THE EFFECT OF GLOBALIZATION OF TRADE IN SERVICES ON ECONOMIC GROWTH: A SIMULTANEOUS ECONOMETRIC ANALYSIS

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CHAPTER I

INTRODUCTION

International trade in services has been a major concern among politicians and economists from all over the world and especially from members of the World Trade Organization (WTO). This apprehension gave birth to the General Agreement in Trade in Services (GATS) whose main goal was to encourage and promote international competition in trading in services among WTO nations. Until now, despite some restructuring of many service sectors in a number of countries, including many of the WTO states, barriers to international competition still exist. Global competition does not subsist in any of the world's services' markets, and export of services has not yet been fully considered.

Many service markets are still dominated by state monopoly power. We know from basic economic theory that a monopolist charges a price higher than marginal cost, and as a result, the government monopolist will not provide low-cost efficient services and a deadweight loss occurs. Some economists argue that the best solution to such inefficiency is to remove trade barriers and promote international competition. This would lead to lower prices and more efficient services to the residents of the home country. Others favor international competition but within certain limits, such as the imposition of tariffs and quantitative restrictions. Many countries follow the latter opinion and adapt commercial policies that limit the access of foreign suppliers of services to the domestic market. In some nations, there exist laws and regulations for

foreign suppliers of services. Among those are licensing fees and market share restrictions. Within this context, there is little difference between the trade protection tools applied to services and those applied to goods. Indeed the policy tools used for trade in services restriction consist of measures such as tariffs, subsidies, quotas and other commercial policies. However, as Hoekman and Primo Braga (1997) point out, there are some basic differences between the characteristics of a service and those of a regular good. Goods are often tangible and they do cross borders when trade occurs. Therefore, in the case of regular goods, ad valorem tariffs as well as quantity quotas are easy to apply. In the case of services, there is not any physical object that crosses the border when trade occurs. Custom agents do not observe the flow of services on the border; they only observe the flow of suppliers or consumers of those services. In most cases, the value of the service will not be known until it is produced and consumed, therefore it will be difficult for tariff collectors to know and charge the exact amount of tariff that should be paid by the supplier of the service.

On the Issue of Trade in Services' Barrier Policies

The application of barriers to trade in services can be challenging but still feasible. The first category of barriers is composed of quantitative restrictions. Quantitative restrictions are often used to limit trade in services, but since services are intangible, quotas are usually applied to the suppliers of services, and in the extreme case, foreign supply of services is just forbidden. An example of such a restriction is the banking sector, where the number of foreign banks in some Middle Eastern and African countries is restricted and even in other countries, foreign banking or foreign

telecommunications services providers are prohibited. In those extreme cases, the major problem is not due to differences in comparative advantage among trading partners, rather, it is because of the internal structure of the market. The financial and telecommunication sectors in most of those nations are not privatized or liberalized; they belong to the government.

The second category of trade barriers falls within the price-based policy instruments like tariffs. An import tariff is a tax applied on the price of the good imported to the home country. Within the context of trade in services, tariffs are generally applied to the movement of persons across nations. Within this policy scheme, countries can increase the visa fees depending on the nature of the visit of the person. Another application of the tariff within the context of trade in services is when a nation imposes a tariff on the input used for the production of services. An example of such an application is the tariff on computers and telecommunications equipment.

The third category of barriers is composed of policies whose main objective is to control prices. Nations who apply such policies are usually state-owned monopolies. Under this system the government fixes the maximum or the minimum prices that a local firm can charge for certain services. Examples of services subject to such a pricing rules are the financial, telecommunications, and transportation services.

The fourth category of barriers to trade in services embrace licensing and procurement. Most of developing nations require a license or certificate in order to provide a certain service. Examples of services subject to licensing include medical, transportation, telecommunication and financial services. In the case of telecommunication and financial sectors, this type of restriction acts as a limitation vis

a vis the network globalization. In fact this could protect local carriers and discriminate against foreign companies. Licensing constitutes a major barrier to foreign investment in telecommunications and financial services. In fact, in order to evaluate investment opportunities, investors look at several factors, among them are the freedom in pricing, competition, laws, regulations, and taxation. The presence of licensing would play a role in deterring foreign investment in the services sector. In many instances, the government can also necessitate that the provider of the service meet certain technical standards. Governments can also require that the foreign provider of the service be a partner with a national firm or person to ensure that part of the revenues generated from the supply of the services stays in the home country. Shin Cho and Myeongho (1997) list the status of foreign ownership restriction in the Asian Pacific Economic Cooperation Group. Among those countries, there are still four nations (Brunei, China, Indonesia, Taiwan) in which foreign ownership is not allowed. They also argue that the status of foreign ownership restriction often reflects the stage of telecommunication development. Indeed, many developing countries (among those are Indonesia and Thailand) have implemented the "build, operate and transfer" (BOT) scheme. Within this scheme, foreign companies build the infrastructure, run the network and share the revenues with the local public firms, and then after a period of time, the foreign carrier transfers the facilities to the local public firm. Another type of foreign integration is the joint venture. This kind of foreign participation is mainly found in developing countries where the local carriers need some kind of technical assistance. With the foreign help, the developing country gets some technological expertise, through which it will develop into a technological transfer. Those types of foreign participation play an

important role for international market integration. On the other hand, they represent a restriction for foreign investment typically through partial control of the network instead of full control.

Other types of trade obstruction include structural and behavioral barriers. Some services sectors require investments in sunk costs which may be high enough to deter entry into a foreign market. Behavioral barriers are usually from within the country. An example of behavioral barriers is the discriminatory access to the telecommunications network or the incompatibility of the existing incumbents' technology with the potential foreign entrant. This conduct would occur when a dominant telecommunication carrier would discriminate against new entrants by imposing limitations to the new provider on the types and quantity of equipment that they can attach to the incumbent's network. This is a way to force the incoming firm to invest in its own interconnecting network and construct additional infrastructure.

On the Issue of the Impact of Service Trade Liberalization

In addition to the physical difference between goods and services, the policy implications and the impact of full liberalization in the services sector differ from those of any regular tangible goods sector. As Mattoo, Rathindran and Subramanian (2001) argue, there are two major effects encountered when liberalizing a certain sector. Those effects are disaggregated into static and dynamic effects. For both services and goods, the static effect is similar; it constitutes a decrease in prices and an improvement in welfare. However, the dynamic effects of liberalization are not the same. In case of services, the spillover of technology and skills due to factor mobility of the supplier of

services will enhance the domestic productivity leading to an increase in domestic output. The second dynamic effect is rather precarious. It reflects the fact that the impact of liberalization of the services sector on the growth in output can be segregated into two effects. The first impact is summarized by the fact that domestic employment in the service sector that is being liberalized can either improve or not improve depending on the market structure of this service. The second impact reflects the increase in productivity of labor in the home country. Figure 1.1 shows the flow and exchange of telecommunications and financial services between the home country and the rest of the world.

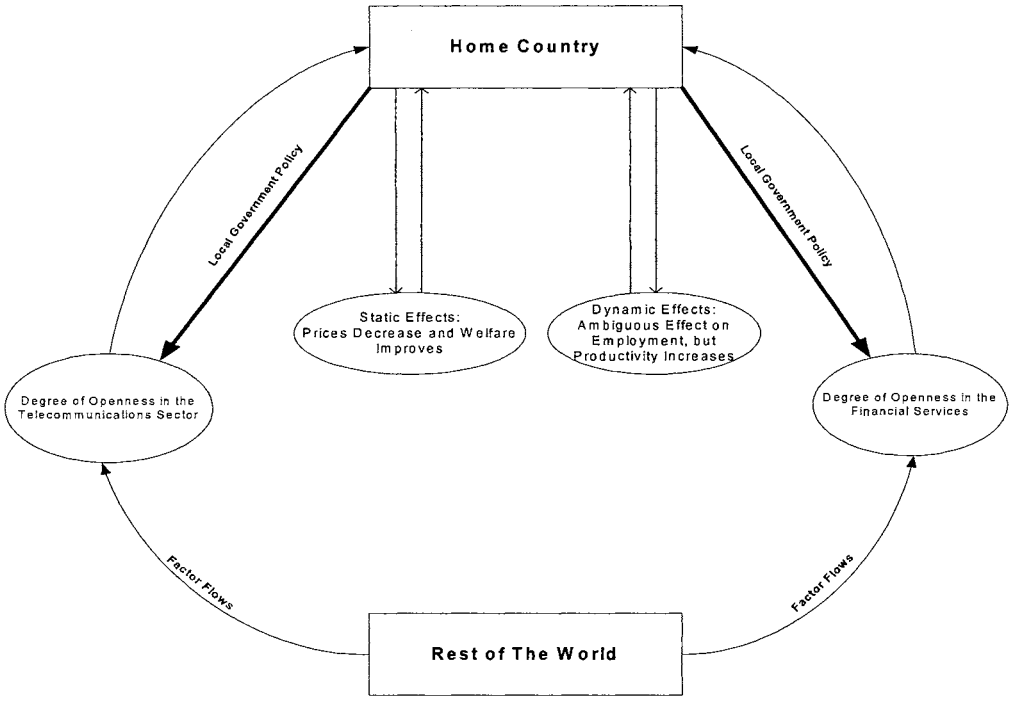

Figure 1.1. Services Factor Flows and the Effects of Service Trade Liberalization

For simplification, the only factor flows to be considered are the ones from the rest of the world to the home country. Whether the home country follows the path of global international competition or the restricted competition, openness of international services markets would stimulate economic growth through technological transfer and positive externalities.

On the Issue of Concerns Raised from Liberalization

Aims at liberalizing the services sectors raised several issues. One of the important concerns is the sovereignty of the home country. Many nations are concerned about their sovereignty when it comes to trade negotiations and policy reform. Usually, economists are mainly in favor of efficiency and optimal welfare results. However, not all policymakers are first and foremost concerned about efficiency. Instead they appeal to sovereignty to argue against international competition and an open market economy.

Shin Cho and Myeongho Lee (1997) gave the example of China. Chinese policy makers tried to allocate the foreign participation in building an urban network in a certain way such that there won't be any market power acquired by a foreign company.

Another issue that is usually brought into negotiation is the competition with the domestic labor. As mentioned before, the effect of liberalization of the services sector on the domestic employment is ambiguous. Depending on the internal market structure, the home employment level can either benefit or lose from an openness policy. It is true that import of services can eliminate some of the domestic service sector jobs, but this does not mean that the total number of jobs available for the domestic population has

decreased. International trade theory taught us that the loss of jobs in one industry is usually compensated by a gain of jobs in another industry.

On the Issue of Preferential and Regional Agreements

During recent years, many countries have been engaged in regional agreements to liberalize their services. Examples of recent services trade agreements include the North American Free Trade Agreement (NAFTA), the General Agreement on Trade in Services (GATS), and the European Union agreements with several neighboring countries. The main concern is whether preferential agreements bring more welfare improvements to the home nation than non-preferential agreements. Mattoo and Fink (2002) highlight the impact of a regional agreement compared to the one of a global agreement. They argue that compared to the status quo, a nation is likely to benefit from a preferential agreement rather than staying without any accord. Compared with non-preferential agreements, regional agreements produce less welfare gains because preferential agreements result in a consumer choice bias. However, regional agreements might be more desirable because of political considerations or because of the regulatory harmonization among neighboring countries.

Objective of the Study

The main objective of the dissertation is to measure the effect of globalization of trade in services on the world's economic growth. In this study, only two sectors are of major interest, telecommunications and financial services. The analysis starts by stating conventional international trade and economic growth assumptions and tries to work out

the empirical implications and impacts of openness of those two services sectors on economic growth. The specific objectives are the followings:

- To measure the effect of openness in trade of telecommunication services and financial services on economic growth.
- To determine whether the level of nations' development affects the impact of openness in trade of telecommunication and financial services on economic growth.
- To estimate simultaneously demand and supply equations and respective elasticities for the telecommunication and financial services sectors.
- To measure the effect of openness in telecommunication services on the financial services sector.

An econometric model will be built whose main purpose is to estimate the effect of openness in trade of telecommunication and financial services on economic growth and to measure the cross sectoral effects of the openness in the two services industries. Indeed, many researchers have stated that openness of international telecommunications markets would stimulate economic growth through technological transfer and positive externalities, but there has not been any estimate of the magnitude of those cross sectoral externalities. In this study, the externalities will be estimated and the effect of globalization in both sectors will be determined. Another contribution of this study is that the model will be estimated simultaneously to account for endogeneity. Previous studies have not taken into account the endogeneity problem within their estimation.

Plan of the Study

The content of the dissertation is as follows: chapter two contains a literature review of previous studies done in this field. Chapter three presents the theoretical framework as well as the behavioral models used for the empirical estimation. Chapter four sketches the estimation methodology, an overview of the data used for estimating the model, and the results of the estimation. Chapter five divulges some policy implications and concludes.

