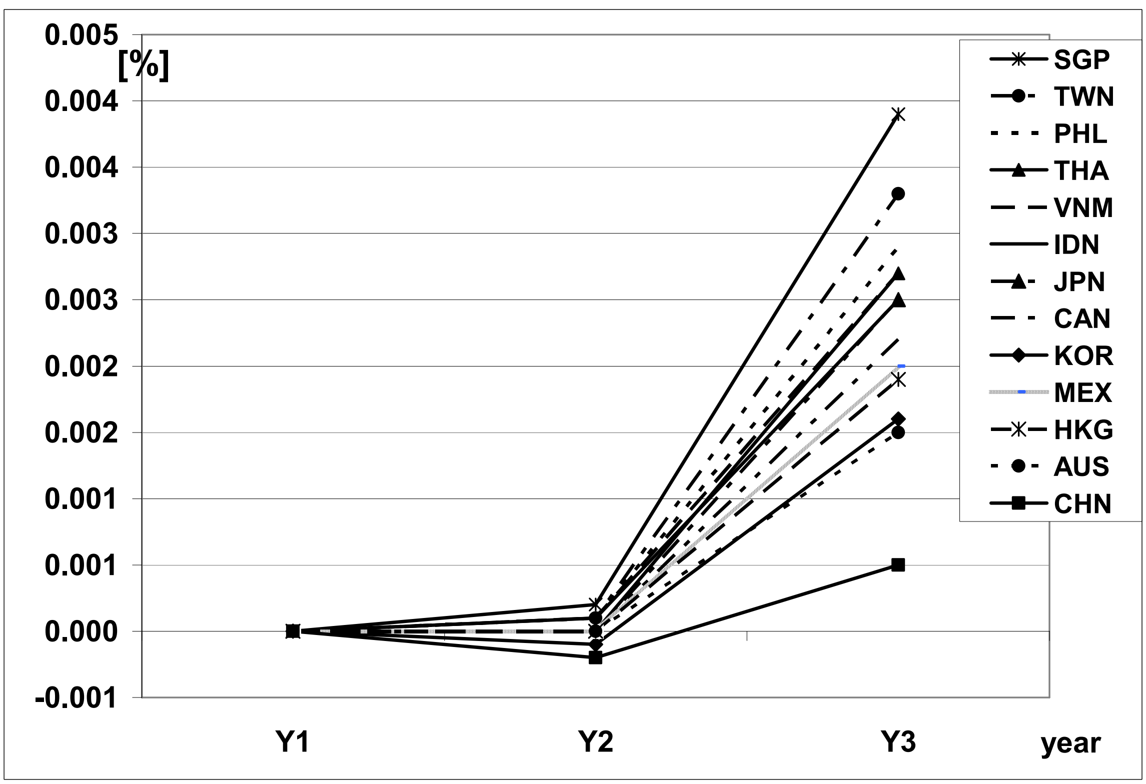
Contribution of technology to change in GDP

Technology as a country specific variable is the overall, region-wide improvement in productivity. Because in this simulation the only sector experiencing technical change is electronics equipment, the change in regional technology is equal to the electronics sector productivity improvement weighed by the share of output of this sector in regional GDP (see Table 7.7 in Appendix A).

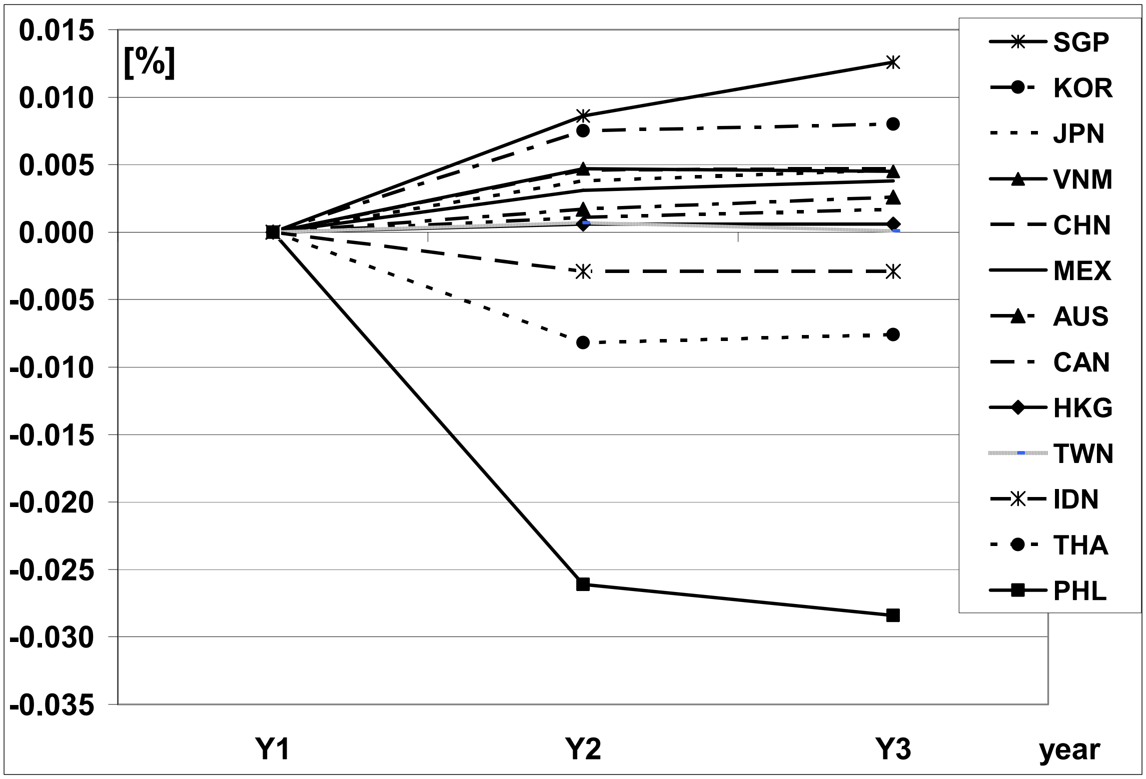
Decomposition of the change in real GDP into changes due to movement in capital, technology and taxes is detailed in Table 7.7 in Appendix A, and pictured on graphs 5.4 to 5.6 below.



Graph 5.4 Cumulative changes in GDP due to technical change



Graph 5.5 Cumulative changes in GDP due to change in capital stock



Graph 5.6 Cumulative changes in GDP due to change in indirect taxes

The graphs for individual countries picturing changes in GDP and its constituents are collected in graphs 7.8 in Appendix A.

Comparing the contributions of the technical change, taxes and capital to the overall change in GDP we can recognize technology as having the greatest impact on the change in GDP. Analyzing graphs 7.8 (Appendix A) we find that the group of countries experiencing the highest growth in GDP (Singapore, Canada, Taiwan, Korea, Japan, China, Mexico and Australia) also experience high technological improvement. In fact, in those countries 90 to 100 percent of growth in real GDP is due to technical change in the ICT sector (see Table 7.9 in Appendix A).

Contribution of taxes to change in GDP

Decomposition of tax component of the change in real GDP due to different taxes accounted for in the model is collected in Table 7.10 in Appendix A. For some of the countries in the sample the change in GDP is mainly due to the change in indirect tax payments. For example Peru's growth in GDP is almost identical as its change in indirect tax receipts (see graph 7.8). For Peru the taxes which provided the highest growths in revenue are tax on private consumption of domestic commodities and output tax (see Table 7.10 in Appendix A). The Philippines experience similar pattern but in different direction. The Philippines GDP decline is explained almost completely by a decrease in tax revenue (graph 7.8). In this case the decline is due to a drop in output tax (table 7.10) on electronics sector. The contracting by almost 3 percent (column 2 Table 7.15) electronics sector in the Philippines is taxed with high 22 percent rate, hence the tax revenue for GDP from this sector declines significantly.

The remaining countries do not exhibit a single explanatory factor for the change in their GDP. For example Thailand in the second year of the simulation experiences decline in tax revenue and increase in technology, with the latter overweighting the tax component and leading to decrease in GDP (see graph 7.8). In the third year however, even though the tax revenue remains low, the second wave of technology transfer contributes to the growth in GDP strongly enough to provide the country with positive GDP growth by the end of the period.

4.2.2 Final demand

We analyze the change in GDP from the expenditure side as a function of the sum of final demands less the imports (C+I+G+X-M). The changes in the GDP and its constituents are detailed on graphs 7.9 in Appendix A.

Private and government expenditure

Each region's nominal private consumption *yp*, government nominal consumption *yg*, and savings *ysave* are determined by maximizing per capital Cobb-Douglas utility function. The nominal regional income *y* is exhausted between the components of final demand, which change according to level of consumption and elasticity of cost wrt to utility *uelas*, and elasticity of cost wrt utility from private consumption *uepriv*:

$$
\begin{aligned}
&yg = y + uelas \\
&ysave = y + uelas \\
&yp = y + uelas - uepriv
\end{aligned}
\tag{1.15}
$$

Values for *y, yg, yp, ysave, uelas* and *uepriv* are detailed in Table 7.11 in Appendix A. The changes in real consumption expenditures are attributed to the differential impacts of movements in aggregate government purchase price index *pgov* (column 1 in Table 7.12 in Appendix A) and the consumer price index *ppriv* (column 2 in Table 7.12 in Appendix A). The divergence in price indices is caused by the diverse purchase patterns of private and public households. The real private and public expenditure is proxied by *up* and *ug* – utility from private and public expenditure (column 4 and 5 in Table 7.12 in Appendix A). Since the model's regional income in its calculation does not include imports and exports, its value is about the half of regional GDP. To adjust the changes in private and government consumption calculated as the shares of regional income, we need to additionally weight them by the shares of private and government expenditure in GDP (column 1 in Table 7.13 in Appendix A). The resulting changes in private and government consumption (columns 2 and 3 Table 7.13 in Appendix A) are used for the calculation of GDP from the expenditure side.

4.2.3 Savings and investment

The increase in regional income *y* leads to increase in the regional savings determined by equation (1.15). The savings however, do not equal investment at the regional level. Savings are accumulated into the 'global saving fund'. This global saving is than exhaustively distributed across regions as investments in the proportions described below. In the GTAP model the regional investment allocation is governed by the current and the expected rates of return – *rorc(r)* and *rore(r)*. The change in the current rate of return *rorc*, is expressed as the ratio of gross to the net rate of return *GRNETR(r)*, multiplied by the difference in percentage changes in rental price of capital, *rental(r)* and price of new capital goods, *pcgds(r)* [2] (see Table 7.14 in Attachment B).

Rental, wage and pcgds in second period, Y2

In the second period, as an effect of direct spillovers from the USA, the countries whose electronics sectors benefited the most are Canada, EU and Japan (see Table 7.2 and graph 5.2) . As a result of improved efficiency the supply price of electronics in those countries fall by 1.29 percent in Canada, 1.13 percent in the EU and 1.04 percent in Japan (for prices for all regions see column 1 in Table 7.15). The changes in supply prices of electronics impact upon the global composition of production of electronics. Canada, EU and Japan, having received the greatest productivity benefits experience decrease in regional price of ICT relative to global price index of ICT, and hence increase in output of the electronics equipment sector. All other regions reduce their domestic output and source more ICT from Canada, the EU and Japan. The changes in output of electronic sectors are detailed in column 2 in Table 7.15. Resulting change in demand for value added (column 3, *qva(r)*) is equal to the change in sectoral output adjusted for improved productivity. Changes in demands for components of value added in turn are equal to change in *qva(r)* adjusted for secondary substitution effect resulting from changes in prices (columns 4 and 5 in Table 7.15). These almost identical changes in demands for capital and labor differ in terms of changes for quantities demanded[3]. For example in Australia output of electronics sector decreases by 1.68 percent. Due to improved productivity of ICT sector (0.15 percent), its demand for inputs, including value added decreases even more by 1.84 percent, and demands for capital and labor fall by 1.80 and -1.85 percent respectively. Because in Australia capital makes only 27 percent of ICT sector inputs, the resulting decrease in quantities demanded are 0.01 for labor and 0.005 for capital. The consequence of laying off more labor than capital in the electronics sector results in a more drastic decrease in wages (by 0.009 percent) than rentals (by 0.0002

[2] Current rate of return in levels: RORC(r)=RENTAL(r)/PCGDS(r)-DEPR(r), and in percentage change form: rorc(r)=GRNETR(r)*(rental(r)-pcgds(r))

[3] change calculates as q_qfe(i,j,r)=VFA(i,j,r)*qfe(i,j,r)/[**sum**(g,,**sum**(k,VFA(g,k,r)))]

percent - columns 9 and 10), or adjusting for the price index for private consumption, freeing more labor than capital leads to a higher increase in the real return to capital than in the real wage by (0.021 and 0.013 percent respectively - columns 12 and 13).

In general, the rental price for capital decreases the most in regions whose contracting electronics sectors are capital intensive (see column 6 in Table 7.15). The countries whose ICT sectors utilize a high share of capital in their manufacturing e.g. the Philippines (94 percent), Thailand (73 percent), Mexico (69 percent) and Peru (95 percent) experience negative growth in their real rental price (column 12).

The price of capital goods, *pcgds(r)* is determined as the supply price of output of the capital goods sector *CGDS(r)*, and is a function of prices of inputs utilized by this sector. The *CGDS(r)* sector does not use any endowments. The main impacts on *pcgds(r)* come from electronics intermediate inputs. Therefore the price of new capital goods, *pcgds(r)* depends mainly on the price index of domestically produced electronics *pfd(r)* (column 15), the price index for imported electronics *pfm(r)* (column 16) the share of electronics used in assembling new investment goods (column 17) and the share of imported electronics in the overall electronics input into the *CGDS(r)* sector.

Rental, wage and pcgds in third period, Y3

In the third period of the simulation *Y3*, there is a further diffusion of the innovative knowledge from the USA via intermediate countries. This 'second hand' knowledge phenomenon allows countries which do not have major trade linkages with the USA to benefit from innovations developed there. From graph 5.2 and Table 7.2 we see that the regions which scored the most in the previous period, Japan, Canada and EU do not benefit significantly in this year of the simulation, and the regions which benefit the most from intermediate sources of innovation are Australia ($\delta''=0.31$), Taiwan ($\delta''=0.25$), Korea ($\delta''=0.24$) and Singapore ($\delta''=0.19$). Singapore's supply price of ICT equipment falls by 0.20 percent in Y3, which leads to a 0.79 percent cumulative decrease (column 1 in Table 7.16 and 7.17) by this time. As a result the output of the ICT sector in Singapore increases by 0.90 percent (column 2 in Table 7.16), which more than recompenses the 0.85 percent decrease in output in the previous year and yields 0.05 percent cumulative improvement in the output(column in Table 7.17). In effect the rental price of capital increases by 0.051 percent (0.15 cumulative, column 9) and the price of new investment goods remains unchanged from its previous level, down at 0.13 percent below its initial value. The current rate of return increases by further 0.06 percent (0.36 percent cumulative, column 19). Taiwan's decrease in supply price of electronic equipment by 0.24 percent (-0.87 percent cumulative, column 1), results in increase of output of ICT sector by 1.05 percent (0.63 percent cumulative, column 2). This makes Singapore and Taiwan the only two countries which, due to the 'second round' of spillover distribution, made up for losses in production of ICT in the previous period.