CHAPTER II

HISTORICAL AND LITERATURE REVIEW

There has been a voluminous amount of research on the costs and benefits of liberalizing trade in goods, and little analysis on the effect of services trade integration on economic growth and welfare. This is not surprising since services constitute a new dimension in regional and multilateral trade agreements. In what follows, a distinction will be made between studies done in the field of trade in goods and studies done in the area of trade in services.

Trade in Goods and Economic Growth

Most economists agree that international trade is an important factor in building an economic system, and that trade policies are fundamental items in every economic plan. Because of international trade, economic agents can specialize in the production of goods in which they have a comparative advantage, and use the revenues generated from these activities to buy products in which they have a comparative disadvantage from foreign producers. The law of comparative advantage was born after David Ricardo's critique of Adam Smith's theory of absolute advantage. Smith's theory of absolute advantage, based on the labor theory of value, stated that with free trade, nations could emphasize the production of goods they can make most economically. According to Smith, absolute cost differences will direct the flow of goods among countries. The major drawbacks of the theory of absolute advantage is that Smith's

concept of cost was based on the assumption that labor is the only factor of production and that the price of a product is based on the amount of labor used in the production process. Disgruntled with the law of absolute advantage, Ricardo developed the theory of relative advantage to show that even if other nations have absolute advantages in the production of most consumable goods, a country can still benefit from trade. The basic idea behind Ricardo's theory is that nations should search for the relatively efficient not just the absolutely efficient. Mutually beneficial trade can still occur even if a country is absolutely less efficient than the other nation.

Throughout recent history, policy-makers have attempted to produce efficient trade policies that can boost economic growth. However, there is not a consensus among economists regarding the effect of openness in trade on economic growth. Some of them believe that economic policies oriented towards openness are beneficial for developing countries, others reject this hypothesis. According to Baldwin (2003), there are several reasons for this disagreement. The first and most important reason is the difference in the way economists define and treat the question that is being investigated. Some researchers are concerned about the impact of outward-oriented policies on economic growth; others are looking at the causal relationship between the increase in trade and the increase in growth. On the other hand, the interpretation and definition of openness differ among authors. Many authors measured openness by the ratio of the sum of imports and exports to the gross domestic product (GDP). This type of interpretation of openness has some problems. One of the problems is that import and export measure the flow of trade between countries, and trade flows are not a perfect measure of trade policies. However, the main reason for using such a measure

of openness is because of availability of data on imports, exports and GDP. Other measures based on trade shares include the deviation from predicted trade (Balassa, 1985), and the changes in trade shares (Helliwell and Chung ,1991). Other type of openness measures include price based and administrative policies, export growth and changes in import shares[1]. The interpretation of openness can include broader terms such as taxation, education system, competition and market structure, the government structure, the legal system, the freedom level as being reflected by the civil rights, the number of "coûts d'état" that the nation has had previously, and the characteristics of institutions and cultures. Another reason for the disagreement among economists regarding the effect of openness in trade on economic growth is reflected by the nature of the data and the econometric approach that researchers use to test their models. Because of some missing data, authors tend to use proxies that might not measure exactly the variable of interest. This might cause inaccurate conclusions and policy implications. On the other hand, econometric techniques such as panel data and cross-country estimations have been criticized because of the fragile theoretical foundation as well as the lack of quality data.

In what follows, a survey of different views regarding openness and growth will be presented. The survey will pursue a historical pattern, starting from the aftermath of the World War II where the import substitution concept was the prevailing policy in developing countries, then presenting some aspects of the export-oriented policies which dominated policymakers between 1970's and 1990's, and ending with the

[1] For a comprehensive study of openness measures and their association between openness and economic growth, refer to Harrison (1996).

prominent study of Rodriguez and Rodrik (2001) where they argue that the evidence linking trade barriers and economic growth is erroneous.

Import Substitution After World War II

After the World War II era, a pervasive view was developed among economists and policy makers with regard to trade policies. The prevailing trade policy for developing countries was import substitution. Developing countries sought to emphasize industrialization by implementing import substitution policies. Such a trade policy involves a wide utilization of trade barriers to stimulate internal industrial production and protect such industries from foreign competition. Examples of such policies include tariffs and import quotas. The argument was that the use of tariffs and quotas on imported goods would protect the domestic industry from foreign competitors by increasing the price of foreign competitors charged in the domestic market. This rationale can be emphasized more with the infant industry argument. Protecting newborn industries will allow them to grow and become competitors with the old industries of the foreign countries. It holds that a country might have a comparative advantage in a product, but because of the lack of experience and skills, it cannot compete effectively with the already established foreign competitors. Therefore, a nation should temporarily protect its newborn industry with inward-oriented strategic trade policies until it matures and become stronger to face foreign competition. However, the infant industry argument can be justified only if the cost of protection on domestic consumers is less than the discounted returns of the grown-up protected industry. Offsetting the major acceptance of this argument by economists and policy

makers, the infant industry argument drew many critics. One of the criticisms is that domestic producers will have no inducement to improve their efficiency because of the lack of foreign competition. Another concern was related to the fact that domestic producers will not be able to take advantage of economies of scale since most of the domestic markets in developing countries are relatively small. Another criticism is that nations can adopt an equivalent subsidy to the infant industry instead of implementing trade restriction policies. A subsidy would avoid the relative price and consumption distortions, thus lowering the welfare cost of infant industry protection.

The impact of import substitution policies on economic growth was positive only in the short run. The long run effects of such inward-oriented policies were an overvalued currency as well as a decrease in economic growth. Baldwin (2003, pp.7) argues that the main reasons for the long run failure of import substitution policies is that economists accepted the infant industry argument without questioning it and the fact that they did not look at the macroeconomic outcome when those policies were applied to all manufacturing industries.

Export Promotion and Outward-Oriented Policies

A seminal study at the National Bureau of Economic Research directed by Krueger and Bhagwati changed the way economists look at trade policies. Bhagwati (1978) and Krueger (1978) concluded that import substitution policies contribute positively to economic growth only in the short run; those policies do not contribute to a sustainable long run economic growth; as would outward-oriented and liberalization policies.

After the failure of the import substitution policies in the long run, economists started to look at outward oriented policies during the 1970-1990 period. They thought that international trade could have positive effects on economic growth, especially in developing countries. The first effect is that trade will move the nation from underemployment to full employment by a reallocation of the unemployed resources into the export industry. The second effect is related to Smith's theory of division of labor. Indeed, with trade a nation can expand the size of its market and benefit from economies of scale through the specialization of its labor. One can mention the cases of Taiwan, Hong Kong and Singapore. However this argument should be considered with caution. As Balassa (1971, pp.27-28) mentions, the impact of policies on economic growth depends heavily on the size of domestic markets. In some cases, small developing countries would not be able to achieve economies of scale comparable to that of developed countries. The third effect is reflected through the transmission of technology and skills, which makes developing countries more productive in the production of manufactured goods. Neoclassical models of growth which were initiated by Solow (1957), treated technology as exogenous, independent from any other variable like the openness to international trade. Critics of the Solow model led economists to pursue more in-depth research and to develop the new growth theory where technology is treated as endogenous, depending on several variables. The theory of endogenous growth was mainly strengthened by the work of Romer (1986) and Lucas (1988) by making this theory more rigorous and giving it a stronger conceptual framework for the long run analysis of trade policies and growth. A fourth impact is that international trade can smooth the progress of capital from developed to

developing countries. Finally, trade can boost competition and make domestic producers more efficient in order to meet foreign rivals. Competition can drive down the prices and increase the welfare of the domestic nation.

Economists began investigating those effects through empirical research. A number of studies emphasized the role of international trade and competition in economic growth. Dollar (1992) studied the effect of openness on economic growth with a sample of ninety-five less developed countries. He concluded that trade liberalization and other openness policy reforms can increase economic growth in poor countries. This would imply that countries with policy environments conducive to openness and globalization have a greater chance to grow more rapidly. Edwards (1993) reviewed much of the empirical literature concerning trade policies and growth. He criticized the early cross-country studies by stating that they do not have a strong theoretical ground and that they are erroneous because of econometric issues. In his conclusion, he suggests that there are still some missing channels that researchers should investigate. There are still unexplained results such as the channels through which openness policies would affect economic growth. Edwards also suggests that researchers should focus on developing more reliable measures of trade policies, but he acknowledges the fact that measures of trade policies without any measurement errors will not be found. During the 1984-1995 period, economists tried to build different openness indices that measure levels of openness. Harrison (1996) collected some of those measures for a cross section of developing countries over time and tested whether these measures give the same results. Among those measures are the ones based on trade shares, the ones based on the price, and the ones based on microeconomic and

productivity studies. She found that the consistency of those measures depends on the time period of interest. Different measures showed different result with respect to growth. The least robust measure of openness was the trade share. However Harrison argues that her results were robust because in cases where openness was statistically significant, she found that more openness leads to higher growth. Edwards (1998) used a panel data for 93 countries over the period 1960-1990 in order to investigate the relationship between openness and the total factor productivity growth. Edwards concluded that openness contributes positively to the productivity and growth of an economy. However, Edwards emphasized that further work needed to be done in this domain in order to understand the transmission mechanism from innovation to openness and finally to growth. Frankel and Romer (1999) studied the effect of trade on income for a sample of countries. They concluded that trade does have an effect on the improvement of the standard of living of economies. More recently, Vamvakidis (2002) questioned the evidence of trade liberalization and growth. In his paper, Vamvakidis estimates the role of trade protection on growth using historical data from 1870 to 1990. His main conclusion is that the positive correlation between growth and openness only holds for recent decades.

In most of the reviewed papers, three issues have been noted. First, many economists agree that there should be more search for an accurate measure of openness. Second, there is not a general agreement regarding the causality effect between growth and openness. Some results show that the causality runs in both ways. More open regimes lead to more growth, but also higher growth rates lead to more openness.

Third, separating long run from short run effect is an important attempt when analyzing the effect of openness on economic growth when using cross sectional time series data.

The Openness-Growth Relationship Paradox

In their paper "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence", Rodriguez and Rodrik (1999) argue that the evidence linking trade barriers and economic growth is flawed. The main issue that the authors were questioning is whether countries with more openness to international trade experience faster growth. In their analysis, the authors criticize the following papers: Dollar (1992), Sachs and Warner (1995), Ben David (1993) and Edwards (1998) in addition to Frankel and Romer (1999) and Lee (1993).

Their main argument is that the conclusion that most research economists have about the relationship between trade barriers and economic growth is based on inaccurate empirical measurement of trade barriers. For instance, in order to measure the outward orientation of countries, Dollar (1992) constructs two indices, the real exchange rate distortion and the index of real exchange rate variability. Dollar argues that his index originality is that it reflects the price level that corresponds to a country's resource endowment. Real over-valuation or under-valuation is measured relative to the norm and provides an indication of the extent to which incentives are geared to the domestic or the international market. Thus, this index measures the extent to which the real exchange rate is distorted away from its free trade level by the trade regime. On the other hand, in their paper " Economic reform and the process of global integration", Sachs and Warner (1995) construct a zero/one index of openness. Their index combines

several criteria of trade restriction policies; among them are the average tariff rate, the economic system, the state export system, the black market premium and others. Another study by Edwards (1998) used alternative ways to measure openness. Edwards tested the significance of nine indicators of openness and then chose the most significant ones to use in his regression. He concluded that there is significant proof that there is a positive relationship between openness and economic growth. On the other hand, Ben David (1993) studied the effects of trade policies on income by questioning whether trade openness and liberalization will reduce the dispersion of income levels. In order to do this analysis, he used the convergence hypothesis and found that there is no systematic relation between trade liberalization and convergence.

The critique by Rodrik and Rodriguez (1999) was mainly about the way those researchers measured trade openness. They argued that most of those measures and indices reflect criteria other than the trade openness of nations. Some of the constructed indices would explain macroeconomic imbalances and inappropriate institutions, other like the deviation of domestic prices of tradable goods from world prices reflects mainly the deviation from the purchasing power parity and is not a measure of trade barriers. One can argue that Rodrik and Rodriguez' arguments are valid. In fact those indices do measure aspects other than trade openness. On the other hand, we have seen empirically that many states who have inappropriate institutions, who experience high market premiums, who have a big deviation of their domestic prices of tradable goods from world prices, who have high levels of tariffs, and many other aspect of macroeconomic imbalance and other economic problems do have high barriers to trade, whether it is in a form of policy restriction or in any other form. Therefore, it would be

difficult to identify and separate those measures from the ones that reflect the real trade barriers, and it would be very hard to come up with measures that would take in consideration all the aspects that Rodrik and Rodriguez mentioned in their critique.

Trade in Services and Economic Growth

On the Difference Between Goods and Services

Early research on trade in services focused on the applicability of the classical international trade in goods theory on the service sector. However, questions were raised on whether traditional trade in goods theories are applicable to the services sector. One economist who emphasized the difference between goods and services is Hill (1977, pp 336) who states that goods and services fit in different categories. Since both commodities belong to different groups, one can argue that the traditional theory of international trade cannot be applied to the service sector. However, Hindley and Smith (1984, pp 386) claimed that there is no reason why the traditional theory of trade would not be applied to the service sector. On the other hand, Melvin (1989) shows that Hindley and Smith's argument is not valid. Melvin built a simple two factors, two goods model of trade in services and showed that the principle of comparative advantage and the Heckscher Ohlin theorem necessitate different interpretations from the ones in the traditional trade in goods models. He also showed that commercial policy has a different effect depending on whether the imported commodity used the mobile or immobile factor intensively. Trade patterns, according to Melvin, cannot be determined in cases where both commodities are tradable, and furthermore the standard

commercial trade theory might have different welfare effects. In a recent NBER working paper, Bhattarai and Whalley (1998) question the difference between the gain from liberalization of network-related services and the gain from liberalizing goods. They argue that smaller countries gain higher per capita benefits than larger countries in case of expansion of their networks where network externalities exist. The authors also argue that the benefits from liberalizing trade in services can be of equal size across large and small countries, in contradiction with the standard trade in goods theory, which predicts that the small country will have higher gains than the large one. According to Mattoo, Rathindran and Subramanian (2001), the difference between the impact of services trade liberalization and goods trade liberalization on economic growth is due to two major reasons. Firstly, in many countries, barriers to entry in many service sectors are maintained not only against foreign suppliers, but also against potential domestic suppliers. Liberalization of those sectors can create more competition from both domestic and foreign suppliers. Secondly, trade in services requires mobility of factors that lead to scale effects, whereas trade in goods does not necessitate movement of factors. Jones and Ruane (1990) looked at the difference between liberalizing the service factors and liberalizing the service product. They conclude that in the context of perfect competition, liberalizing both factors and products will have a positive impact on welfare.

On the General Agreement in Trade in Services

During the last decade of the twentieth century, members of the World Trade Organization were concluding their negotiations with a new agreement on trade in basic

services. The aim of this agreement was to promote international competition as well as to impose new rules in order to ensure a competitive environment for international trade in services. The agreement contains a set of schedules of promises. These promises concern mainly national market access by foreign competitors, and treatment equal to local incumbents for foreign service providers. In addition, most members added some regulatory comments to the schedule. The main point of these new regulations was to address the issue of the dominance of the local incumbents and to ensure a competitive atmosphere within the international services market.

Even though the agreement covered many conditions regarding competition and local market access by foreign service providers, there were many criticisms raised. Economists and lawyers argued that the agreement lacked sufficient precision. For instance, the concepts used in the document were neither precise nor very clear. In addition, according to Bloin (2000), the agreement did not resolve lucidly the issue of state sovereignty vis a vis the trade rules. Other concerns embrace the limited scope of liberalization and the sectoral approach to competition rather than a horizontal approach to domestic and foreign competition regulation.

In brief, participants were mainly afraid of a decline in revenues in the domestic services sector, the control of their local infrastructure as well as the protection of their national sovereignty. Regardless of these concerns and fears, the agreement was a first step toward a complete harmony and synchronization for a competitive trade in services.

However, until now, the basic issues have not been applied widely. Many of the members of the WTO, who signed the agreement, still have market barriers to foreign

competition. As a result, the degree of competition and the magnitude of globalization differ among WTO economies. Global services competition does not exist, and export promotion of services has not been fully adopted yet.

Empirical Research on Trade in Services

Despite the fact that services account for a large share of income in many countries, empirical studies on the impact of services trade policies on economic growth is relatively limited. Early research on trade in services concentrated on the financial sector. In *Financial Structure and Development*, Goldsmith (1969, pp. 390-409) argues that predicting and studying the causal relationship between financial structure development and economic growth is very difficult and uncertain. Goldsmith states that the conclusions economic historians have made regarding the relationship between financial development and economic growth cannot be generalized; for their conclusions reflect only the time period and the countries studied. Expanding on Goldsmith's (1969) research, economists have been able to provide additional evidence that there is a positive relationship between the level of development of the financial structure and economic growth. Indeed, Rajan and Zingales (1998), King and Levine (1993), Beck, Levine and Loayza (2000) all find a positive relationship between financial development and economic growth. Since there is evidence that financial structure development contributes to economic growth, one can hypothesize that liberalization of financial institution and openness to international trade in financial services would also contribute to growth. Levine (2001) analyzed this hypothesis and concluded that international financial liberalization spurs long run economic growth in

developing countries. He argues that liberalizing the financial system and allowing foreign banks to enter the domestic market will foster a more efficient domestic banking system, which will have a positive influence on productivity and growth.

Many researchers wrote survey papers in which they analyze trade liberalization in services. Hoekman and Primo Braga (1997) surveyed the literature on trade in services. They argue that experience shows that restrictions and barriers to trade in services can be costly and that liberalization can add efficiency and welfare gains. They concluded by stating that globalization of trade in services remains a big policy issue. Primo Braga (1996) analyzed the impact of globalization of services in developing countries. His main point was that information technology plays an important role in facilitating trade in services and this is why developing countries should remove their barriers to trade in telecommunication services. Many economists tried to explain the contribution of technology to growth. Jones (1998) argues that technology transfer plays an important role in growth. In fact, both the Solow growth model and the new endogenous theory of growth taught us that the growth rate of an economy depends heavily on the growth rate of the technology.

Other studies emphasized the role that telecommunications investment plays in economic growth. Madden and Savage (1998) studied the relationship between growth of fixed investment, telecommunication infrastructure investment and economic growth for a sample of 27 countries from Central and Eastern Europe. Their findings stress the fact that telecommunication infrastructure investment is an important factor for economic growth. They conclude that countries should create a positive environment to promote and encourage international investment in telecommunication infrastructure. This would

increase the aggregate investment and hence strengthen the causation effect between investment and growth. Roller and Waverman (2001) also analyzed the effect of telecommunication infrastructure on economic development. In their study, they used a simultaneous equations approach in which the supply and demand of telecommunication infrastructure and investment respectively are endogenous in the model. Their main contribution was the use of a micro model which was jointly estimated with a macro production function. They found a causal relationship between telecommunication infrastructure and national output.

Studies of the impact of service trade liberalization on economic growth include Matoo, Rathindran and Subramanian (2001) and Verikos and Zhang (2001). Matoo, Rathindran and Subramanian studied the impact of service trade liberalization on economic growth by proposing a measure of openness of a country's services regime and constructing such measures for the telecommunication and financial services sectors. They ran a cross-country regression for a sample of 60 countries and found that openness in trade in services has an impact on the long run economic growth. Stronger evidence was found for the financial services, and weaker evidence was found for the telecommunications sector. Their estimates suggest that countries with full liberalization of the telecommunication and financial services sectors will have a growth rates up to 1.5 percentage points higher than those with more conservative regimes. On the other hand, Verikios and Zhang (2001) estimated the global gains from liberalizing trade in financial and telecommunications services by using a computable general equilibrium approach. They argue that if countries remove all barriers to trade in telecommunications, there will be an increase of 0.1 % in the world real GNP. On the other hand, they found that

removing all barriers to trade in financial services would also increase the world's real GNP by 0.1%. According to their model, the benefits from liberalizing both sectors are reflected by an estimated increase of the world real GNP by $US 48 billion. Those benefits are distributed to almost all regions; developing countries with high barriers to trade in services capture the highest gains whereas developed countries with low barriers capture the smallest gains.

A recent paper by Whalley (2003) discusses current literature on liberalizing trade in services. Whalley argues that despite the fact that researchers have built complex quantitative models trying to predict the impact of services trade liberalization on economic growth, the big picture reflecting the impact of openness in the services industry remains cloudy and confusing. He states that current results appear to be contradictory, especially for developing countries. The main reason for those inconsistent results is due to the approaches researchers take in modeling the restrictions for trade in services. Other problems emerge from the interpretation of empirical results. Whalley argues that the positive effects on economic growth from openness in trade of services might be due from savings and investment following openness rather than the increase in the use of services after globalization. However, it would be difficult to measure the direct effect of liberalizing trade in services independently.

Many economists argued that promoting telecommunication competition has a positive externality. For instance, telecommunication networks enhance the financial system by creating a virtual financial world. Aronson (1997) analyzed how the new globalization of networks is transforming the financial industry. He concludes that although the technology improvement is enhancing the financial sector there is still a

big need for open markets and competition in the telecommunications services industry. However, Aronson did not estimate the magnitude of those cross-sectoral externalities. A study by Deardoff (2001) explains one of the channels through which liberalizing trade in services benefit the world. Deardoff argues that services are usually used to facilitate trade in goods and hence liberalizing trade in services will lead to a reduction in the price of services which lead to a greater consumer surplus.

The work in this dissertation improves upon existing studies by using a simultaneous equation model where two micro economic models are estimated simultaneously along a macro production growth function. Using such an approach to model the effect of openness in trade in services on economic growth will give enhanced econometric results due to the accountability of simultaneity. This study also builds upon previous research by considering the effect of development on the impact of openness on economic growth as well as the effect of development on the supply of banking services. In addition, the study measures the externality effect of the openness in telecommunication services on the supply of financial services. The following chapter presents the theoretical framework upon which the empirical model will be structured.

CHAPTER III

MODEL STRUCTURE

Model Overview

The model, which is designed to show how openness in trade of services affects economic growth in the presence of factor mobility, is constructed following Roller and Waverman (2001) approach[1]. In order to address this question, two microeconomic models of supply and demand for telecommunication and financial services will be incorporated within the model. The main assumption is that the telecommunication and financial sectors affects economic growth through the openness in international trade channels. Figure 3.1 illustrates the basic components of the model. There are five fundamental elements that constitute the model. Those elements are economic growth, openness in the telecommunication sector, openness in the financial sector, the market for telecommunication services and the market for financial services. Both the telecommunication and financial services markets have an impact on economic growth. Openness in trade of telecommunication services and openness in trade of financial services sectors have a direct effect on economic growth as well as on their respective markets. Since the main objective of this study is to measure and estimate the impact of openness in trade of services on economic growth in the presence of factor flow, it is important to identify an accurate measure of economic growth before proceeding to the next step of model construction. This will be the purpose of the following section.

[1] Roller and Waverman's (2001) goal was to investigate how telecommunications infrastructure affects economic growth. They did not look at the issue of openness in trade of telecommunication services.