Saving and investment

The global savings *globalsave*, increases by 0.14 and 0.15 percent in the second Y2, and third Y3 period of the simulation. These changes translate directly into changes in the global investment fund *globalcgds.* The investments are placed in the regions where they will receive the highest return assuming that the expected rate of return *rore* declines with positive additions to end of period capital stock KE(r). Because in the dynamic simulation the capital stocks are moving between the periods they also affect *rore(r)*[4]. The investments are distributed to equalize changes in expected rates of return across regions. Percentage changes in *kb(r)* and *ke(r)* and resulting movements in regional investments *qcgds(r)* are detailed in Table 7.14 in Appendix A. Note that it takes one period for the destination regions to begin to capitalize on the received spillovers, and the first movement in capital is in second period. The change in start-of-period capital stock *kb(r)*, is equal to the previous year change in end-of-period capital stock *ke(r),* so *kb(r)* does not change until the third period. In this simulation elasticity of RORE(r) wrt KE(r) is relatively large (RF(r)=50), which implies that the supply of new capital goods is not very sensitive to changes in the expected rates of return.

Japan Singapore and Taiwan having the highest change in *rorc(r)* (0.27, 0.30 and 0.32 percent respectively) attract the greatest increase in their investments and resulting end-of-period capital stock *ke(r)* (0.007 percent for Japan and 0.008 percent for Singapore and

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[4] Expected rate of return in levels: RORE(r)=RORC(r)*KE(r)/KB(r)^RF, and in percentage change form: rore(r)=rorc(r)-RF(ke(r)-kb(r)), where RF is exogenous elasticity of RORE(r) wrt KE(r).

Taiwan). Japan however, needs more investment to change its capital stock because its ratio of gross regional investments to end of period capital stock (*INVKER(r)* row 2 in Table 7.14 in Appendix A)) is relatively lower than for Singapore or Taiwan.

At the lower end the USA and Peru experience the lowest increase in rates of return *rorc(r)*: 0.02 percent. To attain the same change in *ke(r)* Peru needs higher increase in investments due to its lower INKER ratio, which is equal to 0.007 percent for Peru, and 0.08 percent for the USA (Table 7.14 in Appendix A).

Looking at the savings and investments in their dollar value terms gives richer picture of the global change of investment allocation. Table 7.18 in Appendix A gives the values for regional savings (column 1), regional net investments (column 2) and the difference between regional savings and investments (column 3). These 'saving gaps' are also pictured on graph 7.10 in Appendix A. Staggering is saving gap in the USA, where investments are almost twice as much as savings. Given the size of US economy, 95 percent of global 'saving deficit' is attributed to this single region, hence it is offset by almost entire global 'saving surplus'. Other countries which invest more than save are: Hong Kong, Philippines, Singapore, Vietnam and Peru. China contributes the most into the global surplus of savings (27 percent) followed by Japan (14 percent) and Malaysia (12 percent).

This picture changes slightly over time. US investment grows faster than savings, which leads to increase in the saving gap (or decrease taking negative sign into account). At the other end of the spectrum, China's savings grow faster than its investment leading to increase in the discrepancy between saved and invested amount. Graph 7.11 in Appendix A pictures changes in the saving gap for selected regions. The difference between saving and investment is calculated as a share of the savings and normalized to unity in the initial year. Positive sign indicates saving surplus and negative sign denote saving deficit.

4.2.4 Composition of international trade

In effect of the international electronic equipment spillovers the quantity index of global exports (*qxwwld*) increases by 0.023 percent in Y2, and decreases slightly by 0.0002 (0.0227 cumulative) percent in the next period, Y3. Tthe price index for global exports (*pxwwld*) falls by 0.098 percent in Y2 and further 0.007 (-0.105 cumulative) percent in Y3, what leads to reduction in global value of exports by 0.072 percent in Y2 and 0.007 percent (-0.08 cumulative) in Y3. Among individual commodities only the global price of electronic equipment decreases relatively to *pxwwld* by -0.53 percent. The global price of food grows by 0.10 percent, manufacturing increase by 0.08 percent, services go up by 0.09 percent and price index for motor vehicles and financial services grows by 0.07 and 0.06 percent respectively (Table 7.20 in Appendix A).

To identify forces behind these changes we analyze regional terms of trade (TOT) effects. We adopt decomposition à la McDougall (1993) and applied for example in Gouranga and Powell (2000). Each region's change in TOT, *tot(r),* is equal to difference of changes in price indexes for exports and imports:

$$tot(r) = px(\bullet, r) - pm(\bullet, r) \tag{1.16}$$

Equation (1.16), can be rewritten (McDougall 1993) as:

$$\begin{aligned} tot(r) = &\sum_i (EXP\_SHR(i,r) - IMP\_SHR(i,r)) \times (pw(i) - pxwwld) \\ &+ \sum_i EXP\_SHR(i,r) \times (pxw(i,r) - pw(i)) \\ &- \sum_i IMP\_SHR(i,r) \times (piw(i,r) - pw(i)) \end{aligned} \tag{1.17}$$

Where *pw(i)* is the world price index for supply of good *i*, *pxw(i)* and *piw(i)* are the percentage changes of the export and import prices of good *i* in region *r*.

The first part of the equation (1.17) ,*Wpe(r)*, represents the change in *tot(r)* due to change in the world price of commodity *i* relative to the global price index of exports. The second expression in equation (1.17), *Xpe(r)*, represents the change in *tot(r)* owned to the difference in changes in price index for exported commodity *i* in region *r* relative to the change in global price index for commodity *i*. The last term of (1.17), *Mpe(r)*, picks up the change in *tot(r)* related to relative changes in price index of imported *i* in region *r* and global price index for *i*. The values for *tot(r)*, *Wpe(r)*, *Xpe(r)* and *Mpe(r)* are detailed in Table 7.19 in Appendix A.

The greatest TOT deterioration by 0.11 percent experiences Japan. (column 1 in Table 7.19). This decrease is mainly due to drop in *Wpe(r)* by 0.085 percent (column 2) and modest decrease in *Xpe(r)* by 0.012 (column 3). *Mpe(r)* increases slightly by 0.013 percent (column 4). The reason for *Wpe(r)* to increase is Japan being nett exporter of electronics (see Table 7.20 in Appendix A), what combined with high drop in price for electronics causes negative effect on *tot(r)*. The decrease in *Xpe(r)* is caused by Japan's export price of electronics (Table 5.22 in Appendix A) being lower than world price for electronics (Table 7.20 in Appendix A). The difference in prices is in turn the effect of high productivity improvement in ICT sector as the result of the spillover effect (section 5.1). The further deterioration of tot(r) by *Mpe(r)* is the effect of Japan's price indexes for imported goods are higher than average price for these goods (Table 5.22 in Appendix A).

The greatest improvement in TOT takes place in Chile (0.10 percent, Table 7.18). This gain is mainly due to *Wpe(r)* growing by 0.099 percent. *Wpe(r)* in Chile grows because this country is a nett importer of electronics, what combined with decrease in the real global price for electronic equipment has positive effect on *tot(r)*.

Since the effect of *Wpe(r)* has the main impact on *tot(r)* in all regions, we can generalize that countries which are nett importers of electronic equipment experience improvement in their terms of trade, and regions in which TOT decline appear to be nett exporters of electronics.

5 Summary and Conclusion

In this paper we analysed the embodied international electronic equipment spillovers within the GTAP framework. The analysis was set up in the model representing 19 APEC economies and two aggregated regions trading six commodities. The spillovers embedded in the electronic equipment were transferred across the borders, and they had capacity to impact upon the productivity of the recipient's ICT sector. The amount of spillovers transferred to a region was dependent on its bilateral trade linkages with other regions, and the extent into which recipient region could utilize available knowledge was dependent on its absorption capacity – new set of parameters introduced to the model.

The experiment consisted of two series of dynamically linked simulations. Both series started with exogenous 3% shock to productivity of the electronic equipment sector in the USA. In one series the spillover linkages were active, whereas in the other series the spillover effect was not allowed. The simulations were carried over the three year/period time: one period was allowed for the transfer of spillovers directly from the USA, and another period for the further diffusion of the innovative knowledge.

To obtain a measure of the spillovers impact upon the economies, we analyse the differences between the results for the two series of the simulations.

The improvements in destinations' regions productivity of electronic equipment sectors have been a function of the volume of imported innovative electronics as well as regional ability to 'extract' and utilize innovative knowledge. This absorption capability was found to be able to amplify 'productivity return' on imported innovative electronic equipment. Some of the regions' improvements in ICT productivity were based on high volume of imported innovative electronics carrying innovation; some regions were improving their productivity 'extracting' more innovative knowledge from their imports than others (Singapore); and some regions are able to benefit both ways (Canada).

Countries which have close economic ties with the USA benefited directly from the source of innovation (Canada or Mexico), whereas other regions have to wait longer for the innovations to reach them via intermediate countries (Australia, Hong Kong). This more timely access to innovation and consequent benefits creates an advantage in the form of earlier growth and investment.

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7 Appendix A: Tables and Graphs

Table 7.1. Absorption capacity γ and Networked Readiness Index (NRI)

NRI		AUS	NZL	CHN	HKG	JPN	KOR	IDN	MYS	PHL	SGP	THA	VNM	CAN	USA	MEX	PER	CHL	TWN	RUS	EU	ROW
5.24	**AUS**	1.00	1.00	1.00	1.00	0.45	0.84	1.00	1.00	1.00	0.54	1.00	1.00	0.55	0.24	1.00	1.00	1.00	0.51	1.00	1.00	1.00
4.93	**NZL**	0.73	1.00	1.00	0.86	0.33	0.62	1.00	1.00	1.00	0.40	1.00	1.00	0.41	0.18	1.00	1.00	1.00	0.38	1.00	0.85	1.00
4.38	**CHN**	0.42	0.58	1.00	0.50	0.19	0.36	1.00	0.67	1.00	0.23	0.84	1.00	0.23	0.10	1.00	1.00	0.81	0.22	1.00	0.49	1.00
5.08	**HKG**	0.85	1.00	1.00	1.00	0.39	0.72	1.00	1.00	1.00	0.46	1.00	1.00	0.47	0.21	1.00	1.00	1.00	0.44	1.00	0.99	1.00
6.03	**JPN**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.54	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5.41	**KOR**	1.00	1.00	1.00	1.00	0.54	1.00	1.00	1.00	1.00	0.64	1.00	1.00	0.66	0.29	1.00	1.00	1.00	0.61	1.00	1.00	1.00
4.07	**IDN**	0.31	0.42	0.73	0.36	0.14	0.26	1.00	0.49	1.00	0.17	0.61	1.00	0.17	0.08	0.94	1.00	0.59	0.16	1.00	0.36	0.96
4.78	**MYS**	0.63	0.86	1.00	0.74	0.29	0.53	1.00	1.00	1.00	0.34	1.00	1.00	0.35	0.15	1.00	1.00	1.00	0.32	1.00	0.73	1.00
3.35	**PHL**	0.15	0.21	0.36	0.18	0.07	0.13	0.49	0.24	1.00	0.08	0.30	0.69	0.08	0.04	0.46	0.68	0.29	0.08	0.70	0.18	0.47
5.85	**SGP**	1.00	1.00	1.00	1.00	0.84	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.45	1.00	1.00	1.00	0.94	1.00	1.00	1.00
4.56	**THA**	0.51	0.69	1.00	0.59	0.23	0.43	1.00	0.80	1.00	0.28	1.00	1.00	0.28	0.12	1.00	1.00	0.97	0.26	1.00	0.59	1.00
3.72	**VNM**	0.22	0.30	0.52	0.26	0.10	0.18	0.70	0.35	1.00	0.12	0.43	1.00	0.12	0.05	0.66	0.99	0.42	0.11	1.00	0.25	0.68
5.83	**CAN**	1.00	1.00	1.00	1.00	0.82	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00	0.44	1.00	1.00	1.00	0.92	1.00	1.00	1.00
6.65	**USA**	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
4.13	**MEX**	0.33	0.45	0.78	0.39	0.15	0.28	1.00	0.52	1.00	0.18	0.65	1.00	0.18	0.08	1.00	1.00	0.63	0.17	1.00	0.38	1.00
3.73	**PER**	0.22	0.30	0.52	0.26	0.10	0.19	0.71	0.35	1.00	0.12	0.44	1.00	0.12	0.05	0.67	1.00	0.42	0.11	1.00	0.26	0.68
4.59	**CHL**	0.52	0.71	1.00	0.61	0.24	0.44	1.00	0.83	1.00	0.28	1.00	1.00	0.29	0.13	1.00	1.00	1.00	0.27	1.00	0.61	1.00
5.91	**TWN**	1.00	1.00	1.00	1.00	0.89	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.48	1.00	1.00	1.00	1.00	1.00	1.00	1.00
3.71	**RUS**	0.22	0.30	0.51	0.25	0.10	0.18	0.70	0.34	1.00	0.12	0.43	0.99	0.12	0.05	0.66	0.98	0.41	0.11	1.00	0.25	0.67
5.09	**EU**	0.86	1.00	1.00	1.00	0.39	0.73	1.00	1.00	1.00	0.47	1.00	1.00	0.48	0.21	1.00	1.00	1.00	0.44	1.00	1.00	1.00
4.11	**ROW**	0.32	0.44	0.76	0.38	0.15	0.27	1.00	0.51	1.00	0.18	0.64	1.00	0.18	0.08	0.98	1.00	0.62	0.17	1.00	0.38	1.00

Table 7.2 ICT sector productivity benefits α, with and without absorption effect, and direct (δ') and indirect (δ'') spillovers for electronic equipment sector

	α		δ'	δ''
Region	**no absorption effect**	**with absorption effect**	**(Y2)**	**(Y3)**
AUS	0.06	0.46	0.15	0.31
NZL	0.01	0.19	0.02	0.17
CHN	0.12	0.26	0.15	0.11
HKG	0.02	0.23	0.04	0.19
JPN	0.24	0.95	0.93	0.03
KOR	0.1	0.5	0.26	0.24
IDN	0.01	0.05	0.01	0.03
MYS	0.03	0.16	0.06	0.10
PHL	0.02	0.03	0.02	0.01
SGP	0.08	0.6	0.41	0.19
THA	0.02	0.11	0.03	0.08
VNM	0	0.01	0.00	0.01
CAN	0.59	1.21	1.21	0.00
MEX	0.35	0.42	0.42	0.01
PER	0.01	0.02	0.01	0.01
CHL	0.02	0.16	0.03	0.13
TWN	0.09	0.71	0.47	0.25
RUS	0.03	0.09	0.02	0.07
EU	0.79	1.04	1.04	0.00
ROW	0.48	0.62	0.52	0.10

Table 7.3 Productivity benefits resulting from spillovers received by region D from region S

S \ D	AUS	NZL	CHN	HKG	JPN	KOR	IDN	MYS	PHL	SGP	THA	VNM	CAN	MEX	PER	CHL	TWN	RUS	EU	ROW
AUS		0.014																		
NZL																				
CHN		0.006		0.047			0.003	0.004			0.007	0.001				0.004				
HKG																				
JPN	0.012	0.002	0.039	0.014		0.071	0.010	0.015	0.009	0.058	0.026	0.002		0.001			0.151			0.003
KOR	0.001		0.003	0.001			0.001	0.001			0.001	0.001				0.001				
IDN																				
MYS											0.001									
PHL																				
SGP	0.001		0.001	0.001		0.001	0.002	0.021	0.002		0.003	0.002								
THA																				
VNM																				
CAN	0.001				0.002	0.001				0.003							0.002			
USA	0.149	0.021	0.148	0.044	0.925	0.258	0.014	0.063	0.020	0.405	0.033	0.003	1.206	0.416	0.010	0.032	0.466	0.021	1.044	0.520
MEX	0.001	0.001														0.009				
PER																				
CHL																				
TWN	0.001		0.005	0.002		0.001	0.001	0.002	0.001	0.001	0.002	0.001								
RUS																				
EU	0.273	0.123	0.048	0.105	0.024	0.154	0.005	0.042	0.001	0.123	0.020	0.002		0.005	0.001	0.031	0.088	0.025		0.091
ROW	0.017	0.017	0.015	0.019		0.008	0.012	0.016		0.006	0.020	0.001		0.004	0.008	0.078	0.002	0.043		
total	**0.456**	**0.184**	**0.259**	**0.233**	**0.951**	**0.494**	**0.048**	**0.164**	**0.033**	**0.596**	**0.113**	**0.013**	**1.206**	**0.426**	**0.019**	**0.155**	**0.709**	**0.089**	**1.044**	**0.614**

Table 7.4 Contributions to total productivity benefit (100 percent) received by region D from region S

D / S	AUS	NZL	CHN	HKG	JPN	KOR	IDN	MYS	PHL	SGP	THA	VNM	CAN	MEX	PER	CHL	TWN	RUS	EU	ROW
AUS		8																		
NZL																				
CHN		3		20			6	2			6	8				3				
HKG																				
JPN	3	1	15	6		14	21	9	27	10	23	15		0			21			0
KOR	0		1	0			2	1			1	8				1				
IDN																				
MYS											1									
PHL																				
SGP	0		0	0		0	4	13	6		3	15								
THA																				
VNM																				
CAN	0				0	0				1							0			
USA	33	11	57	19	97	52	29	38	61	68	29	23	100	98	53	21	66	24	100	85
MEX	0	1														6				
PER																				
CHL																				
TWN	0		2	1		0	2	1	3	0	2	8								
RUS																				
EU	60	67	19	45	3	31	10	26	3	21	18	15		1	5	20	12	28		15
ROW	4	9	6	8		2	25	10		1	18	8		1	42	50	0	48		
total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Table 7.5 Export shares of electronic equipment from S to D. (sum across rows).

D / S	AUS	NZL	CHN	HKG	JPN	KOR	IDN	MYS	PHL	SGP	THA	VNM	CAN	USA	MEX	PER	CHL	TWN	RUS	EU	ROW	total
AUS	0.00	0.12	0.06	0.01	0.04	0.02	0.05	0.03	0.01	0.06	0.02	0.00	0.02	0.21	0.01	0.00	0.01	0.02	0.00	0.16	0.17	1.00
NZL	0.38	0.00	0.04	0.01	0.03	0.01	0.01	0.02	0.01	0.02	0.01	0.00	0.02	0.20	0.01	0.00	0.01	0.01	0.00	0.15	0.10	1.00
CHN	0.01	0.00	0.00	0.08	0.14	0.03	0.01	0.01	0.00	0.02	0.01	0.00	0.02	0.32	0.01	0.00	0.00	0.02	0.00	0.20	0.10	1.00
HKG	0.01	0.00	0.51	0.00	0.05	0.02	0.00	0.02	0.02	0.01	0.01	0.00	0.01	0.12	0.01	0.00	0.00	0.04	0.00	0.13	0.06	1.00
JPN	0.02	0.00	0.12	0.02	0.00	0.07	0.02	0.03	0.02	0.03	0.04	0.01	0.02	0.27	0.01	0.00	0.00	0.08	0.00	0.17	0.09	1.00
KOR	0.02	0.00	0.17	0.01	0.10	0.00	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.20	0.02	0.00	0.01	0.03	0.01	0.15	0.18	1.00
IDN	0.02	0.00	0.01	0.01	0.19	0.01	0.00	0.09	0.02	0.22	0.04	0.00	0.01	0.15	0.02	0.00	0.00	0.02	0.00	0.11	0.08	1.00
MYS	0.02	0.00	0.06	0.01	0.13	0.02	0.03	0.00	0.01	0.22	0.04	0.01	0.02	0.15	0.01	0.00	0.00	0.03	0.00	0.16	0.08	1.00
PHL	0.01	0.00	0.06	0.01	0.20	0.01	0.01	0.02	0.00	0.07	0.01	0.00	0.02	0.31	0.01	0.00	0.00	0.03	0.00	0.19	0.03	1.00
SGP	0.03	0.00	0.11	0.02	0.05	0.03	0.04	0.19	0.04	0.00	0.05	0.03	0.01	0.11	0.01	0.00	0.00	0.03	0.00	0.12	0.13	1.00
THA	0.05	0.01	0.04	0.02	0.17	0.01	0.01	0.04	0.02	0.08	0.00	0.01	0.01	0.16	0.01	0.00	0.00	0.02	0.00	0.20	0.14	1.00
VNM	0.01	0.00	0.02	0.01	0.48	0.02	0.00	0.02	0.00	0.04	0.22	0.00	0.00	0.01	0.01	0.00	0.00	0.04	0.00	0.08	0.03	1.00
CAN	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.01	0.00	0.00	0.00	0.00	0.06	0.04	1.00
USA	0.02	0.00	0.04	0.01	0.08	0.03	0.00	0.01	0.01	0.03	0.01	0.00	0.20	0.00	0.12	0.00	0.01	0.03	0.01	0.26	0.15	1.00
MEX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.92	0.00	0.00	0.00	0.00	0.00	0.02	0.03	1.00
PER	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.31	0.02	0.00	0.07	0.00	0.00	0.06	0.51	1.00
CHL	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.15	0.13	0.00	0.00	0.00	0.06	0.57	1.00
TWN	0.02	0.00	0.16	0.02	0.09	0.03	0.01	0.03	0.02	0.02	0.03	0.02	0.03	0.28	0.01	0.00	0.00	0.00	0.00	0.15	0.08	1.00
RUS	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.23	0.62	1.00
EU	0.01	0.00	0.03	0.00	0.02	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.12	0.01	0.00	0.00	0.01	0.01	0.55	0.18	1.00
ROW	0.01	0.00	0.03	0.01	0.03	0.01	0.00	0.01	0.00	0.02	0.01	0.00	0.01	0.14	0.02	0.00	0.01	0.01	0.04	0.44	0.23	1.00

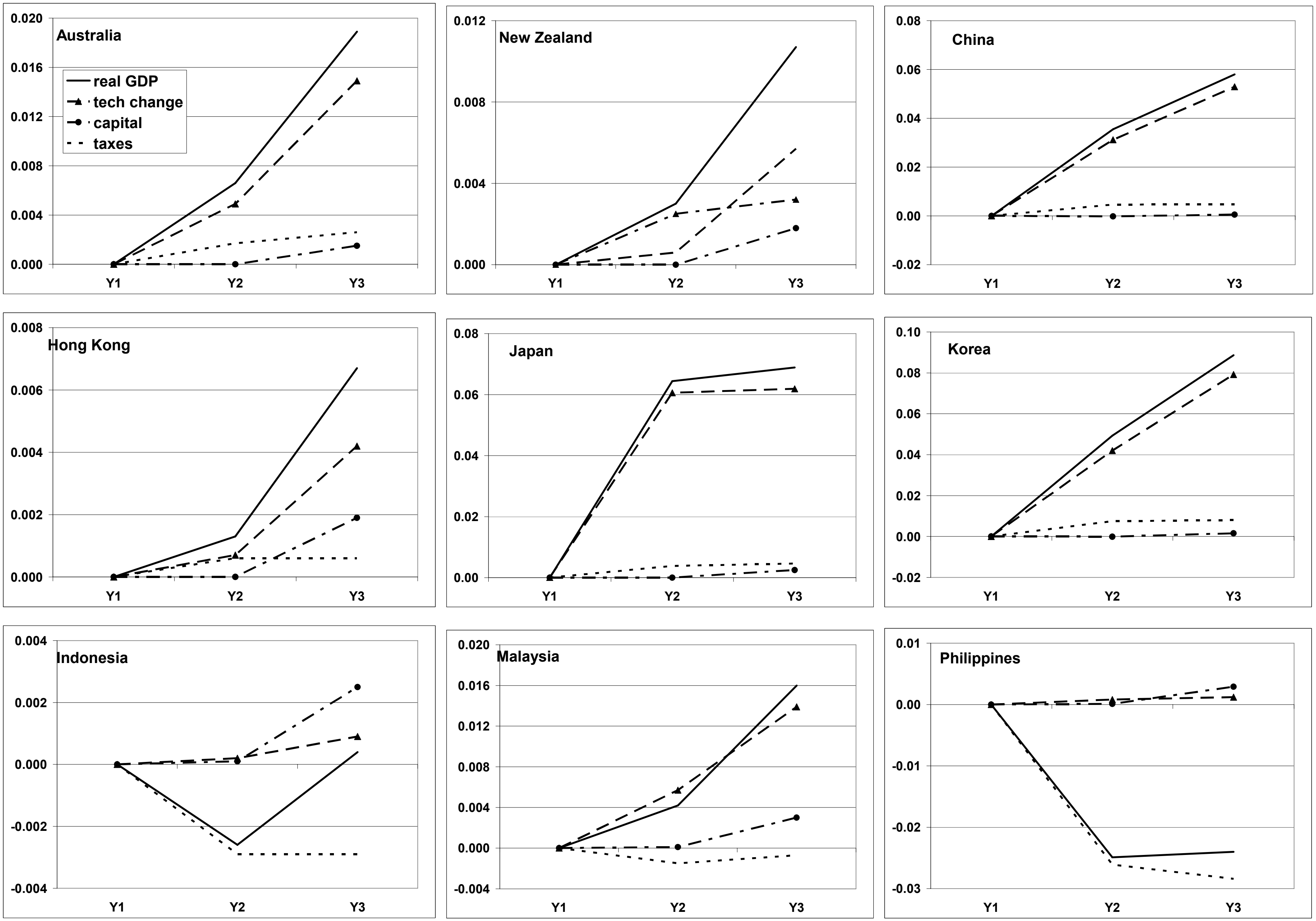
Table 7.6 Import Shares of electronic equipment from S to D. Sum across columns.

S \ D	AUS	NZL	CHN	HKG	JPN	KOR	IDN	MYS	PHL	SGP	THA	VNM	CAN	USA	MEX	PER	CHL	TWN	RUS	EU	ROW
AUS	0.00	0.19	0.00	0.00	0.00	0.00	0.03	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00
NZL	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHN	0.06	0.04	0.00	0.44	0.19	0.07	0.09	0.05	0.04	0.06	0.06	0.09	0.03	0.10	0.02	0.04	0.04	0.06	0.01	0.03	0.04
HKG	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JPN	0.15	0.13	0.29	0.19	0.00	0.38	0.34	0.25	0.40	0.20	0.39	0.21	0.04	0.16	0.05	0.09	0.06	0.45	0.03	0.06	0.07
KOR	0.02	0.02	0.07	0.02	0.05	0.00	0.06	0.03	0.03	0.02	0.03	0.12	0.01	0.02	0.01	0.03	0.04	0.02	0.01	0.01	0.03
IDN	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.03	0.01	0.04	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MYS	0.01	0.01	0.01	0.01	0.02	0.01	0.03	0.00	0.02	0.09	0.03	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
PHL	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SGP	0.03	0.02	0.03	0.03	0.02	0.02	0.08	0.19	0.08	0.00	0.06	0.12	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.01
THA	0.04	0.02	0.01	0.02	0.04	0.01	0.02	0.03	0.03	0.04	0.00	0.04	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01
VNM	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CAN	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.01	0.02	0.02	0.00	0.01	0.01	0.01
USA	0.25	0.18	0.12	0.08	0.32	0.24	0.08	0.14	0.17	0.23	0.09	0.04	0.73	0.00	0.70	0.35	0.28	0.22	0.08	0.12	0.16
MEX	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.19	0.00	0.01	0.02	0.00	0.00	0.00	0.01
PER	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
TWN	0.02	0.02	0.07	0.05	0.04	0.02	0.04	0.05	0.05	0.02	0.06	0.11	0.01	0.03	0.01	0.02	0.01	0.00	0.00	0.01	0.01
RUS	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
EU	0.32	0.32	0.31	0.12	0.21	0.20	0.20	0.18	0.12	0.20	0.19	0.21	0.13	0.27	0.15	0.27	0.34	0.16	0.59	0.66	0.52
ROW	0.05	0.03	0.04	0.04	0.05	0.03	0.03	0.04	0.02	0.06	0.04	0.02	0.02	0.05	0.04	0.12	0.16	0.03	0.26	0.09	0.11
total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 7.7 Cumulative percentage changes in ICT sector's TFP, regional TFP, real GDP and its constituents.