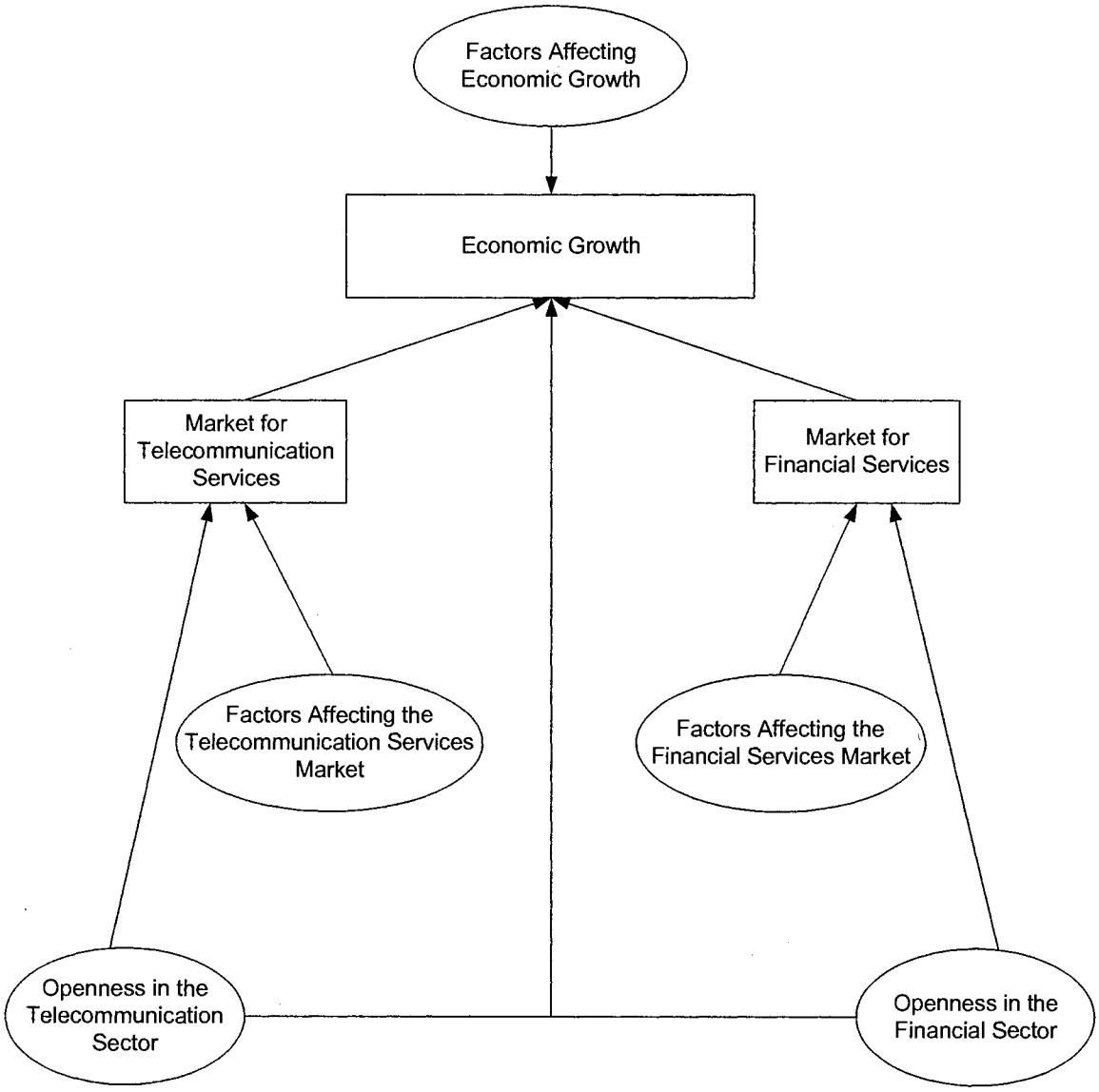

Figure 3.1. Model Overview

Search for an Accurate Measure of Economic Growth

This section sketches the theoretical framework behind the use of the growth of the gross national product as a dependent variable in the growth equation used in the study. First assume there are several nations in which the main factors of production are telecommunications capital *(TEL)*, financial capital *(FIN)* and other capital *(K)*, along with labor *(L)*. Drawing on Boarnet (1998) and Yilmaz, Haynes and Dinc (2002)[2], the output in each of those nations is represented by a continuous production function of the following form:

(1) $Y = \alpha(TEL)\beta(FIN)f(K,L)$

where, Y is output, α, β, and f are continuous functions such that $\alpha'(TEL) > 0, \beta'(FIN) > 0$, $f_K > 0$, $f_{KK} < 0$, $f_L > 0$, and $f_{LL} < 0$.

The marginal product of each factor of production is calculated as follows:

$$\frac{\partial Y}{\partial TEL} = \alpha'(TEL)\beta(FIN)f(K,L)$$

$$\frac{\partial Y}{\partial FIN} = \alpha(TEL)\beta'(FIN)f(K,L)$$

$$\frac{\partial Y}{\partial K} = \alpha(TEL)\beta(FIN)f_K(K,L)$$

$$\frac{\partial Y}{\partial L} = \alpha(TEL)\beta(FIN)f_L(K,L)$$

Assuming the markets are perfectly competitive and the labor and capital markets are mobile within each country, then each factor of production will be paid its marginal

[2] For a deep review of model specification, refer to Boarnet (1998). Yilmaz, Haynes, and Dinc (2002) used Boarnet model in order to estimate the spillover effects of telecommunications infrastructure. Their study was done for the United States.

revenue product. In fact the first-order condition of the profit maximization function leads to:

$$w_i = p\alpha(TEL_i)\beta(FIN_i)f_L(K_i, L_i)$$

$$r_i^K = p\alpha(TEL_i)\beta(FIN_i)f_K(K_i, L_i)$$

$$r_i^{TEL} = p\alpha'(TEL_i)\beta(FIN_i)f(K_i, L_i)$$

$$r_i^{FIN} = p\alpha(TEL_i)\beta'(FIN_i)f(K_i, L_i)$$

where $p, w_i, r_i^K, r_i^{TEL}, r_i^{FIN}$ are the prices of output, labor, other capital, telecommunications capital, and financial capital in country *i*.

Taking the first partial derivatives of $w_i, r_i^K, r_i^{TEL}, r_i^{FIN}$ with respect to *TEL* and *FIN* leads to:

(2) $$\frac{\partial w_i}{\partial TEL_i} = p\alpha'(TEL_i)\beta(FIN_i)f_L(K_i, L_i) > 0$$

(3) $$\frac{\partial r_i^K}{\partial TEL_i} = p\alpha'(TEL_i)\beta(FIN_i)f_K(K_i, L_i) > 0$$

(4) $$\frac{\partial r_i^{FIN}}{\partial TEL_i} = p\alpha'(TEL_i)\beta'(FIN_i)f(K_i, L_i) > 0$$

(5) $$\frac{\partial w_i}{\partial FIN_i} = p\alpha(TEL_i)\beta'(FIN_i)f_L(K_i, L_i) > 0$$

(6) $$\frac{\partial r_i^K}{\partial FIN_i} = p\alpha(TEL_i)\beta'(FIN_i)f_K(K_i, L_i) > 0$$

(7) $$\frac{\partial r_i^{TEL}}{\partial FIN_i} = p\alpha'(TEL_i)\beta'(FIN_i)f(K_i, L_i) > 0.$$

Our main goal is not to study spillover effects of the telecommunications and financial infrastructure among countries, rather equations (2) through (7) were derived in order to

show that when we have an increase in capital investment, whether it is in telecommunications or financial services, the prices of factors of production increase in the short run leading to a movement of factors of production from the nation with a lower return on capital to the nation with a higher one, assuming again capital mobility. An interesting result from equations (4) and (7) is that the change in the rent of financial capital from a given change in telecommunications capital investment is equal to the change in the rent of telecommunications capital from a given change in the financial capital investment, ceteris paribus. This means that the cross rental effects of telecommunications and financial capital investments are the same. This result is derived from Young's theorem which states that the cross partial derivatives of a continuous function are equal. In our case the parent function is the profit function from which we obtained the first order conditions. An implication of the Heckscher-Ohlin theorem is that in the long run, the relative factor prices will equalize. In our case, when we consider the trade in services, we should also be concerned about factor mobility. In fact, exporting telecommunication or financial services to a foreign country requires investment in capital infrastructure.

Since our main objective in this study is to measure the economic growth effect of openness in trade of services in the presence of factor flow, we should look for a dependent variable proxy that will measure accurately the growth effect when factor mobility is assumed. Considering GDP growth as our proxy for economic growth measure would either overstate or understate our evaluation depending on whether the home country is a net importer or a net exporter of services. Therefore, an appropriate measure for economic growth in the presence of factor mobility would be the GNP per

capita growth. Since the main purpose of this study is to analyze the openness effect on economic growth, the appropriate variable of interest would be the GNP per capita growth.

The Behavioral Models

The models are constructed following the approach of Roller and Waverman (2001). First we will construct the national production growth functions by having the growth of GNP as the dependent variable. Then we will proceed by defining the micro models of supply and demand for the telecommunications as well as the financial services sectors. Within this framework, the telecommunication services as well as the financial services sectors will be endogenized into the aggregate growth production function in order to control for the causal effect.

A Behavioral Model for the Telecommunication Services Sector

Since our main objective is to test for the relationship between growth and openness in trade of telecommunication services, a growth production function will be specified as follow:

(8) $G_j = f(X_j, Inv_j^{Tel}, Op_j^{Tel})$

where G_j, the dependent variable, is the growth rate of per capita GNP in country j, X_j is a vector of growth control variables for country j, Inv_j^{Tel} is the investment in telecommunication infrastructure in country j, and Op_j^{Tel} is an index of openness in trade of telecommunications services. Equation (8) relates the national growth aggregate activity to growth control variables, the investment in telecommunication infrastructure

and the index of openness in trade of telecommunication services. The coefficient on *Inv* in equation (8) accounts for the one way causal relationship between the investments in telecommunication infrastructure and the growth in gross national product. Since investment in telecommunication infrastructure depends on other explanatory variables, we specify three other equations that will endogenize the demand and supply of telecommunication services.

Since by definition, the market demand is the total quantity of a good that the consumers are willing and able to buy, demand for telecommunication services is usually inferred by the number of subscribers in different telecommunications services plans and the number of potential consumers who are waiting for their application to be processed in order to be connected to the service network. Hence, the demand for telecommunication services equation will be specified as follows:

(9) $Tel_j = h(GDP_j / POP_j, P_j^{Tel}, POP_j)$

where Tel_j is the local telecommunications demand for country j, GDP_j / POP_j is the gross domestic product per capita for country j, and P_j^{Tel} is the average price of telecommunication services in country j, POP_j is the total population in country j. Equation (9) states that the demand for telecommunication services is a function of per capita GDP, the average price for telecommunication services and the total population.

In order to specify the supply behavioral function, we need to consider the open economy case as opposed to the closed economy case. In an open economy, the market supply of a certain good is defined as the sum of the domestic supply of the good and imports of the same good. Hence in order to specify the market supply function, we

need first to specify the import behavioral function. Domestic imports of telecommunication services:

(10) $M_j^{Tel} = g(GDP_j, P_j^{Tel}, Ex_j, Op_j^{Tel}, Tel_j)$

where M_j^{Tel} and Ex_j are the import of telecommunications services and the exchange rate respectively. Equation (10) provides for the relationship between imports of telecommunication services and some exogenous variables that will explain the changes in imports in the telecommunication services sector. It is important to note that equation (10) provides also for the income and price elasticities of demand for telecommunication services.

Supply of telecommunications services will be defined as follows:

(11) $S_j^{Tel} = u(P_j^{Tel}, GA_j, WL_j^{Tel}, Op_j^{Tel})$

where S_j^{Tel} is the supply of telecommunication services in country j, GA_j is the geographic area of country j, and WL_j^{Tel} is the waiting list for connection to telecommunication services in country j. Equation (11) represents the supply of telecommunication services as being a function of price of telecommunication services, the geographic area of the country, the waiting list for connection, and the openness index for trade in telecommunication services. Figure 3.2 shows a schematic representation of the behavioral model for the telecommunication sector. Notice that there are two independent variables; the telecommunication infrastructure investment and the waiting list are used also as a variable of measurement for the dependant variables; supply and demand for telecommunication services respectively.

The next section presents a behavioral specification for the financial services sector.

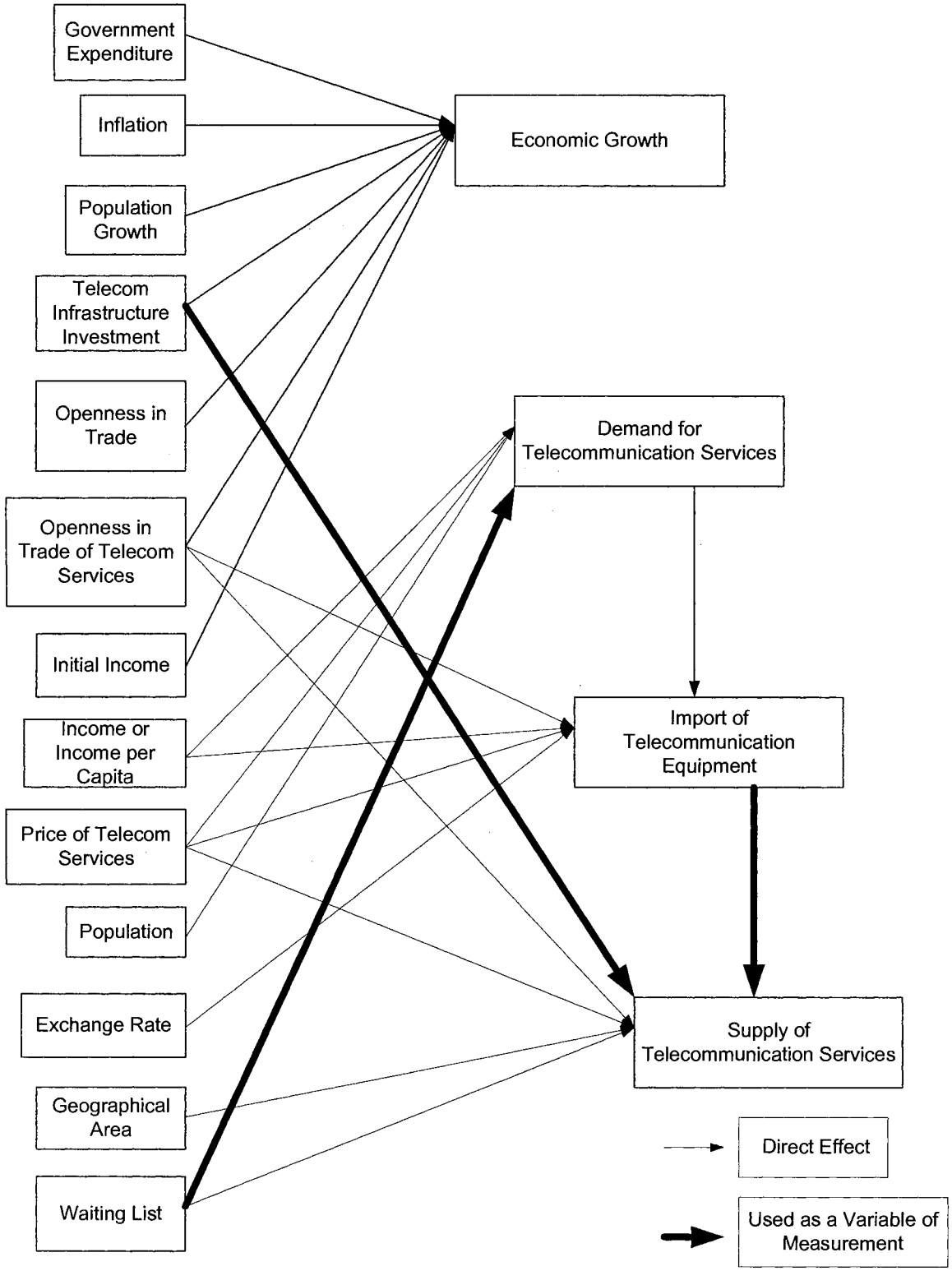

Figure 3.2. The Behavioral Model for the Telecommunication Sector

A Behavioral Model for the Telecommunication and Financial Services Sector

In this section we build a model where both the telecommunication and the financial services sectors are integrated within the model. The only modification is in the aggregate national production growth function where the growth in GNP is expressed as a follows:

(12) $G_j = n(X_j, Inv_j^{Tel}, Op_j^{Tel}, Op_j^{Fin})$

Equation (12) states that the growth in GNP is a function of growth control variables, the investment in telecommunication infrastructure, an index of openness in trade of telecommunication services, and an index of openness in trade in financial services. Demand for financial services is specified as follows:

(13) $Fin_j = l(r_j, Inf_j, GDP_j / POP_j, POP_j)$

where Fin_j is the demand for financial services in country j, r_j is the real interest rate in country j, and Inf_j is the inflation rate in country j. Equation (13) states that the demand of financial services is a function of the real interest rate, the inflation rate, GDP per capita and the total population in the country of interest. It is important to note that equation (13) accounts also for the interest elasticity of the demand for financial services. The behavioral function for the supply of financial services is as follows:

(14) $S_j^{Fin} = m(GA_j, y_j, Op_j^{Fin}, r_j)$

where S_j^{Fin} is the supply of financial services in country j, y_j is the initial income. Equation (14) states that the supply of financial services is a function of the geographic area, the initial income, the openness in trade of financial services and the real interest rate of the country of interest.

To complete this model, we should represent it along with equations (9), (10), and (11). This model provides for the endogenous relationship between the aggregate national growth production function, the telecommunication as well as the financial services sectors. In this way, we will be able to investigate the effect of interaction between the two sectors on economic growth. Figure 3.3 shows a schematic representation of the behavioral model for the telecommunication and financial sectors. As in the previous model, the two independent variables telecommunication infrastructure investment and waiting list enter as proxies for measurement of the supply and demand for telecommunication services respectively. In addition, the quantity demanded of telecommunication services is an explanatory variable for the import of telecommunication equipment, and import of telecommunication equipment enters as a variable of measurement for the supply of telecommunication services. The difference between this model and the previous one is that in this representation, the financial sector is incorporated within the model through the addition of the supply and demand of financial services equations. It is worth noting that the demand for financial services is also an explanatory variable for the welfare growth. Because of the interdependent structure of this model, it would be important to take into consideration a simultaneous econometric methodology when estimating this model.

The following chapter will discuss the data and the methodology for the econometric implementation of the discussed models.

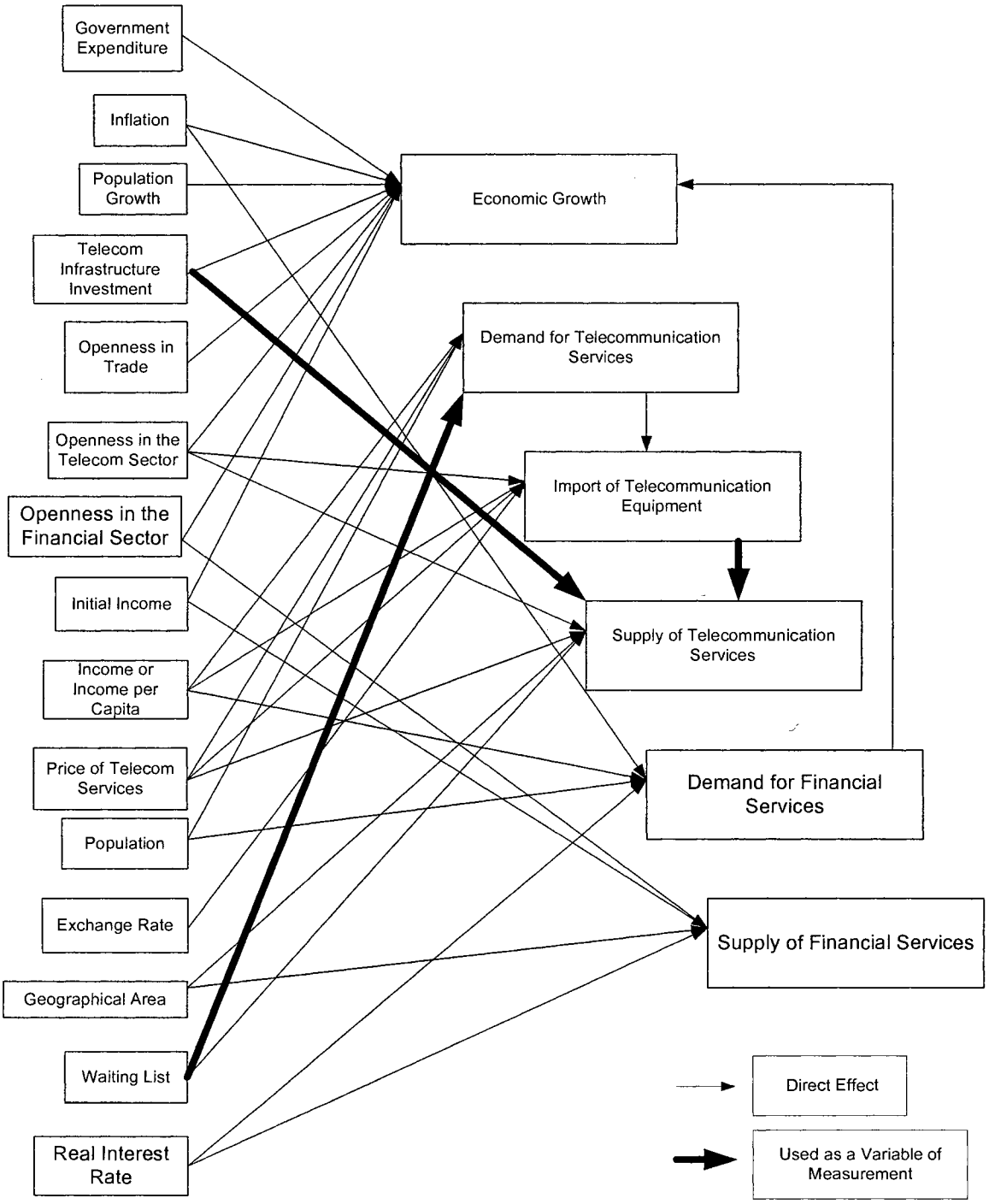

Figure 3.3. The Behavioral Model for the Telecommunication and Financial Sectors

CHAPTER IV

METHODOLOGY, DATA AND RESULTS

The Effect of Openness in Telecommunication Services on Growth

Methodology

The empirical implementation of equations (8), (9), (10) and (11) involves the estimation of the following system of equations:

GNP growth equation:

$$(8') \quad \begin{aligned} G_j &= a_0 + a_1 \ln Gov_j + a_2 Inf_j + a_3 pop_j + a_4 \ln Inv_j^{Tel} + a_5 \ln Op_j + a_6 Op_j^{Tel} \\ &+ a_7[\ln(y_j) Op_j^{Tel}] + \varepsilon_j^1 \end{aligned}$$

Demand for telecommunication services equation:

$$(9') \quad \ln(\sum_{i=1}^{5} Sub_{ij} + WL_j) = b_0 + b_1 \ln(GDP_j / POP_j) + b_2 \ln P_j^{Tel} + b_3 \ln POP_j + \varepsilon_j^2$$

Import of telecommunication equipment equation:

$$(10') \quad \begin{aligned} \ln M_j^{Tel} &= c_0 + c_1 \ln GDP_j + c_2 \ln P_j^{Tel} + c_3 \ln Ex_j + c_4 Op_j^{Tel} \\ &+ c_5 \ln(\sum_{i=1}^{5} Sub_{ij} + WL_j) + \varepsilon_j^3 \end{aligned}$$

Supply of telecommunication services equation:

$$(11') \quad \ln(M_j^{Tel} + Inv_j^{Tel}) = d_0 + d_1 \ln P_j^{Tel} + d_2 \ln GA_j + d_3 \ln WL_j^{Tel} + d_4 Op_j^{Tel} + \varepsilon_j^4$$

where G_j is the average annual growth rate of per capita GNP[1] based on purchasing power parity (PPP) for country j, Gov_j is the average of the government consumption to

[1] The average annual growth rate of per capita GNP was computed for each country as follows: $(\ln GNP_{2000} - \ln GNP_{1989})/12$

GDP ratio for country j, Inf_j is the average inflation rate based on the GDP deflator, pop_j is the average annual population growth rate for country j, Inv_j is the average annual telecommunication equipment investment for country j, Op_j is a measure of openness to international trade for country j which is computed as the average of the ratio of the sum of export and import to the GDP. Op_j^{Tel} is an index of openness to international trade in telecommunication services which takes values from 1 to 9 with higher values indicating more openness. Since the effect of openness of telecommunication services on the GNP growth depends on the level of development of each country, an interaction variable representing the product of the initial GNP (y_j) by the openness index of telecommunication services (Op_j^{Tel}) was implemented in the regression. It is important to note that the interaction variable provides also for the convergence rate. Since under certain situations, less developed countries tend to have a higher rate of growth in GNP than more developed countries, we expect that the coefficient of the interaction variable (a_7) to be negative. The coefficients in front of the government consumption to GDP ratio (a_1), the inflation rate (a_2), and the population growth rate (a_3) are expected to be negative. The coefficient in front of the investment in telecommunication infrastructure (a_4) is expected to be positive. Following the openness and growth past evidence, as discussed before, most of the previous researchers have found that openness in international trade does contribute to growth. Hence we expect the coefficient in front of the openness index (a_5) to be positive.

Equation (9') estimates the demand for telecommunication services in country *j*. The dependent variable $\sum_{i=1}^{5} sub_{ij}$ represents the average sum of the number of subscribers in each telecommunication service in country *j*. Telecommunication services include cable television, cellular mobile telephone, integrated services digital network, telex and telephones. Since the market demand includes also the potential consumers who are willing to buy the services, we added to the sum of subscribers in different services the number of people waiting for their application to be processed in order to be connected to public switched telephone network (WL_j). Variables that explain the demand for telecommunication services include the average per capita GDP (GDP_j / POP_j) for country *j*, the average price of telecommunication services in country *j* (P_j^{Tel}) and the total population of country *j* (POP_j). The average price of telecommunication services was computed by dividing the average total revenue from the telecommunication services by the sum of the average total number of subscribers in each service ($\sum_{i=1}^{5} Sub_{ij}$). Assuming that telecommunication services are normal goods, we expect the coefficient in front of the average per capita GDP (b_1) to be positive, the coefficient in front of the average price (b_2) to be negative, and the coefficient in front of the average total population (b_3) to be positive.

Since we are dealing with an open economy case, the supply of telecommunication services depends on the imports of those same services. Hence we endogenized the import by estimating it empirically within the model. We used the sum of investment in telecommunication infrastructure and the import of telecommunication

equipment as a proxy for supply of telecommunication services. Equation (10') provides an estimation of the import function. The variable Ex_j is the average official exchange rate. We expect that the coefficient in front of per capita income (c_1) to be positive, the one in front of the average price (c_2) to be negative, the one in front of the average exchange rate (c_3) to be negative, the one in front of the openness in trade of telecommunication services (c_4) to be positive and the one in front of the sum of the total subscribers and the number of people waiting for connection (c_5) to be positive.