	1	2		3		4		5		6		7	
region	**share of ICT[%]**	**ICT sector TFP**		**Regional TFP**		**real GDP**		**Change in GDP due to TFP**		**Change in GDP due to change in capital**		**Change in GDP due to change in taxes**	
	Y2	**Y2**	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**
AUS	**3.4**	0.149	0.461	**0.005**	**0.015**	0.007	0.019	**0.005**	**0.015**	0	0.002	**0.002**	**0.003**
NZL	**3.3**	0.021	0.186	**0.001**	**0.006**	0.003	0.011	**0.001**	**0.006**	0	0.002	**0.003**	**0.003**
CHN	**21.9**	0.148	0.26	**0.031**	**0.053**	0.036	0.058	**0.031**	**0.053**	0	0.001	**0.005**	**0.005**
HKG	**2.6**	0.044	0.234	**0.001**	**0.004**	0.001	0.007	**0.001**	**0.004**	0	0.002	**0.001**	**0.001**
JPN	**6.6**	0.925	0.951	**0.061**	**0.062**	0.064	0.069	**0.061**	**0.062**	0	0.003	**0.004**	**0.005**
KOR	**16.7**	0.258	0.497	**0.042**	**0.079**	0.049	0.089	**0.042**	**0.079**	0	0.002	**0.008**	**0.008**
IDN	**4.1**	0.014	0.048	**0**	**0.001**	-0.003	0	**0**	**0.001**	0	0.003	**-0.003**	**-0.003**
MYS	**13.2**	0.063	0.164	**0.006**	**0.014**	0.004	0.016	**0.006**	**0.014**	0	0.003	**-0.002**	**-0.001**
PHL	**4.8**	0.02	0.033	**0.001**	**0.001**	-0.025	-0.024	**0.001**	**0.001**	0	0.003	**-0.026**	**-0.028**
SGP	**16**	0.404	0.598	**0.062**	**0.088**	0.07	0.104	**0.062**	**0.088**	0	0.004	**0.009**	**0.013**
THA	**10.9**	0.033	0.111	**0.003**	**0.009**	-0.006	0.004	**0.003**	**0.009**	0	0.003	**-0.008**	**-0.008**
VNM	**4.1**	0.003	0.013	**0**	**-0.001**	0.004	0.006	**0**	**-0.001**	0	0.003	**0.005**	**0.005**
CAN	**6.6**	1.205	1.205	**0.08**	**0.079**	0.081	0.083	**0.08**	**0.079**	0	0.002	**0.001**	**0.002**
MEX	**7.4**	0.415	0.425	**0.031**	**0.031**	0.034	0.037	**0.031**	**0.031**	0	0.002	**0.003**	**0.004**
PER	**4.7**	0.01	0.02	**0**	**0.001**	0.013	0.015	**0**	**0.001**	0	0.001	**0.012**	**0.014**
CHL	**1.5**	0.032	0.157	**0**	**0.002**	0.003	0.007	**0**	**0.002**	0	0.002	**0.003**	**0.003**
TWN	**11.9**	0.466	0.712	**0.054**	**0.081**	0.055	0.084	**0.054**	**0.081**	0	0.003	**0.001**	**0**
RUS	**2.5**	0.021	0.088	**0**	**0**	0.006	0.008	**0**	**0**	0	0.002	**0.006**	**0.006**

Graphs 7.8 Change in real GDP and its constituents for individual countries



cont Graph 7.8

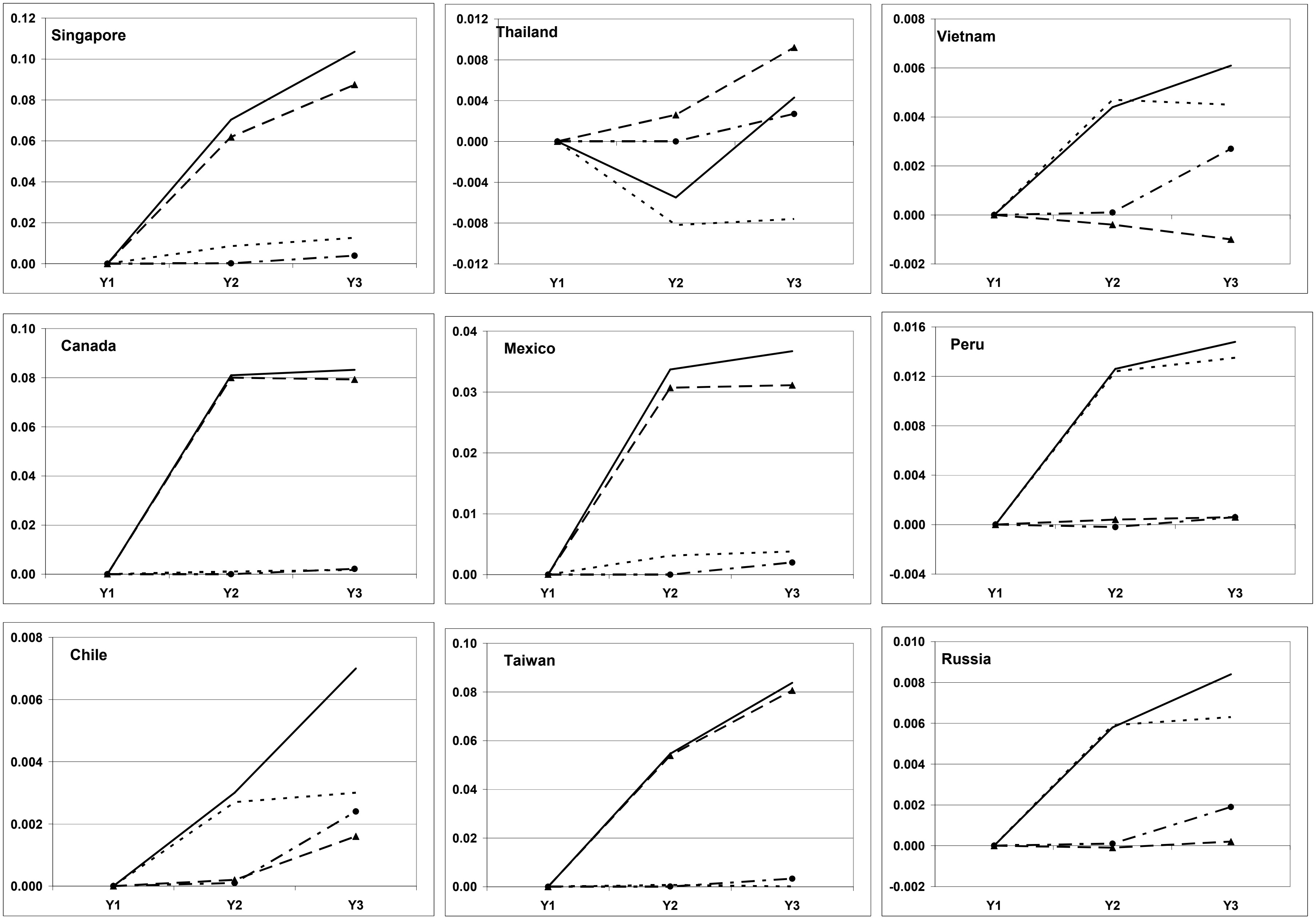


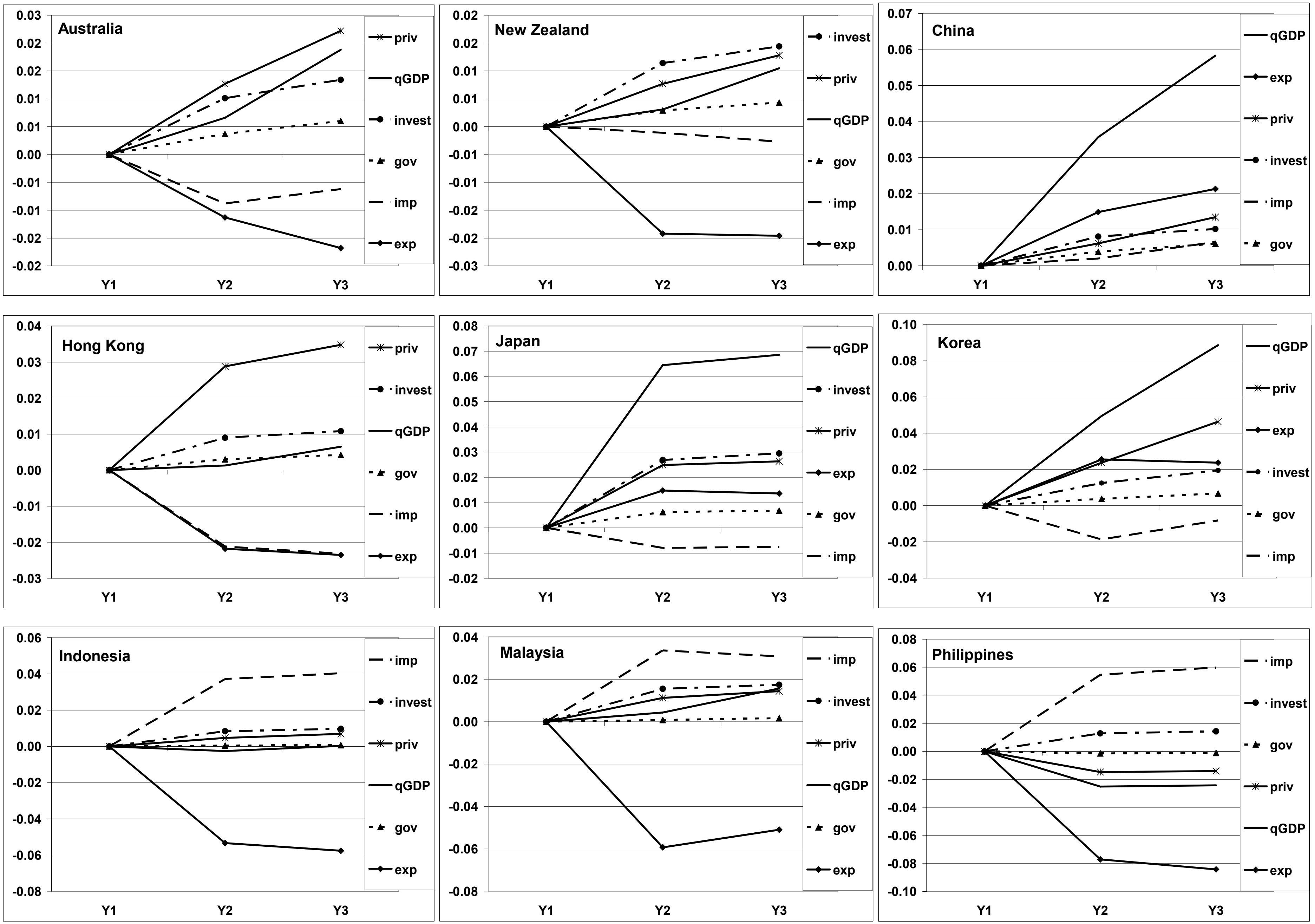
Table 7.9 Percentage contributions of tech change, capital and taxes into 100 percent change in real GDP

region		Y2	Y3	region		Y2	Y3
AUS	real GDP	1	1	THA	real GDP	1	1
	tech change	0.7	0.8		tech change	-0.5	2.1
	capital	0	0.1		capital	0	0.6
	taxes	0.3	0.1		taxes	1.5	-1.8
NZL	real GDP	1	1	VNM	real GDP	1	1
	tech change	0.2	0.5		tech change	-0.1	-0.2
	capital	0	0.2		capital	0	0.4
	taxes	0.8	0.3		taxes	1.1	0.7
CHN	real GDP	1	1	CAN	real GDP	1	1
	tech change	0.9	0.9		tech change	1	1
	capital	0	0		capital	0	0
	taxes	0.1	0.1		taxes	0	0
HKG	real GDP	1	1	MEX	real GDP	1	1
	tech change	0.5	0.6		tech change	0.9	0.8
	capital	0	0.3		capital	0	0.1
	taxes	0.5	0.1		taxes	0.1	0.1
JPN	real GDP	1	1	PER	real GDP	1	1
	tech change	0.9	0.9		tech change	0	0
	capital	0	0		capital	0	0
	taxes	0.1	0.1		taxes	1	0.9
KOR	real GDP	1	1	CHL	real GDP	1	1
	tech change	0.9	0.9		tech change	0.1	0.2
	capital	0	0		capital	0	0.3
	taxes	0.2	0.1		taxes	0.9	0.4
IDN	real GDP	1	1	TWN	real GDP	1	1
	tech change	-0.1	2.3		tech change	1	1
	capital	0	6.3		capital	0	0
	taxes	1.1	-7.3		taxes	0	0
MYS	real GDP	1	1	RUS	real GDP	1	1
	tech change	1.4	0.9		tech change	0	0
	capital	0	0.2		capital	0	0.2
	taxes	-0.4	0		taxes	1	0.8
PHL	real GDP	1	1	SGP	real GDP	1	1
	tech change	0	-0.1		tech change	0.9	0.8
	capital	0	-0.1		capital	0	0
	taxes	1	1.2		taxes	0.1	0.1