Equation (11') provides an estimation of the supply function where GA_j is the average geographical surface area measured in square kilometers. We expect the coefficient in front of the average price (d_1), the one in front of the average geographical surface area (d_2), the one in front of the waiting list (d_3), and the one in front of the openness index for the telecommunication services to be all positive.

To estimate the above system of equations, the methods of ordinary least squares (OLS), the two stage least squares (2SLS) and the three stage least squares (3SLS) will be used. Since the model of interest is a simultaneous equations one, we expect that the 3SLS method will give us the most robust results. Indeed, it has been proven that the 3SLS estimator is consistent and in general asymptotically more efficient than the 2SLS estimator. Also, the 3SLS accounts for simultaneity since all the equations will be estimated together as a set, whereas in the case of OLS and 2SLS the equations in the system are estimated separately. Kennedy (1998, pp. 157-167). However, 2SLS and OLS will still be employed for the purposes of exploration and comparison[2].

[2] SAS version 8 will be used to perform the estimations.

To test for misspecification, we will conduct tests for normality, heteroscedasticity, and nonlinearity. The Jarque-Bera test[3] will be used to test for normality of the error distribution. This asymptotic test is based on the skewness and kurtosis of the probability distribution. The following test statistic will be used:

$$JB = n\left[\frac{S^2}{6} + \frac{(K-3)^2}{24}\right]$$

where JB is the Jarque-Bera test statistic, n is the number of observations, S and K are the skewness and kurtosis coefficients of the errors distribution respectively. Under the null hypothesis that the error terms are normally distributed, the Jarque-Bera test statistic follows a Chi-square distribution with 2 degrees of freedom. It is important to note that the Jarque-Bera test is a large sample test and our sample of 64 countries might not be very large. However it will still give us an idea about whether the residuals are distributed normally. To test for heteroscedasticity, Koenker-Bassett test will be used. This test is done by regressing the squared residuals on the squared estimated values of the regressand. The null hypothesis that the coefficient estimate of the squared estimated values of the regressand is zero is tested by an F test. The Ramsey's regression specification error test (RESET) will be used to perform a test of nonlinearity (Johnston and Dinardo, 1997, p. 121 and Gujarati, 2003, pp. 521-523). In order to perform this test, the estimated independent variable is obtained, squared and then introduced as an additional regressor in the original regression form. An F test is employed in order to test whether the model is mis-specified or well specified.

To check for identification, the order condition of identifiability was used. The model is indeed identified. (For each specification)

[3] For a thorough discussion of the Jarque-Bera test, see Gujarati (2003, pp 148-149 and pp. 886-890).

Data

A cross-country regression model was estimated for a sample of 64 countries aggregated as follows: 40 are from low and middle-income countries, and 24 are from high-income countries. Appendix 1 contains a list of the countries included in the sample categorized by income group. The data covered the period 1989-2000, and averages over this period were computed for each variable. Appendix 2 contains a descriptive statistical analysis of the variables used in the regressions. Data on GNP growth rate, government consumption to GDP ratio, inflation rate, population growth, exports, imports, GDP per capita, exchange rates, and geographical surface area were extracted from the World Development Indicators (2002) published by the World Bank. Data on the annual investment in the telecommunication sector, imports of telecommunication equipment, national total revenue of telecommunication sector, number of subscribers in each telecommunication service and the waiting list for main lines were taken from the World Telecommunication Indicators (2002) published by the International Telecommunication Union. Data on the openness index for international trade in telecommunication services were taken from Mattoo, Rathindran and Subramanian (2001). In their paper, Mattoo, Rathindran and Subramanian constructed the openness index for the telecommunication sector based on the market structure, the foreign ownership structure (whether foreign direct investment is allowed), and the existence of independent regulators. For the construction of the index, they used market structure data from a survey done by the International Telecommunication Union in 1998. The index, which was based on a lexicographic approach, ranked countries from 1 to 9, with higher values given to more open countries.

Estimation Results

The first estimation of (8')-(11') includes all the explanatory variables of interest as well as dummy variables to account for differences among the growth rates of low income (di1), lower middle income (di2), and upper middle income countries (di3). Results for the whole sample from the three methods of estimation are shown in columns (1) in Tables 4-1, 4-2, 4-3, and 4-4. The estimated parameters for the aggregate growth production equation indicate that inflation rate and population growth rate are negative and significantly associated with GNP growth. On the other hand, the coefficient on the openness in trade and the coefficient on the investment in telecommunication infrastructure are positive and significant. The coefficient estimate of –0.0245 on the dummy variables for low-income countries suggests that low-income countries have grown on average less than the high-income countries by 2.45 percentage points. Note that the coefficient estimate of the dummy variable for the lower middle-income countries is also negative and highly significant. The parameter estimate of the openness index in trade of telecommunication services is positive and significantly associated with growth in GNP. The total effect of the openness in trade of telecommunication services on economic growth for the whole sample can be measured as follows[4]:

$$\frac{\partial G}{\partial Op^{Tel}} = 0.0187 - 0.0023\left[\overline{\ln(GNI89)}\right]$$

where $\overline{\ln(GNI89)}$ is the mean of $\ln(GNI89)$.

[4] Since the estimation of equations (8')-(11') needs a simultaneous econometric methodology, the results of the 3SLS methodology are used for the computation of the total effect of the openness in trade of telecommunication services.

Table 4-1

Openness in Telecommunications Services and Growth
Growth Equation Regression Results: Whole Sample

Dependent Variable: Growth of Per Capita GNP (1989-2000)

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	0.0054	0.0750**	-0.0060	0.0738**	0.0059	0.1155***	-0.0065	0.0795**	0.0098	0.059**	-0.0095	0.0738**
	(0.14)	(2.55)	(-0.14)	(2.25)	(0.15)	(2.93)	(-0.15)	(2.52)	(0.26)	(2.16)	(-0.22)	(2.39)
ln(Gov)	-0.0090	-0.0114*	-0.0096	-0.0125*	-0.0090*	-0.0134**	-0.0096*	-0.0127**	-0.0093*	-0.0111**	-0.0096*	-0.0112*
	(-1.59)	(-1.97)	(-1.52)	(-1.92)	(-1.74)	(-2.37)	(-1.65)	(-2.11)	(-1.80)	(-2.11)	(-1.68)	(-1.93)
ln(Inf)	-0.0025**	-0.0033***	-0.0019	-0.0028*	-0.0025**	-0.0031***	-0.0019	-0.0028**	-0.0026**	-0.0033***	-0.0020*	-0.0029**
	(-2.17)	(-2.89)	(-1.49)	(-2.20)	(-2.39)	(-2.87)	(-1.62)	(-2.35)	(-2.50)	(-3.21)	(-1.71)	(-2.51)
pop	-0.0049**	-0.0040*	-0.0058**	-0.0047*	-0.0049**	-0.0049**	-0.0057**	-0.0049**	-0.0050**	-0.0039*	-0.0056**	-0.0050**
	(-2.29)	(-1.81)	(-2.44)	(-1.95)	(-2.52)	(-2.25)	(-2.62)	(-2.15)	(-2.58)	(-1.96)	(-2.62)	(-2.25)
$ln(Inv^{Tel})$	0.0025*	0.0010	0.0027*	0.0010	0.0024**	-0.0010	0.0027**	0.0007	0.0025**	0.0016	0.0030**	0.0007
	(1.99)	(0.87)	(1.98)	(0.81)	(2.02)	(-0.58)	(2.02)	(0.60)	(2.09)	(1.48)	(2.25)	(0.55)
ln(Op)	0.0077**		0.0089**		0.0076***		0.0088***		0.0069**		0.0085**	
	(2.43)		(2.52)		(2.61)		(2.70)		(2.37)		(2.62)	
Op^{Tel}	0.0188***	0.0186***	0.0129***	0.0123**	0.0188***	0.0160***	0.0129***	0.0119***	0.0187***	0.0191***	0.0132***	0.0134***
	(4.39)	(4.16)	(2.93)	(2.65)	(4.79)	(3.50)	(3.17)	(2.76)	(4.81)	(4.70)	(3.25)	(3.17)
Op^{Tel}xln(GNI89)	-0.0022***	-0.0022***	-0.0016***	-0.0015***	-0.0022***	-0.0018***	-0.0016***	-0.0015***	-0.0023***	-0.0023***	-0.0017***	-0.0016***
	(-4.49)	(-4.22)	(-3.08)	(-2.77)	(-4.89)	(-3.33)	(-3.32)	(-2.85)	(-4.93)	(-4.72)	(-3.45)	(-3.17)
di1	-0.0241***	-0.0290***	-0.0152*	-0.0201**	-0.0241***	-0.0266***	-0.0152*	-0.0198**	-0.0245***	-0.0249***	-0.0138*	-0.0154*
	(-2.89)	(-3.43)	(-1.71)	(-2.23)	(-3.18)	(-3.26)	(-1.86)	(-2.36)	(-3.26)	(-3.27)	(-1.71)	(-1.89)
di2	-0.0246***	-0.0281***			-0.0246***	-0.0264***			-0.0256***	-0.0269***		
	(-3.49)	(-3.89)			(-3.83)	(-3.82)			(-4.01)	(-4.14)		
di3	-0.0082	-0.0106*			-0.0082	-0.0089			-0.0088*	-0.0099*		
	(-1.40)	(-1.77)			(-1.54)	(-1.53)			(-1.66)	(-1.83)		
di4			-0.0095	-0.0128*			-0.0098*	-0.0125**			-0.0095	-0.0116*
			(-1.52)	(-1.92)			(-1.65)	(-2.02)			(-1.61)	(-1.93)
N	64	64	64	64	64	64	64	64	64	64	64	64
R^2	0.50	0.45	0.38	0.30	0.50	0.43	0.37	0.30				
Adj. R^2	0.41	0.36	0.27	0.20	0.41	0.34	0.27	0.20				
System R^2									0.92	0.75	0.77	0.61
Jarque-Bera[5]	0.89	0.17	0.99	0.61	0.89	0.12	0.98	0.78	0.82	0.18	0.90	0.73
Joint Koenker-Bassett (F)[6]	1.98	0.66	0.38	1.95	1.59	0.26	0.39	1.53	1.36	0.21	0.31	1.56
Reset (F)[7]	2.33	0.02	0.13	0.83	0.49	0.09	0.17	1.52	0.26	0.23	0.17	1.04

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[5] The 5% critical value for the Jarque-Bera statistic is 5.99.

[6] The 5% critical value for the Koenker-Bassett statistic is 1.94.

[7] The 5% critical value for the F statistic is 3.0.

Table 4-2

Openness in Telecommunications Services and Growth
Demand for Telecommunication Services Equation Regression Results: Whole Sample

Dependent Variable: Number of Subscribers plus the Waiting List

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	-9.3357***	11.5751***	5.1932	22.3831***	-11.2169***	9.7845**	3.7644	25.3121***	-10.6695***	15.971***	11.0263**	25.3189***
	(-9.04)	(3.58)	(1.37)	(6.09)	(-8.34)	(2.25)	(0.75)	(4.83)	(-7.94)	(3.64)	(2.29)	(4.83)
ln(GDP/POP)	1.4055***	1.2407***			1.4072***	1.2398***			1.3852***	1.1887***		
	(31.20)	(6.74)			(30.86)	(6.88)			(30.56)	(7.33)		
$\ln(P^{Tel})$	-0.5169***	-1.2389***	-0.5738	-1.2140**	-0.24934	-0.9445	-0.3687	-1.6934*	-0.2703	-1.7566***	-0.8137	-1.6945*
	(-4.55)	(-2.71)	(-1.23)	(-2.02)	(-1.50)	(-1.42)	(-0.56)	(-1.98)	(-1.62)	(-2.73)	(-1.24)	(-1.98)
ln(POP)	0.9134***		0.8062***		0.9274***		0.8168***		0.9138***		0.5410***	
	(31.18)		(6.73)		(30.59)		(6.82)		(30.27)		(4.94)	
N	64	64	64	64	64	64	64	64	64	64	64	64
R^2	0.96	0.46	0.46	0.06	0.96	0.43	0.45	0.05				
Adj. R^2	0.96	0.44	0.44	0.04	0.96	0.41	0.43	0.04				
System R^2									0.92	0.75	0.77	0.61
Jarque-Bera[8]	5.97	0.64	3.50	0.76	14.13	0.67	3.74	0.98	14.22	0.60	1.57	0.99
Joint Koenker-Bassett (F)[9]	1.98	0.66	0.38	1.95	1.59	0.26	0.39	1.53	1.36	0.21	0.31	1.56
Reset (F)[10]	1.62	2.34	0.81	1.86	12.68	1.30	1.15	0.74	13.06	1.28	1.63	0.28

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[8] The 5% critical value for the Jarque-Bera statistic is 5.99.

[9] The 5% critical value for the Koenker-Bassett statistic is 1.94.

[10] The 5% critical value for the F statistic is 3.0.

Table 4-3

Openness in Telecommunications Services and Growth
Import of Telecommunication Equipment Equation Regression Results: Whole Sample

Dependent Variable: Import of Telecom Equipment

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	3.3435*	-3.4733	3.3298*	-4.0650*	3.1330	-6.8627**	3.2214	-8.4386***	3.9380	-9.4272***	3.7887	-5.0800*
	(1.87)	(-1.61)	(1.88)	(-1.91)	(1.28)	(-2.44)	(1.33)	(-3.00)	(1.62)	(-3.48)	(1.57)	(-1.85)
ln(GDP)	-0.1294	0.7895***	-0.1341	0.7871***	-0.2538	0.8063***	-0.2441	0.8113***	-0.2750*	0.8616***	-0.2759*	0.7060***
	(-1.00)	(13.11)	(-1.07)	(12.97)	(-1.63)	(13.32)	(-1.61)	(12.86)	(-1.79)	(15.24)	(-1.82)	(11.62)
ln(Ex)	-0.0042	-0.0497			0.0082	-0.0325			0.0155	-0.0021		
	(-0.16)	(-1.40)			(0.32)	(-0.89)			(0.62)	(-0.06)		
$\ln(P^{Tel})$	0.8050***	0.3617	0.8132***	0.4370*	1.0324***	0.8356**	1.0064***	1.0521***	1.0152***	1.0160***	0.9954***	0.9183***
	(4.61)	(1.58)	(4.91)	(1.95)	(4.34)	(2.44)	(4.52)	(3.10)	(4.29)	(3.02)	(4.47)	(2.73)
Op^{Tel}	0.0546*	0.1256***	0.0548*	0.1332***	0.0456	0.1288***	0.0451	0.1339***	0.0679**	0.1241***	0.0522*	0.1543***
	(1.84)	(3.20)	(1.86)	(3.40)	(1.53)	(3.30)	(1.52)	(3.33)	(2.34)	(3.44)	(1.76)	(3.88)
$\ln(\sum_{i=1}^{3} sub_i + wl)$	0.9366***		0.9412***		1.0693***		1.0595***		1.0480***		1.0769***	
	(7.52)		(7.83)		(7.10)		(7.22)		(7.07)		(7.35)	
N	64	64	64	64	64	64	64	64	64	64	64	64
R^2	0.92	0.85	0.92	0.84	0.92	0.84	0.92	0.83				
Adj. R^2	0.91	0.84	0.92	0.83	0.91	0.83	0.91	0.82				
System R^2									0.92	0.75	0.77	0.61
Jarque-Bera[11]	19.60	20.75	19.27	18.28	4.38	1.92	4.81	1.48	3.29	1.38	4.13	2.33
Joint Koenker-Bassett (F)[12]	1.98	0.66	0.38	1.95	1.59	0.26	0.39	1.53	1.36	0.21	0.31	1.56
Reset (F)[13]	2.43	0.96	2.48	0.67	3.40	1.08	6.13	1.49	3.34	0.97	6.10	1.37

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[11] The 5% critical value for the Jarque-Bera statistic is 5.99.

[12] The 5% critical value for the Koenker-Bassett statistic is 1.94.

[13] The 5% critical value for the F statistic is 3.0.

Table 4-4

Openness in Telecommunications Services and Growth
Supply of Telecommunication Services Equation Regression Results: Whole Sample

Dependent Variable: Investment in Telecom Infrastructure plus Imports

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	17.1854***	23.0032***	20.4494***	18.6622***	20.4491***	35.4027***	24.3394***	19.5800***	21.5653***	38.5334***	23.0017***	23.1633***
	(5.15)	(6.22)	(5.99)	(6.59)	(4.09)	(5.71)	(4.61)	(4.90)	(4.34)	(6.50)	(4.56)	(5.91)
$\ln(P^{Tel})$	-0.2579	-0.8384	-0.3227	-0.1317	-0.7367	-2.6228***	-0.9004	-0.2797	-0.9034	-2.6858***	-0.6588	-0.6260
	(-0.56)	(-1.59)	(-0.65)	(-0.29)	(-1.03)	(-2.89)	(-1.16)	(-0.44)	(-1.27)	(-3.04)	(-0.88)	(-0.98)
ln(GA)	0.2671***	0.3332***			0.2633***	0.32057***			0.2843***	0.0669		
	(3.21)	(3.43)			(3.26)	(3.03)			(3.56)	(0.82)		
ln(WL)	-0.0639	-0.1670***	-0.0463		-0.0832*	-0.3095***	-0.0699		-0.1045**	-0.2732***	-0.0182	
	(-1.38)	(-3.42)	(-0.94)		(-1.66)	(-4.36)	(-1.29)		(-2.12)	(-4.25)	(-0.37)	
Op^{Tel}	0.3515***		0.3877***	0.4184***	0.3330***		0.3647***	0.4161***	0.3075***		0.2600***	0.1709***
	(4.98)		(5.18)	(6.22)	(4.64)		(4.73)	(6.29)	(4.33)		(3.69)	(4.23)
N	64	64	64	64	64	64	64	64	64	64	64	64
R^2	0.49	0.28	0.40	0.39	0.49	0.31	0.40	0.39				
Adj. R^2	0.46	0.24	0.37	0.37	0.45	0.28	0.37	0.37				
System R^2									0.92	0.75	0.77	0.61
Jarque-Bera[14]	0.70	0.33	1.28	0.81	0.62	0.08	1.36	0.77	0.51	0.57	0.58	0.54
Joint Koenker-Bassett (F)[15]	1.98	0.66	0.38	1.95	1.59	0.26	0.39	1.53	1.36	0.21	0.31	1.56
Reset (F)[16]	0.39	0.38	1.28	0.08	0.04	0.00	0.18	0.01	0.04	0.17	0.00	0.37

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[14] The 5% critical value for the Jarque-Bera statistic is 5.99.

[15] The 5% critical value for the Koenker-Bassett statistic is 1.94.

[16] The 5% critical value for the F statistic is 3.0.

The total effect is equal to –0.001023 (with a standard error of 0.000608) indicating that an increase of one unit in the index will lead to a decrease of 0.1023 percentage points in GNP per capita growth rate. This result does not match previous expectations. The insight behind the implementation of the interaction parameter was that low-income countries rarely produce telecommunication services, they mainly import those services. Hence this interaction parameter captures the fact that openness in trade of telecommunication services might benefit only less developed countries; developed countries might be hurt from openness. Setting the above equation equal to zero and solving for $\overline{GNI89}$ give us a threshold of $3,396 suggesting that countries that have an initial income (GNP per capita in 1989 adjusted for PPP) above $3,396 are hurt from openness in trade of telecommunication services. In order to investigate the reason behind the negative sign of the total effect of the openness index in trade in telecommunication services, we split our sample and estimated the same models for low and middle-income countries alone, and high-income countries alone. The results are reported in Tables 4-5, 4-6, 4-7, 4-8, 4-9, 4-10, 4-11, and 4-12. The total effect of the openness in trade of telecommunication services on economic growth for low and middle-income countries is 0.000727 (with a standard error of 0.000817) meaning that an increase of the telecommunication openness index by one point will lead to an increase in GNP per capita growth by 0.0727 percentage points. On the other hand, the total effect of the openness in trade of telecommunication services on economic growth for high-income countries is –0.00105 (with a standard error of 0.000699), suggesting that an increase in the telecommunication openness index by one point will lead to a decrease of the GNP growth rate by 0.105 percentage point. This analysis explains the negative sign

for the total effect of openness in telecommunication sector when the whole sample was considered in the estimation. Note that the total effect for high-income countries is larger in absolute value than the total effect for the low-income countries. The negative effect in the whole sample is caused by the negative effect found in the high-income countries sample. This result can be explained through the theory of reciprocal demand of John Stuart Mill (1921). Assume that low-income countries import telecommunication services and export another good, say agricultural products. Most low-income countries have a small demand for telecommunication services compared to the demand of agricultural products of high-income countries. Considering low income countries as small ones, the term of trade would converge to the price of the high-income countries and hence low-income countries would benefit more than high-income countries from trade. In the extreme case, high-income countries might even be hurt from trading. On the other hand, as we have seen in chapter one, there might be negative effects when liberalizing international trade in telecommunication services. According to Mattoo Rathindran and Subramanian(2001) those negative effects are explained through the decrease in the employment of national factors of production, and since GNP accounts for income earned by the citizens and businesses of the nation, the negative effect of the decrease in employment of national factors can have a big impact on the GNP per capita growth. In the extreme case, the magnitude of the negative factor employment effect might be higher than the magnitude of the spillover of technology and the total result of liberalizing trade in telecommunication services can be negative. In the case of lower- income counties, the magnitude of the positive spillover of technology effect seems to be much higher than

Table 4-5

Openness in Telecommunications Services and Growth
Growth Equation Regression Results: Low And Middle Income Countries

Dependent Variable: Growth of Per Capita GNP (1989-2000)

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	0.0185	0.0649	0.0030	0.0489	0.0117	0.1069**	-0.0040	0.0638	0.0129	0.1042**	-0.0076	0.0562
	(0.31)	(1.47)	(0.05)	(1.07)	(0.22)	(2.18)	(-0.07)	(1.51)	(0.24)	(2.13)	(-0.14)	(1.40)
ln(Gov)	-0.0147	-0.0143	-0.0147	-0.0143	-0.0146	-0.0160*	-0.0146*	-0.0149*	-0.0157*	-0.0159*	-0.0147*	-0.0143*
	(-1.57)	(-1.52)	(-1.57)	(-1.52)	(-1.79)	(-1.87)	(-1.79)	(-1.79)	(-1.95)	(-1.86)	(-1.83)	(-1.81)
ln(Inf)	-0.0028*	-0.0037**	-0.0028*	-0.0037**	-0.0028**	-0.0035***	-0.0028**	-0.0036***	-0.0027*	-0.0034**	-0.0026*	-0.0031**
	(-1.80)	(-2.65)	(-1.80)	(-2.65)	(-2.06)	(-2.75)	(-2.06)	(-2.93)	(-2.01)	(-2.74)	(-1.94)	(-2.63)
pop	-0.0076**	-0.0076**	-0.0076**	-0.0076**	0.0067	-0.0088***	-0.0074**	-0.0080**	-0.0073**	-0.0087***	-0.0072**	-0.0077***
	(-2.31)	(-2.31)	(-2.31)	(-2.31)	(1.40)	(-2.86)	(-2.63)	(-2.74)	(-2.57)	(-2.83)	(-2.55)	(-2.75)
$ln(Inv^{Tel})$	0.0028	0.0018	0.0028	0.0018	0.0031*	-0.0002	0.0031*	0.0011	0.0032*	-0.0001	0.0032*	0.0013
	(1.49)	(1.06)	(1.49)	(1.06)	(1.75)	(-0.09)	(1.75)	(0.69)	(1.82)	(-0.03)	(1.84)	(0.81)
ln(Op)	0.0064		0.0064		0.0067		0.0067		0.0066		0.0066	
	(1.17)		(1.17)		(1.40)		(1.40)		(1.39)		(1.40)	
Op^{Tel}	0.0218***	0.0211***	0.0218***	0.0211***	0.0222***	0.0183**	0.0222***	0.0201***	0.0221***	0.0184**	0.0218***	0.0223***
	(2.99)	(2.88)	(2.99)	(2.88)	(3.47)	(2.66)	(3.47)	(3.08)	(3.49)	(2.68)	(3.44)	(3.59)
Op^{Tel}xln(GNI89)	-0.0027***	-0.0026***	-0.0027***	-0.0026***	-0.0027***	-0.0022**	-0.0027***	-0.0024***	-0.0027***	-0.0022**	-0.0027***	-0.0027***
	(-2.95)	(-2.82)	(-2.95)	(-2.82)	(-3.42)	(-2.51)	(-3.42)	(-2.99)	(-3.45)	(-2.54)	(-3.39)	(-3.49)
di1	-0.0157*	-0.0161*			-0.0157**	-0.0149**			-0.0162**	-0.0149**		
	(-1.97)	(-2.01)			(-2.28)	(-2.07)			(-2.37)	(-2.06)		
di2	-0.0169***	-0.0170***	-0.0012	-0.0009	-0.0169***	-0.0169***	-0.0012	-0.0013	-0.0179***	-0.0169***	-0.0008	-0.0008
	(-3.00)	(-3.00)	(-0.20)	(-0.15)	(-3.46)	(-3.30)	(-0.21)	(-0.23)	(-3.70)	(-3.31)	(-0.15)	(-0.16)
di3			0.0156*	0.0161*			0.157**	0.0157**			0.0170**	0.0186***
			(1.97)	(2.01)			(2.28)	(2.22)			(2.49)	(2.77)
N	40	40	40	40	40	40	40	40	40	40	40	40
R^2	0.54	0.52	0.54	0.52	0.54	0.50	0.54	0.51				
Adj. R^2	0.40	0.39	0.40	0.39	0.40	0.37	0.40	0.38				
System R^2									0.90	0.65	0.80	0.61
Jarque-Bera[17]	1.05	0.55	1.05	0.55	1.06	0.39	1.06	0.40	1.08	0.38	1.26	0.29
Joint Koenker-Bassett (F)[18]	1.23	1.92	1.46	1.93	1.41	3.50	1.91	2.19	1.41	3.25	0.76	2.78
Reset (F)[19]	0.06	0.95	0.06	0.95	7.01	8.34	7.01	8.07	0.09	1.21	0.13	0.98

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[17] The 5% critical value for the Jarque-Bera statistic is 5.99.