Table 7.10 Decomposition f the change in GDP due to taxes

	Change in GDP due to taxes		Output tax		Firms import taxes		Firms domestic taxes		Private consumption imported		Private consumption domestic		Export tax		Import tax	
	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3
AUS	0.0017	0.0026	**-0.0001**	**0.0004**	0.0005	0.0004		**0.0001**	0.0005	0.0007	**0.0005**	**0.0006**	-0.0002	-0.0002	**0.0005**	**0.0005**
NZL	0.0025	0.0032	**0.0007**	**0.001**	0.0005	0.0004	**-0.0001**		-0.0002	-0.0001	**0.0012**	**0.0016**	-0.0005	-0.0004	**0.0009**	**0.0006**
CHN	0.0046	0.0047	**0.0006**	**0.0014**									0.0031	0.0029	**0.0009**	**0.0003**
HKG	0.0006	0.0006		**0.0001**									0.0006	0.0005		
JPN	0.0038	0.0046	**0.0018**	**0.0023**	0.0002	0.0002		**0.0001**	0.0005	0.0004	**0.0001**	**0.0002**			**0.0013**	**0.0013**
KOR	0.0075	0.008	**0.0019**	**0.0023**	0.0008	0.0005			-0.0002	0.0003			0.0005	0.0004	**0.0045**	**0.0044**
IDN	-0.0029	-0.0029	**-0.0025**	**-0.0024**									0.0008	0.0008	**-0.0011**	**-0.0013**
MYS	-0.0015	-0.0007		**0.0004**			**0.0001**	**0.0001**			**-0.0001**	**-0.0001**	0.0005	0.0005	**-0.0021**	**-0.0017**
PHL	-0.0261	-0.0284	**-0.0249**	**-0.027**					-0.0001	-0.0002			0.0006	0.0006	**-0.0016**	**-0.0019**
SGP	0.0086	0.0126	**0.0002**	**0.0008**			**0.0008**	**0.0012**	0.0015	0.002	**0.0062**	**0.0085**			**-0.0001**	
THA	-0.0082	-0.0076	**0.0014**	**0.0019**			**0.0001**	**0.0001**	-0.0001	-0.0001			0.0011	0.001	**-0.0106**	**-0.0104**
VNM	0.0047	0.0045	**0.0004**	**0.0009**									0.0031	0.0031	**0.0012**	**0.0005**
CAN	0.0011	0.0017	**-0.0003**		-0.0002	-0.0002	**-0.0021**	**-0.002**	0.0023	0.0023	**0.001**	**0.0011**			**0.0004**	**0.0003**
MEX	0.0031	0.0038	**0.0018**	**0.0021**	0.0001	0.0001	**0.0001**	**0.0001**							**0.0012**	**0.0015**
PER	0.0124	0.0135	**0.0005**	**0.0006**	0.005	0.0055	**0.0017**	**0.0018**	0.0001	0.0001	**0.0009**	**0.001**	0.0014	0.0015	**0.0029**	**0.0031**
CHL	0.0027	0.003	**0.0004**	**0.0005**	0.0002	0.0002	**-0.0003**	**-0.0003**	0.0004	0.0004	**0.0009**	**0.0012**			**0.0011**	**0.001**
TWN	0.0007	0.0001	**0.0006**	**0.001**		0.0001	**0.0006**	**-0.0007**	-0.0001		**0.0005**	**0.0006**			**-0.0009**	**-0.0009**
RUS	0.0059	0.0063	**0.0022**	**0.0026**	0.0001	0.0001	**0.0022**	**0.0024**	-0.0001	-0.0001			0.0002	0.0001	**0.0012**	**0.0011**

Graph 7.9. Percentage changes in real GDP and its constituents (G+C+I+X-M)



cont graphs 7.9

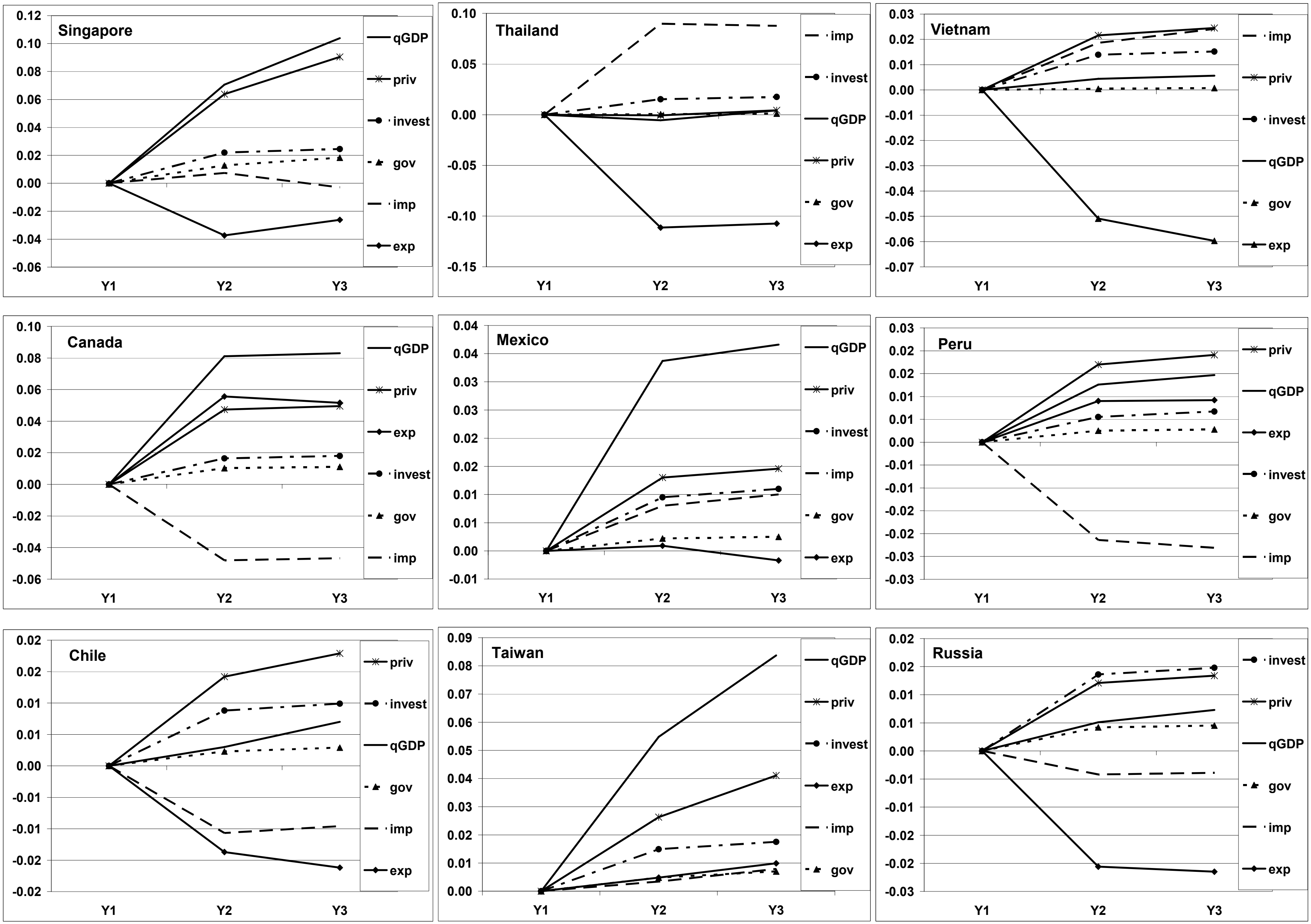


Table 7.11. Changes in nominal regional income, elasticity of cost wrt utility (uelas), elasticity of cost wrt utility from private consumption (uepriv), government and private nominal incomes, and nominal savings.

	1.regional income		2.uelas		3.uepriv		4.Government income		5.Private income		6.Savings	
	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3
AUS	-0.001	0.039	**0.002**	**0.003**	0.002	0.005	**0.001**	**0.042**	-0.001	0.038	**0.001**	**0.042**
NZL	-0.017	0.001	**0.000**	**0.001**	0.001	0.001	**-0.017**	**0.002**	-0.017	0.001	**-0.017**	**0.002**
CHN	-0.079	-0.054	**-0.002**	**-0.002**	-0.003	-0.005	**-0.080**	**-0.056**	-0.077	-0.052	**-0.080**	**-0.056**
HKG	0.017	0.031	**0.004**	**0.005**	0.006	0.006	**0.021**	**0.035**	0.016	0.029	**0.021**	**0.035**
JPN	0.143	0.142	**0.004**	**0.004**	0.006	0.006	**0.147**	**0.146**	0.141	0.140	**0.147**	**0.146**
KOR	0.015	0.106	**0.004**	**0.009**	0.006	0.014	**0.019**	**0.115**	0.013	0.102	**0.019**	**0.115**
IDN	-0.004	0.001	**0.000**	**0.000**	-0.001	-0.001	**-0.005**	**0.000**	-0.004	0.001	**-0.005**	**0.000**
MYS	0.010	0.024	**0.000**	**0.000**	0.000	0.000	**0.010**	**0.024**	0.010	0.025	**0.010**	**0.024**
PHL	-0.064	-0.067	**-0.001**	**-0.001**	-0.001	-0.001	**-0.065**	**-0.068**	-0.064	-0.067	**-0.065**	**-0.068**
SGP	0.110	0.181	**0.009**	**0.012**	0.013	0.018	**0.119**	**0.192**	0.106	0.175	**0.119**	**0.192**
THA	-0.051	-0.040	**-0.001**	**-0.001**	-0.001	-0.001	**-0.052**	**-0.041**	-0.051	-0.040	**-0.052**	**-0.041**
VNM	0.008	0.010	**-0.002**	**-0.003**	-0.002	-0.003	**0.006**	**0.007**	0.008	0.010	**0.006**	**0.007**
CAN	0.165	0.167	**0.009**	**0.009**	0.014	0.014	**0.174**	**0.176**	0.160	0.161	**0.174**	**0.176**
USA	-0.158	-0.163	**-0.001**	**-0.001**	-0.002	-0.002	**-0.160**	**-0.164**	-0.158	-0.162	**-0.160**	**-0.164**
MEX	-0.040	-0.044	**0.001**	**0.002**	0.002	0.002	**-0.038**	**-0.042**	-0.040	-0.044	**-0.038**	**-0.042**
PER	0.008	0.011	**0.000**	**0.000**	0.000	0.001	**0.009**	**0.012**	0.008	0.011	**0.009**	**0.012**
CHL	0.014	0.022	**0.001**	**0.001**	0.001	0.002	**0.015**	**0.023**	0.014	0.021	**0.015**	**0.023**
TWN	0.011	0.075	**0.004**	**0.006**	0.006	0.010	**0.015**	**0.081**	0.009	0.072	**0.015**	**0.081**
RUS	0.016	0.017	**0.000**	**0.000**	0.000	0.000	**0.015**	**0.017**	0.016	0.017	**0.015**	**0.017**

Table 7.12. Price indices for public consumption (*pgov*), private consumption (*ppriv*)and savings (*psave*), and real government consumption (*ug*), private consumption (*up*) and savings (*qsave*) proxied by per capita utility.

	1.pgov		2. ppriv		3. psave		4. ug		5. up		6. qsave	
	Y2	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**
AUS	-0.020	0.010	**-0.023**	**0.001**	-0.073	-0.064	**0.020**	**0.033**	0.021	0.037	**0.111**	**0.064**
NZL	-0.033	-0.022	**-0.031**	**-0.021**	-0.132	-0.146	**0.017**	**0.025**	0.014	0.022	**0.133**	**0.129**
CHN	-0.111	-0.104	**-0.092**	**-0.083**	-0.168	-0.181	**0.031**	**0.047**	0.015	0.031	**0.112**	**0.101**
HKG	-0.005	0.000	**-0.028**	**-0.024**	-0.055	-0.057	**0.026**	**0.035**	0.044	0.053	**0.083**	**0.078**
JPN	0.111	0.107	**0.097**	**0.093**	-0.021	-0.029	**0.036**	**0.039**	0.044	0.047	**0.163**	**0.176**
KOR	-0.018	0.049	**-0.028**	**0.022**	-0.101	-0.081	**0.037**	**0.066**	0.041	0.080	**0.201**	**0.100**
IDN	-0.011	-0.009	**-0.012**	**-0.010**	-0.106	-0.114	**0.006**	**0.010**	0.008	0.011	**0.106**	**0.110**
MYS	-0.003	0.000	**-0.043**	**-0.043**	-0.148	-0.161	**0.013**	**0.024**	0.053	0.067	**0.165**	**0.171**
PHL	-0.053	-0.059	**-0.044**	**-0.047**	-0.201	-0.219	**-0.011**	**-0.009**	-0.020	-0.020	**0.131**	**0.155**
SGP	0.032	0.072	**-0.001**	**0.024**	-0.136	-0.134	**0.087**	**0.120**	0.107	0.150	**0.309**	**0.252**
THA	-0.056	-0.051	**-0.049**	**-0.046**	-0.202	-0.213	**0.004**	**0.010**	-0.001	0.006	**0.158**	**0.161**
VNM	0.002	0.000	**-0.018**	**-0.019**	-0.118	-0.135	**0.004**	**0.007**	0.026	0.029	**0.128**	**0.141**
CAN	0.121	0.120	**0.077**	**0.075**	-0.021	-0.026	**0.053**	**0.056**	0.083	0.087	**0.187**	**0.200**
USA	-0.159	-0.165	**-0.149**	**-0.154**	-0.172	-0.179	**-0.001**	**0.001**	-0.009	-0.008	**0.014**	**0.019**
MEX	-0.058	-0.064	**-0.060**	**-0.066**	-0.119	-0.128	**0.020**	**0.022**	0.019	0.022	**0.077**	**0.090**
PER	-0.014	-0.014	**-0.016**	**-0.015**	-0.042	-0.045	**0.022**	**0.025**	0.024	0.026	**0.053**	**0.054**
CHL	-0.004	-0.001	**-0.009**	**-0.007**	-0.117	-0.125	**0.019**	**0.024**	0.022	0.028	**0.139**	**0.140**
TWN	-0.022	0.029	**-0.034**	**0.006**	-0.255	-0.260	**0.037**	**0.052**	0.043	0.066	**0.326**	**0.275**
RUS	-0.012	-0.012	**-0.007**	**-0.008**	-0.067	-0.070	**0.027**	**0.029**	0.023	0.025	**0.083**	**0.086**

Table 7.13. Shares of private and public expenditures and savings in GDP, and contributions of changes in private consumption, government consumption and savings into change in GDP

	Share in GDP in Y2			2. gov_con_shr		3. pri_con_shr		4. qsave	
	govexp	privexp	save	Y2	Y3	Y2	Y3	Y2	Y3
AUS	0.18	0.601	0.114	0.004	0.006	0.013	0.022	0.013	0.007
NZL	0.17	0.566	0.162	0.003	0.004	0.008	0.013	0.015	0.015
CHN	0.128	0.428	0.351	0.006	0.009	0.009	0.018	0.013	0.012
HKG	0.113	0.656	0.124	0.005	0.006	0.026	0.032	0.01	0.009
JPN	0.172	0.558	0.125	0.006	0.007	0.027	0.028	0.019	0.02
KOR	0.099	0.576	0.208	0.007	0.012	0.025	0.048	0.023	0.011
IDN	0.07	0.607	0.239	0.001	0.002	0.005	0.006	0.012	0.013
MYS	0.063	0.208	0.622	0.002	0.004	0.032	0.04	0.019	0.02
PHL	0.134	0.744	0.021	-0.002	-0.002	-0.012	-0.012	0.015	0.018
SGP	0.145	0.591	0.148	0.016	0.022	0.064	0.09	0.035	0.029
THA	0.102	0.55	0.222	0.001	0.002	-0.001	0.004	0.018	0.018
VNM	0.078	0.817	-0.006	0.001	0.001	0.016	0.017	0.015	0.016
CAN	0.191	0.567	0.141	0.009	0.01	0.05	0.052	0.021	0.023
USA	0.152	0.69	0.069	0	0	-0.006	-0.005	0.002	0.002
MEX	0.11	0.668	0.11	0.004	0.004	0.012	0.013	0.009	0.01
PER	0.111	0.713	0.072	0.004	0.005	0.014	0.016	0.006	0.006
CHL	0.116	0.626	0.182	0.003	0.004	0.013	0.017	0.016	0.016
TWN	0.128	0.61	0.187	0.007	0.009	0.026	0.04	0.037	0.031
RUS	0.151	0.52	0.199	0.005	0.005	0.014	0.015	0.009	0.01

Table 7.14. Ratio of gross to net returns on capital (*GRN*), ratio of gross investments to end-of-period capital stock (*INVKER*). Percentage changes in: price of new capital (*pcgds*), current rate of return (*rorc*), expected rate of return (*rore*), demand for capital goods (*qcgds*), and end- and beginning-of-period capital stocks (*ke* and *kb*).

	1. GRN	2. INVKER	3.rental		4. pcgds		5. rorc		6. rore		7. qcgds		8. ke		9. kb	
	Y2	Y2	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y2	Y3	Y3	Y4
AUS	1.51	0.08	0	0.03	-0.07	-0.06	0.1	0.13	-0.09	-0.1	0.05	0.06	0.004	0.008	0.004	0.008
NZL	1.38	0.08	-0.03	-0.02	-0.13	-0.14	0.13	0.17	-0.09	-0.1	0.06	0.08	0.004	0.01	0.004	0.01
CHN	1.4	0.14	-0.1	-0.08	-0.16	-0.17	0.08	0.13	-0.09	-0.1	0.03	0.04	0.003	0.008	0.003	0.008
HKG	1.28	0.1	0.01	0.02	-0.05	-0.05	0.08	0.09	-0.09	-0.1	0.03	0.04	0.003	0.007	0.003	0.007
JPN	2	0.07	0.12	0.12	-0.02	-0.02	0.27	0.27	-0.09	-0.1	0.11	0.12	0.007	0.015	0.007	0.015
KOR	1.41	0.08	-0.01	0.08	-0.09	-0.07	0.12	0.22	-0.09	-0.1	0.05	0.08	0.004	0.01	0.004	0.01
IDN	1.19	0.07	-0.01	0	-0.1	-0.11	0.11	0.12	-0.09	-0.1	0.05	0.06	0.004	0.008	0.004	0.008
MYS	1.4	0.05	0.02	0.03	-0.14	-0.16	0.21	0.23	-0.09	-0.1	0.11	0.13	0.006	0.013	0.006	0.013
PHL	1.3	0.07	-0.06	-0.07	-0.2	-0.21	0.17	0.18	-0.09	-0.1	0.07	0.08	0.005	0.011	0.005	0.011
SGP	1.36	0.11	0.09	0.14	-0.13	-0.13	0.3	0.36	-0.09	-0.1	0.07	0.09	0.008	0.017	0.008	0.017
THA	1.34	0.06	-0.07	-0.07	-0.2	-0.21	0.16	0.18	-0.09	-0.1	0.08	0.09	0.005	0.011	0.005	0.01
VNM	1.38	0.13	0	0	-0.11	-0.13	0.16	0.17	-0.09	-0.1	0.04	0.05	0.005	0.01	0.005	0.01
CAN	1.47	0.08	0.14	0.14	-0.01	-0.02	0.23	0.23	-0.09	-0.1	0.08	0.09	0.006	0.013	0.006	0.013
USA	1.35	0.08	-0.15	-0.16	-0.17	-0.17	0.02	0.02	-0.09	-0.1	0.02	0.03	0.002	0.004	0.002	0.004
MEX	1.27	0.07	-0.05	-0.06	-0.11	-0.12	0.08	0.08	-0.09	-0.1	0.05	0.06	0.003	0.007	0.003	0.007
PER	1.23	0.07	-0.02	-0.02	-0.04	-0.04	0.02	0.02	-0.09	-0.1	0.03	0.04	0.002	0.005	0.002	0.005
CHL	1.18	0.1	0.01	0.01	-0.11	-0.12	0.14	0.15	-0.09	-0.1	0.05	0.06	0.005	0.01	0.004	0.01
TWN	1.29	0.09	0	0.05	-0.25	-0.25	0.32	0.38	-0.09	-0.1	0.09	0.11	0.008	0.018	0.008	0.017
RUS	1.66	0.07	0.02	0.02	-0.06	-0.06	0.12	0.12	-0.09	-0.1	0.06	0.07	0.004	0.009	0.004	0.009

Table 7.15
Changes in variables in period two, *Y2*, which determine change in current rate of return *rorc(r)* and price of capital goods *pcgds(r):*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	ps	***qo***	***qva***	***qfeK***	***qfeL***	***sKel***	***qLel***	***qKel…***	***rental***	***wage***	***ppriv***	***rrent***	***rwage***	***pcgds***	***pfd***	***pfm***	***sEcp***	***sMelK***	***rorc***
AUS	-0.25	-1.68	-1.8	-1.8	-1.85	0.28	-0.01	-0.005	0	-0.009	-0.02	0.021	0.013	-0.07	-0.25	-0.64	0.1	0.71	0.1
NZL	-0.11	-2.95	-3	-2.95	-3.03	0.42	-0.02	-0.014	-0.028	-0.031	-0.03	0.002	-0.001	-0.13	-0.11	-0.63	0.2	0.8	0.13
CHN	-0.31	-1.01	-1.2	-1.1	-1.23	0.49	-0.03	-0.035	-0.097	-0.075	-0.09	-0.008	0.014	-0.17	-0.31	-0.77	0.18	0.25	0.09
HKG	-0.12	-2.91	-3	-2.93	-3.09	0.51	-0.01	-0.012	0.014	0.008	-0.03	0.041	0.035	-0.05	-0.12	-0.54	0.08	0.87	0.08
JPN	-1.04	1.39	0.49	0.48	0.49	0.37	0.005	0.005	0.126	0.126	0.1	0.027	0.027	-0.02	-1.04	-0.45	0.12	0.18	0.28
KOR	-0.42	-0.97	-1.2	-1.2	-1.27	0.59	-0.02	-0.032	-0.005	0.013	-0.03	0.021	0.039	-0.1	-0.42	-0.7	0.14	0.39	0.12
IDN	-0.36	-1.73	-1.8	-1.75	-1.78	0.52	-0.01	-0.006	-0.003	-0.014	-0.01	0.006	-0.004	-0.1	-0.36	-0.72	0.13	0.91	0.11
MYS	-0.28	-2.76	-2.9	-2.91	-2.85	0.4	-0.04	-0.029	0.024	-0.013	-0.04	0.065	0.028	-0.14	-0.28	-0.67	0.2	0.98	0.2
PHL	-0.26	-2.94	-3	-3	-3.09	0.94	0	-0.018	-0.056	-0.026	-0.04	-0.016	0.014	-0.2	-0.26	-0.69	0.26	0.91	0.16
SGP	-0.6	-0.85	-1.2	-1.21	-1.26	0.43	-0.02	-0.016	0.098	0.074	0	0.098	0.074	-0.13	-0.6	-0.59	0.23	0.92	0.3
THA	-0.37	-2.24	-2.3	-2.3	-2.34	0.73	-0.02	-0.025	-0.064	-0.049	-0.05	-0.018	-0.004	-0.2	-0.37	-0.75	0.22	0.96	0.16
VNM	-0.16	-3.07	-3.1	-2.94	-3.16	0.27	-0.01	-0.004	0.004	-0.015	-0.02	0.02	0.001	-0.11	-0.17	-0.68	0.17	0.84	0.16
CAN	-1.29	4.39	3.25	3.2	3.27	0.33	0.037	0.026	0.142	0.162	0.08	0.067	0.087	-0.02	-1.29	-0.34	0.16	0.76	0.23
USA	-0.17	-1.38	-1.4	-1.35	-1.39	0.33	-0.02	-0.016	-0.162	-0.167	-0.16	-0.007	-0.012	-0.17	-0.17	-0.83	0.14	0.25	0.01
MEX	-0.52	-0.42	-0.8	-0.82	-0.83	0.69	-0.01	-0.011	-0.048	-0.047	-0.06	0.013	0.014	-0.11	-0.52	-0.38	0.15	0.74	0.08
PER	-0.04	-0.87	-0.9	-0.89	-0.97	0.95	0	-0.019	-0.02	0.026	-0.02	-0.006	0.041	-0.04	-0.04	-0.56	0.16	0.2	0.02
CHL	-0.08	-2.49	-2.6	-2.48	-2.6	0.41	-0.01	-0.004	0.011	0.003	-0.01	0.018	0.01	-0.11	-0.08	-0.63	0.18	0.9	0.14
TWN	-0.63	-0.41	-0.9	-0.84	-0.87	0.31	-0.01	-0.008	0.004	-0.007	-0.03	0.036	0.025	-0.25	-0.63	-0.72	0.35	0.73	0.31
RUS	-0.09	-3.56	-3.7	-3.61	-3.71	0.3	-0.02	-0.008	0.023	-0.009	-0.01	0.028	-0.004	-0.06	-0.09	-0.85	0.06	0.93	0.12

1. *ps(r)*-supply price of ICT , 2.*qo(r)*-quantity of output of ICT sector, 3.*qva(r)*-quantity of value added in ICT sector, 4.*qfe(K,ele,r)*-capital demanded by ICT sector, 5.*qfe(L,ele,r)*-labor demanded by ICT sector, 6.*sKel*-share of capital in ICT sector, 7.*qLel*-quantity of labor used in ICT sector, 8.*qKel*-quantity of capital used in ICT sector, 9.*rental(r)*-rental price for capital, 10.*wage(r)*-price of labor, 11.*ppriv(r)*-price index for private consumption, 12.*rrental(r)*-real rental, 13.*rwage(r)*-real wage, 14.*pcgds(r)*-price of capital goods, 15.*pfd(r)*-price index for domestic ICT, 16.*pfm(r)*-price index for imported ICT, 17.*sEcp*-share of electronics used in *CGDS(r)* sector, 18, *sMelK*-share of imported electronics in ICT used by *CGDS(r)* sector, 19.*rorc(r)*-current rate of return on capital.

Table 7.16
Changes in variables in period three, *Y3*, which determine change in current rate of return *rorc(r)* and price of capital goods *pcgds(r)*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	ps	**qo**	**qva**	**qfeK**	**qfeL**	**sKel**	**qLel**	**qKel…**	**rental**	**wage**	**ppriv**	**rrent**	**rwage**	**pcgds**	**pfd**	**pfm**	**sEcp**	**sMelK**	**rorc**
AUS	-0.32	1.07	0.77	0.76	0.78	0.28	0.0038	0.002	0.031	0.041	0.023	0.008	0.018	0.01	-0.32	-0.05	0.1	0.71	0.0321
NZL	-0.17	0.52	0.37	0.36	0.37	0.42	0.0018	0.001	0.013	0.016	0.01	0.003	0.006	-0.01	-0.17	-0.09	0.2	0.8	0.0339
CHN	-0.13	0.16	0.05	0.05	0.05	0.49	0.0007	-0.0024	0.022	0.025	0.009	0.013	0.016	-0.01	-0.13	-0.07	0.18	0.25	0.0467
HKG	-0.2	0.69	0.51	0.5	0.53	0.51	0.0025	0.0015	0.01	0.012	0.005	0.005	0.007	0	-0.2	-0.08	0.08	0.87	0.0133
JPN	-0.04	-0.08	-0.1	-0.1	-0.11	0.37	-0.001	-0.0008	-0.008	-0.002	-0.004	-0.004	0.002	-0.01	-0.04	-0.07	0.12	0.18	-0.0004
KOR	-0.25	0.6	0.38	0.37	0.39	0.59	0.0066	0.0082	0.091	0.087	0.05	0.041	0.036	0.02	-0.25	-0.04	0.14	0.39	0.0957
IDN	-0.07	0.05	0.02	0.02	0.02	0.52	-0.0004	-0.0003	0.001	0.004	0.002	-0.001	0.002	-0.01	-0.07	-0.08	0.13	0.91	0.0105
MYS	-0.14	0.49	0.41	0.42	0.41	0.4	0.002	0.0015	0.007	0.014	0	0.007	0.014	-0.01	-0.14	-0.08	0.2	0.98	0.0196
PHL	-0.03	-0.11	-0.12	-0.12	-0.13	0.94	-0.0002	-0.0021	-0.008	-0.002	-0.003	-0.005	0.001	-0.02	-0.03	-0.07	0.26	0.91	0.0095
SGP	-0.2	0.9	0.73	0.72	0.74	0.43	0.0127	0.0082	0.051	0.067	0.025	0.026	0.041	0	-0.2	-0.06	0.23	0.92	0.0617
THA	-0.11	0.3	0.23	0.23	0.23	0.73	0.0009	0.0008	0.006	0.009	0.003	0.003	0.007	-0.01	-0.1	-0.07	0.22	0.96	0.0186
VNM	-0.04	-0.19	-0.2	-0.19	-0.2	0.27	-0.0015	-0.0007	-0.004	-0.002	-0.001	-0.003	-0.001	-0.02	-0.03	-0.1	0.17	0.84	0.0183
CAN	-0.01	-0.15	-0.15	-0.15	-0.16	0.33	-0.0009	0.0002	-0.004	0	-0.002	-0.002	0.002	-0.01	-0.01	-0.03	0.16	0.76	0.0029
USA	-0.01	-0.07	-0.07	-0.07	-0.07	0.33	-0.001	-0.0013	-0.006	-0.005	-0.005	-0.001	0.001	-0.01	-0.01	-0.04	0.14	0.25	0.0013
MEX	-0.02	-0.08	-0.09	-0.09	-0.1	0.69	-0.0015	-0.0018	-0.007	-0.005	-0.006	-0.001	0.001	-0.01	-0.02	-0.03	0.15	0.74	0.002
PER	-0.01	-0.05	-0.06	-0.06	-0.07	0.95	-0.0001	-0.0015	-0.001	0.004	0	-0.001	0.004	0	-0.01	-0.05	0.16	0.2	0.0026
CHL	-0.13	0.36	0.24	0.24	0.25	0.41	0.0004	0	0.003	0.007	0.002	0.001	0.005	-0.01	-0.13	-0.05	0.18	0.9	0.0127
TWN	-0.24	1.05	0.83	0.82	0.83	0.31	0.0115	0.0073	0.05	0.065	0.039	0.011	0.026	-0.01	-0.24	-0.05	0.35	0.73	0.0667
RUS	-0.07	0.08	0.02	0.02	0.02	0.3	-0.0001	-0.0004	-0.002	0.002	-0.001	-0.001	0.003	0	-0.07	-0.04	0.06	0.93	-0.0026

1. *ps(r)*-supply price of ICT , 2.*qo(r)*-quantity of output of ICT sector, 3.*qva(r)*-quantity of value added in ICT sector, 4.*qfe(K,ele,r)*-capital demanded by ICT sector, 5.*qfe(L,ele,r)*-labor demanded by ICT sector, 6.*sKel*-share of capital in ICT sector, 7.*qLel*-quantity of labor used in ICT sector, 8.*qKel*-quantity of capital used in ICT sector, 9.*rental(r)*-rental price for capital, 10.*wage(r)*-price of labor, 11.*ppriv(r)*-price index for private consumption, 12.*rrental(r)*-real rental, 13.*rwage(r)*-real wage, 14.*pcgds(r)*-price of capital goods, 15.*pfd(r)*-price index for domestic ICT, 16.*pfm(r)*-price index for imported ICT, 17.*sEcp*-share of electronics used in *CGDS(r)* sector, 18, *sMelK*-share of imported electronics in ICT used by *CGDS(r)* sector, 19.*rorc(r)*-current rate of return on capital.

Table 7.17
Cumulative changes in variables in period three, *Y3*, which determine change in current rate of return *rorc(r)* and price of capital goods *pcgds(r):*

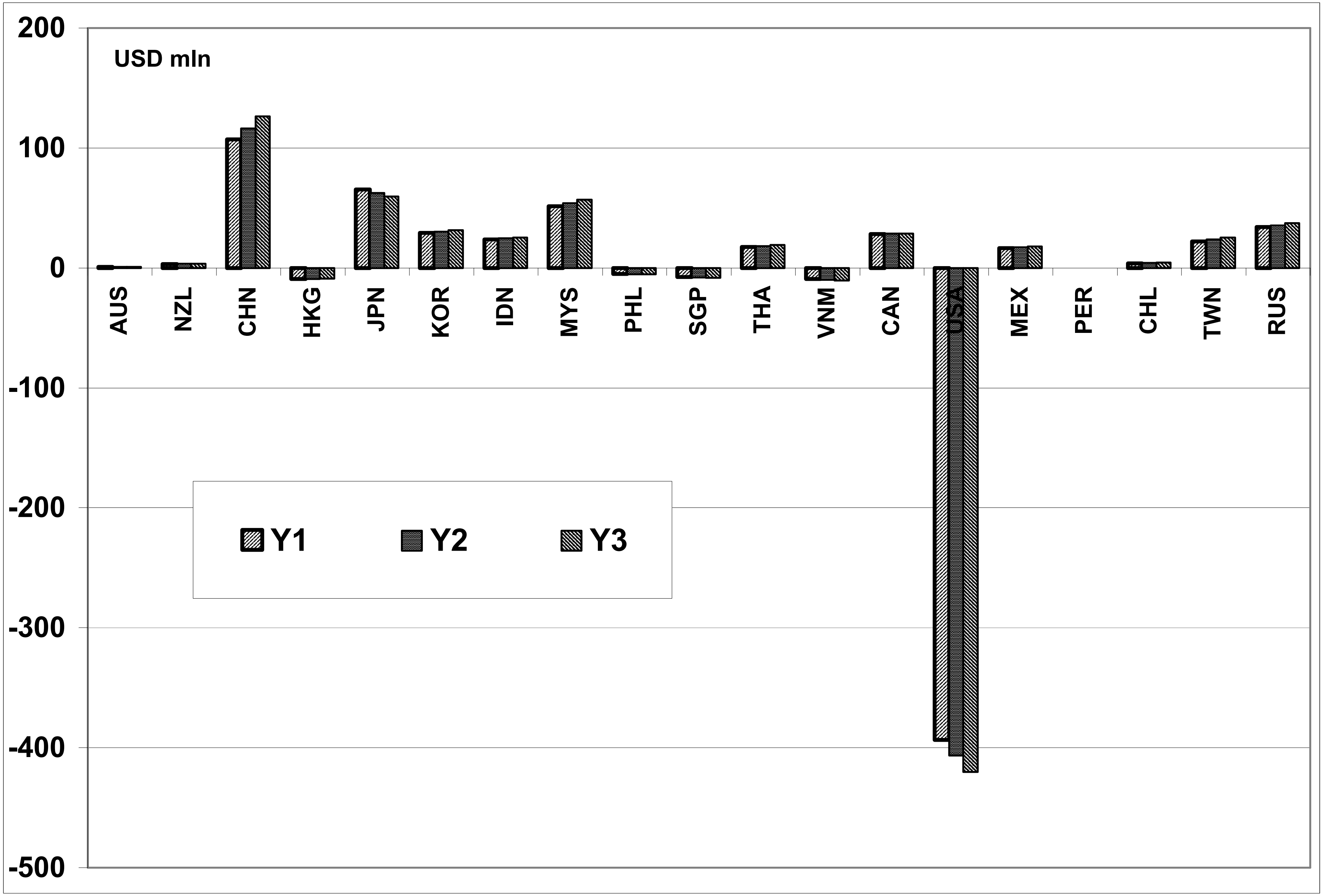
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
	ps	***qo***	***qva***	***qfeK***	***qfeL***	***sKel***	***qLel***	***qKel…***	***rental***	***wage***	***ppriv***	***rrent***	***rwage***	***pcgds***	***pfd***	***pfm***	***sEcp***	***sMelK***	***rorc***
AUS	-0.58	-0.63	-1.08	-1.05	-1.09	0.28	-0.006	-0.003	0.031	0.033	0	0.029	0.031	-0.06	-0.58	-0.69	0.1	0.71	0.13
NZL	-0.28	-2.44	-2.64	-2.6	-2.67	0.42	-0.016	-0.013	-0.016	-0.016	-0.02	0.005	0.005	-0.14	-0.28	-0.72	0.2	0.8	0.16
CHN	-0.43	-0.85	-1.11	-1.04	-1.18	0.49	-0.026	-0.037	-0.075	-0.05	-0.08	0.005	0.03	-0.18	-0.43	-0.84	0.18	0.25	0.13
HKG	-0.32	-2.24	-2.5	-2.44	-2.58	0.51	-0.012	-0.011	0.024	0.019	-0.02	0.046	0.042	-0.05	-0.32	-0.63	0.08	0.87	0.09
JPN	-1.07	1.31	0.38	0.38	0.38	0.37	0.004	0.004	0.119	0.124	0.1	0.024	0.029	-0.02	-1.07	-0.52	0.12	0.18	0.28
KOR	-0.66	-0.37	-0.86	-0.83	-0.89	0.59	-0.016	-0.024	0.086	0.1	0.02	0.062	0.076	-0.08	-0.66	-0.75	0.14	0.39	0.22
IDN	-0.43	-1.68	-1.74	-1.73	-1.76	0.52	-0.01	-0.006	-0.002	-0.009	-0.01	0.005	-0.002	-0.11	-0.43	-0.8	0.13	0.91	0.12
MYS	-0.41	-2.28	-2.47	-2.5	-2.45	0.4	-0.039	-0.027	0.031	0.001	-0.04	0.071	0.041	-0.16	-0.41	-0.75	0.2	0.98	0.22
PHL	-0.29	-3.05	-3.12	-3.12	-3.21	0.94	-0.002	-0.02	-0.064	-0.028	-0.04	-0.021	0.015	-0.22	-0.29	-0.76	0.26	0.91	0.17
SGP	-0.79	0.05	-0.52	-0.5	-0.53	0.43	-0.01	-0.008	0.15	0.141	0.03	0.123	0.115	-0.13	-0.79	-0.64	0.23	0.92	0.36
THA	-0.48	-1.95	-2.09	-2.07	-2.12	0.73	-0.019	-0.025	-0.058	-0.04	-0.04	-0.015	0.003	-0.21	-0.48	-0.81	0.22	0.96	0.17
VNM	-0.2	-3.25	-3.29	-3.12	-3.36	0.27	-0.014	-0.004	0	-0.017	-0.02	0.017	0.001	-0.13	-0.2	-0.78	0.17	0.84	0.18
CAN	-1.3	4.23	3.09	3.05	3.11	0.33	0.036	0.027	0.138	0.162	0.07	0.066	0.089	-0.02	-1.3	-0.36	0.16	0.76	0.23
USA	-0.18	-1.44	-1.44	-1.41	-1.46	0.33	-0.021	-0.017	-0.168	-0.172	-0.16	-0.008	-0.011	-0.18	-0.18	-0.87	0.14	0.25	0.01
MEX	-0.54	-0.5	-0.91	-0.91	-0.93	0.69	-0.012	-0.013	-0.055	-0.051	-0.07	0.012	0.015	-0.12	-0.54	-0.41	0.15	0.74	0.08
PER	-0.06	-0.93	-0.96	-0.96	-1.04	0.95	-0.002	-0.02	-0.021	0.03	-0.01	-0.007	0.044	-0.04	-0.06	-0.61	0.16	0.2	0.02
CHL	-0.21	-2.14	-2.31	-2.24	-2.36	0.41	-0.007	-0.004	0.013	0.01	-0.01	0.019	0.015	-0.12	-0.21	-0.68	0.18	0.9	0.15
TWN	-0.87	0.63	-0.04	-0.03	-0.04	0.31	-0.001	-0.001	0.054	0.058	0.01	0.046	0.051	-0.26	-0.87	-0.76	0.35	0.73	0.38
RUS	-0.15	-3.48	-3.66	-3.59	-3.69	0.3	-0.018	-0.009	0.021	-0.007	-0.01	0.027	-0.001	-0.07	-0.15	-0.89	0.06	0.93	0.12

1. *ps(r)*-supply price of ICT , 2.*qo(r)*-quantity of output of ICT sector, 3.*qva(r)*-quantity of value added in ICT sector, 4.*qfe(K,ele,r)*-capital demanded by ICT sector, 5.*qfe(L,ele,r)*-labor demanded by ICT sector, 6.*sKel*-share of capital in ICT sector, 7.*qLel*-quantity of labor used in ICT sector, 8.*qKel*-quantity of capital used in ICT sector, 9.*rental(r)*-rental price for capital, 10.*wage(r)*-price of labor, 11.*ppriv(r)*-price index for private consumption, 12.*rrental(r)*-real rental, 13.*rwage(r)*-real wage, 14.*pcgds(r)*-price of capital goods, 15.*pfd(r)*-price index for domestic ICT, 16.*pfm(r)*-price index for imported ICT, 17.*sEcp*-share of electronics used in *CGDS(r)* sector, 18, *sMelK*-share of imported electronics in ICT used by *CGDS(r)* sector, 19.*rorc(r)*-current rate of return on capital.

Table 7.18. Value of savings, investment and difference between savings and investments.

	1. SAVE			2. REGINV			3. SAVING GAP		
	Y1	Y2	Y3	Y1	Y2	Y3	Y1	Y2	Y3
AUS	40,836	41,646	42,525	39,815	40,711	41,718	1,021	936	807
NZL	8,150	8,383	8,629	4,926	5,047	5,181	3,224	3,336	3,449
CHN	406,421	437,991	472,654	299,273	321,672	346,216	107,149	116,319	126,439
HKG	20,026	21,412	22,908	29,245	30,516	31,893	-9,219	-9,104	-8,984
JPN	522,312	526,363	532,904	456,953	463,737	473,434	65,359	62,627	59,470
KOR	88,485	91,532	94,873	59,266	61,155	63,270	29,219	30,377	31,604
IDN	34,693	35,820	37,019	10,980	11,243	11,533	23,713	24,577	25,486
MYS	54,205	57,311	60,579	2,751	3,218	3,646	51,454	54,094	56,933
PHL	1,456	1,547	1,643	6,398	6,727	7,067	-4,942	-5,181	-5,424
SGP	12,528	13,366	14,298	20,058	21,177	22,419	-7,530	-7,811	-8,121
THA	25,230	26,575	27,986	7,856	8,411	8,955	17,374	18,164	19,032
VNM	-210	-221	-233	9,142	9,765	10,444	-9,352	-9,986	-10,677
CAN	100,794	102,555	104,562	72,626	74,127	75,904	28,168	28,428	28,658
USA	694,238	713,001	728,027	1,087,633	1,119,528	1,148,228	-393,395	-406,527	-420,201
MEX	67,899	69,772	71,831	51,456	52,646	54,014	16,443	17,126	17,817
PER	3,866	4,008	4,158	3,980	4,096	4,221	-114	-88	-63
CHL	12,069	12,568	13,098	8,116	8,415	8,741	3,953	4,154	4,357
TWN	52,478	55,108	57,990	30,284	31,489	32,820	22,195	23,618	25,170
RUS	61,044	64,545	68,284	26,839	28,978	30,997	34,205	35,567	37,288
Total	3,352,080	3,446,420	3,548,925	3,352,079	3,446,420	3,548,924	1	1	1

Graph 7.10. Difference between savings and investments



Graph 7.11. Changes in the saving gap for selected regions calculated as a share of the savings and normalized to unity in the initial year. Positive sign indicates saving surplus and negative sign denote saving deficit.

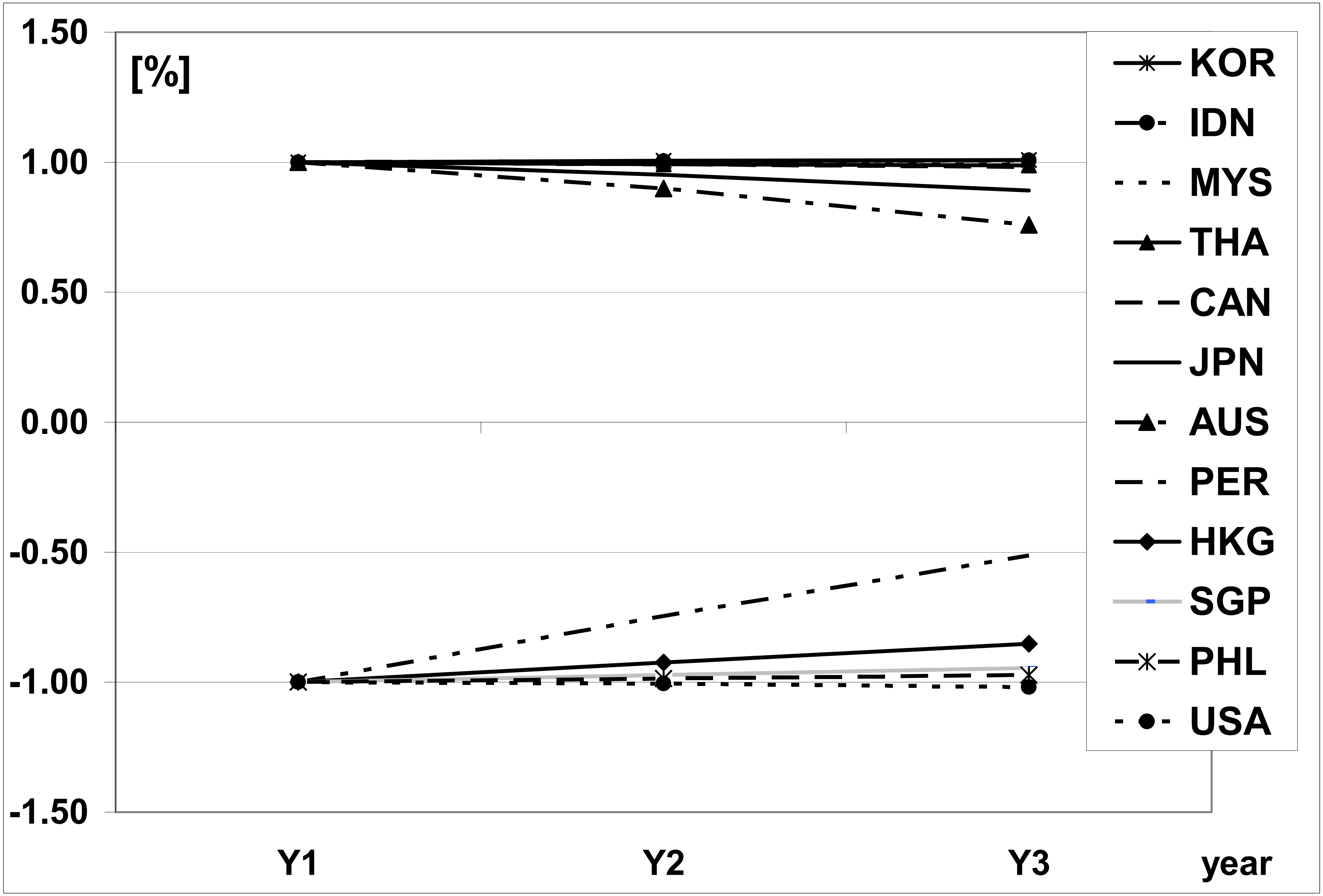


Table 7.19
Percentage change in terms of trade variable *tot(r)*, and its decomposition into the world price effect *Wpe(r)*, export price effect *Xpe(r)*, and imports price effect *Mpe(r)*.

	1. tot(r)		***2. Wpe(r)***		***3. Xpe(r)***		***4. Mpe(r)***	
	Y2	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**	**Y2**	**Y3**
AUS	0.086	0.103	**0.085**	**0.092**	0.008	0.019	**0.007**	**0.008**
NZL	0.063	0.074	**0.067**	**0.074**	0.001	0.005	**0.006**	**0.004**
CHN	0	-0.003	**0.013**	**0.012**	-0.023	-0.025	**-0.01**	**-0.009**
HKG	0.06	0.066	**0.049**	**0.052**	0.01	0.015	**-0.001**	**0.001**
JPN	-0.11	-0.116	**-0.085**	**-0.09**	-0.012	-0.012	**0.013**	**0.014**
KOR	0.004	0.014	**0.019**	**0.019**	-0.017	-0.006	**-0.002**	**-0.001**
IDN	0.065	0.071	**0.052**	**0.056**	0.015	0.017	**0.002**	**0.002**
MYS	0.062	0.069	**0.064**	**0.068**	0.003	0.003	**0.005**	**0.002**
PHL	0.036	0.039	**0.022**	**0.023**	0.01	0.012	**-0.004**	**-0.004**
SGP	0.033	0.038	**0.035**	**0.037**	0.006	0.009	**0.008**	**0.008**
THA	0.039	0.041	**0.029**	**0.031**	0.007	0.006	**-0.004**	**-0.004**
VNM	0.058	0.065	**0.042**	**0.045**	0.024	0.026	**0.008**	**0.006**
CAN	0.018	0.024	**0.045**	**0.05**	-0.014	-0.01	**0.014**	**0.016**
USA	-0.053	-0.061	**-0.03**	**-0.033**	-0.022	-0.024	**0.001**	**0.003**
MEX	-0.038	-0.038	**-0.022**	**-0.024**	-0.012	-0.008	**0.005**	**0.007**
PER	0.065	0.07	**0.079**	**0.085**	0	0	**0.014**	**0.015**
CHL	0.102	0.111	**0.099**	**0.107**	0.012	0.014	**0.009**	**0.01**
TWN	0.036	0.039	**0.032**	**0.034**	-0.011	-0.008	**-0.015**	**-0.013**
RUS	0.091	0.094	**0.064**	**0.068**	0.029	0.028	**0.002**	**0.003**
EU	-0.006	-0.007	**-0.011**	**-0.011**	0.016	0.016	**0.011**	**0.011**
ROW	0.062	0.067	**0.05**	**0.054**	0.016	0.018	**0.004**	**0.005**

Table 7.20

Percentage changes in global price for commodity *i pw(i)* and change in global price index for exports *pxwwld*.

	1. pw(i)		**2. pw(i)-pxwwld**	
	Y2	**Y3**	**Y2**	**Y3**
Food	0.002	0.005	0.1	0.109
Mnfcs	-0.016	-0.017	0.082	0.088
Svces	-0.006	-0.008	0.091	0.096
Ele	-0.63	-0.677	-0.532	-0.572
Mvh	-0.029	-0.033	0.069	0.071
Ofi	-0.038	-0.04	0.06	0.065
	3. pxwwld			
	Y2	**Y3**		
global	-0.098	-0.105		

Table 7.21 export/import shares of commodity *i* in total export/import expenditure of the region.

	EXP_SHR						IMP_SHR					
	Food	**Mnfcs**	**Svces**	**Ele**	**Mvh**	**Ofi**	**Food**	**Mnfcs**	**Svces**	**Ele**	**Mvh**	**Ofi**
AUS	0.23	0.48	0.20	0.05	0.03	0.01	0.04	0.51	0.17	0.18	0.09	0.01
NZL	0.42	0.31	0.21	0.05	0.01	0.00	0.08	0.50	0.20	0.15	0.08	0.01
CHN	0.04	0.74	0.07	0.15	0.01	0.00	0.05	0.62	0.14	0.17	0.02	0.00
HKG	0.00	0.17	0.79	0.02	0.00	0.02	0.06	0.64	0.17	0.10	0.02	0.02
JPN	0.01	0.44	0.13	0.25	0.17	0.00	0.10	0.56	0.20	0.10	0.02	0.01
KOR	0.01	0.63	0.17	0.11	0.08	0.00	0.06	0.62	0.17	0.14	0.02	0.00
IDN	0.10	0.77	0.07	0.05	0.01	0.00	0.09	0.48	0.24	0.14	0.04	0.00
MYS	0.05	0.70	0.18	0.06	0.01	0.00	0.06	0.59	0.16	0.17	0.02	0.00
PHL	0.06	0.76	0.08	0.09	0.01	0.00	0.08	0.68	0.08	0.13	0.02	0.00
SGP	0.02	0.63	0.23	0.11	0.00	0.00	0.04	0.66	0.12	0.16	0.01	0.00
THA	0.14	0.57	0.14	0.12	0.02	0.00	0.06	0.61	0.12	0.17	0.03	0.00
VNM	0.19	0.61	0.14	0.05	0.00	0.01	0.06	0.43	0.35	0.12	0.02	0.03
CAN	0.07	0.49	0.14	0.12	0.17	0.00	0.05	0.45	0.13	0.20	0.16	0.01
USA	0.07	0.42	0.25	0.18	0.06	0.01	0.04	0.55	0.13	0.15	0.12	0.00
MEX	0.05	0.49	0.07	0.24	0.15	0.00	0.07	0.52	0.10	0.20	0.11	0.01
PER	0.21	0.60	0.17	0.01	0.00	0.00	0.14	0.49	0.19	0.14	0.03	0.01
CHL	0.22	0.56	0.20	0.01	0.00	0.00	0.06	0.54	0.17	0.17	0.05	0.00
TWN	0.01	0.72	0.10	0.14	0.01	0.00	0.05	0.62	0.11	0.19	0.02	0.00
RUS	0.04	0.81	0.11	0.04	0.01	0.00	0.15	0.41	0.25	0.15	0.04	0.00
EU	0.07	0.45	0.22	0.16	0.10	0.01	0.07	0.50	0.19	0.14	0.08	0.01
ROW	0.10	0.60	0.20	0.07	0.02	0.01	0.09	0.52	0.17	0.15	0.05	0.01

Table 7.22
Percentage changes in of the export (*pxw(i,r)*) and import (*piw(i,r)*) prices of traded commodity *i* in region *r*.

			AUS	NZL	CHN	HKG	JPN	KOR	IDN	MYS	PHL	SGP	THA	VNM	CAN	USA	MEX	PER	CHL	TWN	RUS	EU	ROW
pxw(i,r)	Y2	Food	-0.01	-0.03	-0.07	0.00	0.10	-0.01	0.00	-0.01	-0.04	0.02	-0.02	0.00	0.08	-0.15	-0.05	-0.01	0.00	-0.01	0.01	0.12	0.02
		Mnfcs	-0.03	-0.04	-0.10	-0.02	0.09	-0.07	-0.01	-0.04	-0.04	-0.03	-0.04	-0.01	0.07	-0.15	-0.07	-0.02	-0.01	-0.03	0.00	0.09	0.00
		Svces	-0.02	-0.03	-0.11	-0.01	0.11	-0.02	-0.01	-0.02	-0.05	0.04	-0.06	-0.01	0.12	-0.16	-0.06	-0.01	0.00	-0.02	-0.01	0.13	0.02
		Ele	-0.25	-0.11	-0.31	-0.12	-1.04	-0.42	-0.36	-0.28	-0.26	-0.60	-0.37	-0.16	-1.29	-0.17	-0.52	-0.04	-0.08	-0.63	-0.09	-1.13	-0.63
		Mvh	-0.02	-0.08	-0.12	0.00	0.09	-0.08	-0.01	0.01	-0.04	-0.04	-0.07	-0.02	-0.02	-0.15	-0.07	-0.02	-0.02	-0.04	-0.05	0.03	-0.03
		Ofi	-0.01	-0.03	-0.11	0.01	0.12	0.00	0.00	-0.01	-0.05	0.05	-0.06	0.00	0.13	-0.16	-0.05	0.00	0.00	-0.01	0.00	0.14	0.03
	Y3	Food	0.02	-0.02	-0.05	0.01	0.10	0.04	0.00	0.00	-0.04	0.05	-0.02	0.00	0.08	-0.15	-0.06	0.00	0.01	0.03	0.01	0.11	0.03
		Mnfcs	0.00	-0.03	-0.09	-0.01	0.09	-0.04	-0.01	-0.04	-0.05	-0.02	-0.04	-0.01	0.06	-0.16	-0.07	-0.03	-0.01	0.00	-0.01	0.08	0.00
		Svces	0.01	-0.02	-0.10	0.00	0.11	0.05	-0.01	-0.01	-0.05	0.07	-0.05	-0.02	0.12	-0.17	-0.06	-0.01	0.00	0.03	-0.01	0.12	0.02
		Ele	-0.58	-0.28	-0.43	-0.32	-1.07	-0.66	-0.43	-0.41	-0.29	-0.79	-0.48	-0.20	-1.30	-0.18	-0.54	-0.06	-0.21	-0.87	-0.15	-1.14	-0.73
		Mvh	0.00	-0.08	-0.13	0.01	0.08	-0.06	0.00	0.01	-0.05	-0.02	-0.08	-0.01	-0.02	-0.16	-0.08	-0.02	-0.02	-0.02	-0.06	0.02	-0.02
		Ofi	0.02	-0.02	-0.09	0.02	0.12	0.08	0.00	0.00	-0.05	0.11	-0.05	0.00	0.13	-0.17	-0.05	0.00	0.01	0.05	0.00	0.14	0.03
piw(i,r)	Y2	Food	0.01	0.00	-0.01	-0.01	-0.03	-0.04	-0.02	-0.01	-0.02	0.01	0.00	0.00	-0.07	0.04	-0.09	0.00	0.02	-0.03	0.04	0.08	0.02
		Mnfcs	-0.02	-0.03	0.00	-0.04	-0.04	-0.01	-0.01	-0.01	-0.01	-0.03	0.00	-0.02	-0.08	0.01	-0.09	-0.02	-0.01	-0.01	0.03	0.04	0.01
		Svces	0.03	0.03	0.02	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.07	0.04	0.03	0.03	0.00	0.03	0.03	0.02
		Ele	-0.64	-0.63	-0.77	-0.54	-0.45	-0.70	-0.73	-0.67	-0.69	-0.58	-0.75	-0.68	-0.34	-0.83	-0.37	-0.56	-0.63	-0.72	-0.85	-0.87	-0.76
		Mvh	0.02	0.04	0.03	0.03	-0.02	0.00	0.04	0.05	0.03	0.02	0.04	-0.03	-0.12	0.01	-0.10	0.00	-0.02	0.02	0.02	0.03	0.01
		Ofi	0.03	0.02	0.01	0.05	0.03	0.01	-0.03	0.03	0.03	-0.04	-0.03	0.05	0.04	0.10	0.04	0.04	-0.03	-0.01	-0.03	0.03	0.03
	Y3	Food	0.02	0.01	-0.01	0.00	-0.02	-0.03	-0.02	0.00	-0.01	0.02	0.01	0.01	-0.07	0.04	-0.09	0.00	0.02	-0.03	0.04	0.07	0.03
		Mnfcs	-0.02	-0.02	0.00	-0.04	-0.03	-0.01	0.00	-0.01	-0.01	-0.02	0.00	-0.01	-0.08	0.01	-0.09	-0.02	-0.01	-0.01	0.03	0.03	0.01
		Svces	0.02	0.03	0.02	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.07	0.04	0.02	0.03	0.00	0.03	0.03	0.02
		Ele	-0.69	-0.72	-0.84	-0.63	-0.52	-0.75	-0.80	-0.75	-0.76	-0.64	-0.81	-0.78	-0.36	-0.87	-0.40	-0.61	-0.68	-0.76	-0.89	-0.90	-0.80
		Mvh	0.02	0.03	0.02	0.02	-0.03	-0.01	0.03	0.04	0.02	0.02	0.04	-0.02	-0.12	0.01	-0.10	0.00	-0.02	0.02	0.01	0.02	0.01
		Ofi	0.03	0.02	0.01	0.05	0.03	0.01	-0.02	0.03	0.03	-0.04	-0.03	0.05	0.04	0.10	0.04	0.04	-0.03	-0.02	-0.03	0.03	0.03