[18] The 5% critical value for Koenker-Bassett statistic is 2.43.

[19] The 5% critical values for the F statistic are 3.07 for models (1), (2) and (3), and 3.06 for models (4).

Table 4-6

Openness in Telecommunications Services and Growth
Demand for Telecom Services Equation Regression Results : Low And Middle Income Countries

Dependent Variable: Number of Subscribers plus the Waiting List

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	-6.8840***	17.2536***	12.2286***	29.0054***	-10.0803***	22.2785***	17.1530***	38.3092***	-8.8521***	27.0647***	27.5370***	38.1524***
	(-3.39)	(4.02)	(3.47)	(9.79)	(-3.61)	(3.53)	(3.83)	(8.41)	(-3.19)	(4.88)	(7.59)	(8.39)
ln(GDP/POP)	1.3425***	0.9951***			1.4198***	0.8489**			1.3657***	0.5492**		
	(13.49)	(3.44)			(12.98)	(2.69)			(12.73)	(2.17)		
$\ln(P^{Tel})$	-0.6697***	-1.8438***	-1.6283***	-2.4378***	-0.3494	-2.4775***	-2.2510***	-3.9793***	-0.4344*	-2.8630***	-2.9436***	-3.9534***
	(-3.91)	(-3.97)	(-4.31)	(-4.98)	(-1.36)	(-3.31)	(-4.36)	(-5.28)	(-1.69)	(-4.05)	(-6.09)	(-5.26)
ln(POP)	0.8521***		0.7135***		0.8899***		0.6436***		0.8736***		0.2713***	
	(17.01)		(6.00)		(16.25)		(5.15)		(16.00)		(3.24)	
N	40	40	40	40	40	40	40	40	40	40	40	40
R^2	0.94	0.54	0.69	0.39	0.94	0.49	0.67	0.41				
Adj. R^2	0.94	0.51	0.67	0.37	0.93	0.47	0.66	0.39				
System R^2									0.90	0.65	0.80	0.61
Jarque-Bera[20]	0.28	0.35	0.90	0.29	0.94	0.56	0.70	0.47	1.06	0.44	0.86	0.47
Joint Koenker-Bassett (F)[21]	1.23	1.92	1.46	1.93	1.41	3.50	1.91	2.19	1.41	3.25	0.76	2.78
Reset (F)[22]	0.84	3.63	3.15	0.38	0.97	5.20	2.67	0.36	0.91	4.89	2.53	0.42

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[20] The 5% critical value for the Jarque-Bera statistic is 5.99.

[21] The 5% critical value for Koenker-Bassett statistic is 2.43.

[22] The 5% critical values for the F statistic are 3.07 for models (1), (2) and (3), and 3.06 for models (4).

Table 4-7

Openness in Telecommunications Services and Growth
Import of Telecom Equipment Equation Regression Results: Low And Middle Income Countries

Dependent Variable: Import of Telecom Equipment

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	2.0764	-06012	2.2756	-0.728	0.7824	0.9239	1.6111	-0.6794	0.4283	4.8402	0.2687	4.5774
	(0.93	(-0.20)	(1.04)	(-0.25)	(0.25)	(0.23)	(0.54)	(-0.16)	(0.14)	(1.25)	(0.09)	(1.11)
ln(GDP)	-0.0029	0.7611***	0.0084	0.7618***	-0.1940	0.7469***	-0.1722	0.7612***	-0.3242*	0.6614***	-0.2258	0.6482***
	(-0.02)	(9.99)	(0.06)	(10.14)	(-1.10)	(10.04)	(-0.99)	(9.10)	(-1.87)	(9.38)	(-1.31)	(8.33)
ln(Ex)	0.0175	-0.0089			0.0318	-0.0148			0.0395	0.0003		
	(0.59)	(-0.22)			(1.07)	(-0.37)			(1.40)	(0.01)		
$\ln(P^{Tel})$	0.7128***	-0.0028	0.6773***	0.0097	1.390***	-0.1860	1.0134***	0.0043	1.3388***	-0.4774	1.2103***	-0.3989
	(3.04)	(-0.01)	(3.02)	(0.04)	(3.44)	(-0.41)	(3.30)	(0.01)	(4.11)	(-1.10)	(3.98)	(-0.92)
Op^{Tel}	0.0476	0.0646	0.0460	0.0655	0.0517	0.0556	0.0470	0.0653	0.0532*	0.0391	0.0464	0.0626
	(1.46)	(1.45)	(1.43)	(1.49)	(1.55)	(1.20)	(1.44)	(1.48)	(1.67)	(0.96)	(1.44)	(1.46)
$\ln(\sum_{i=1}^{5} sub_i + wt)$	0.8395***		0.8258***		1.0778***		1.0444***		1.2423***		1.1486***	
	(5.66)		(5.69)		(5.96)		(5.91)		(7.04)		(6.60)	
N	40	40	40	40	40	40	40	40	40	40	40	40
R^2	0.91	0.82	0.91	0.82	0.90	0.82	0.90	0.82				
Adj. R^2	0.89	0.80	0.90	0.80	0.88	0.80	0.89	0.80				
System R^2									0.90	0.65	0.80	0.61
Jarque-Bera[23]	28.24	54.26	33.39	52.33	2.44	92.92	3.44	53.17	2.27	73.62	2.27	55.75
Joint Koenker-Bassett (F)[24]	1.23	1.92	1.46	1.93	1.41	3.50	1.91	2.19	1.41	3.25	0.76	2.78
Reset (F)[25]	0.82	4.89	1.04	4.50	0.15	2.56	1.79	4.52	0.12	3.71	1.57	8.54

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[23] The 5% critical value for the Jarque-Bera statistic is 5.99.

[24] The 5% critical value for Koenker-Bassett statistic is 2.43.

[25] The 5% critical values for the F statistic are 3.07 for models (1), (2) and (3), and 3.06 for models (4).

Table 4-8

Openness in Telecommunications Services and Growth
Supply of Telecom Services Equation Regression Results: Low And Middle Income Countries

Dependent Variable: Investment in Telecom Infrastructure plus Imports

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	18.2124***	20.6716***	20.2502***	26.1419***	25.2636***	30.2461***	25.8745***	35.9923***	25.2951***	34.1970***	30.9484***	37.1091***
	(5.72)	(6.47)	(5.37)	(8.41)	(5.58)	(4.93)	(4.92)	(6.99)	(5.63)	(6.58)	(7.31)	(8.92)
$\ln(P^{Tel})$	-0.9947**	-1.3163***	-0.8231*	-1.2292**	-1.9842***	-2.5829***	-1.5901**	-2.7745***	-1.9889***	-2.7070***	-2.1396***	-2.9263***
	(-2.47)	(-3.27)	(-1.71)	(-2.55)	(-3.28)	(-3.44)	(-2.29)	(-3.45)	(-3.31)	(-3.94)	(-3.52)	(-4.26)
ln(GA)	0.4679***	0.4874***			0.4968***	0.5836***			0.4955***	0.2188		
	(4.11)	(4.04)			(4.28)	(309)			(4.30)	(1.52)		
ln(WL)	0.0662	0.0698	0.2957**		-0.0319	-0.1960	0.2299*		-0.0280	-0.0783	0.1135	
	(0.58)	(0.57)	(2.46)		(-0.26)	(-0.63)	(1.83)		(-0.23)	(-0.33)	(1.35)	
Op^{Tel}	0.1592**		0.1793**	0.1904**	0.1033		0.1365	0.0870	0.09658		0.0614	0.04739***
	(2.36)		(2.22)	(2.22)	(1.42)		(1.62)	(0.85)	(1.34)		(1.19)	(2.77)
N	40	40	40	40	40	40	40	40	40	40	40	40
R^2	0.62	0.55	0.43	0.33	0.60	0.50	0.43	0.35				
Adj. R^2	0.57	0.51	0.38	0.29	0.55	0.46	0.38	0.32				
System R^2									0.90	0.65	0.80	0.61
Jarque-Bera[26]	0.93	4.82	7.26	0.76	0.79	0.30	2.36	1.28	0.73	0.33	1.76	1.26
Joint Koenker-Bassett (F)[27]	1.23	1.92	1.46	1.93	1.41	3.50	1.91	2.19	1.41	3.25	0.76	2.78
Reset (F)[28]	0.29	0.77	0.01	0.35	0.17	0.41	0.03	0.17	0.18	0.75	0.03	0.27

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[26] The 5% critical value for the Jarque-Bera statistic is 5.99.

[27] The 5% critical values for Koenker-Bassett statistic is 2.43.

[28] The 5% critical values for the F statistic are 3.07 for models (1), (2) and (3), and 3.06 for models (4).

Table 4-9

Openness in Telecommunications Services and Growth Growth Equation Regression Results: High Income Countries

Dependent Variable: Growth of Per Capita GNP (1989-2000)

	OLS	2SLS	3SLS
Variable	(1)	(1)	(1)
Intercept	-0.0003	-0.0093	-0.0057
	(-0.01)	(-0.30)	(-0.19)
ln(Gov)	-0.0007	-0.0003	-0.0002
	(-0.16)	(-0.08)	(-0.05)
ln(Inf)	-0.0025	-0.0025	-0.0023
	(-1.17)	(-1.38)	(-1.29)
pop	0.0011	0.0009	0.0013
	(0.53)	(0.58)	(0.77)
$\ln(Inv^{Tel})$	0.0011	0.0014	0.0012
	(0.96)	(1.47)	(1.22)
ln(Op)	0.0064**	0.0069***	0.0067**
	(2.30)	(2.99)	(2.90)
Op^{Tel}	0.0184*	0.0182**	0.0183**
	(2.05)	(2.47)	(2.51)
Op^{Tel}xln(GNI89)	-0.0021**	-0.0021**	-0.0020**
	(-2.30)	(-2.80)	(-2.80)
N	24	24	24
R^2	0.69	0.70	
Adj. R^2	0.56	0.56	
System R^2			0.98
Jarque-Bera[29]	2.96	3.56	2.49
Joint Koenker-Bassett (F)[30]	1.02	1.50	1.22
Reset (F)[31]	7.93	7.65	8.22

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[29] The 5% critical value for the Jarque-Bera statistic is 5.99.

[30] The 5% critical value for the Koenker Bassett statistic is 2.49.

[31] The 5% critical value for the F statistic is 3.14.

Table 4-10

Openness in Telecommunications Services and Growth
Demand for Telecom Services Equation Regression Results: High Income Countries

Dependent Variable: Number of Subscribers plus the Waiting List

	OLS	2SLS	3SLS
Variable	(1)	(1)	(1)
Intercept	-8.7694***	-8.7091***	-8.6275***
	(-5.65)	(-6.11)	(-6.24)
ln(GDP/POP)	1.0735***	1.0950***	1.0679***
	(5.92)	(6.39)	(6.57)
$\ln(P^{Tel})$	-0.2321	-0.2789	-0.2405
	(-1.38)	(-1.54)	(-1.34)
ln(POP)	0.9723***	0.9735***	0.9702***
	(47.18)	(51.23)	(51.33)
N	24	24	
R^2	0.99	0.99	
Adj. R^2	0.99	0.99	
System R^2			0.98
Jarque-Bera[32]	0.33	0.20	0.23
Joint Koenker-Bassett (F)[33]	1.02	1.50	1.22
Reset (F)[34]	4.73	2.75	2.82

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[32] The 5% critical value for the Jarque-Bera statistic is 5.99.

[33] The 5% critical value for the Koenker Bassett statistic is 2.49.

[34] The 5% critical value for the F statistic is 3.14.

Table 4-11

Openness in Telecommunications Services and Growth
Import of Telecom Equipment Equation Regression Results: High Income Countries

Dependent Variable: Import of Telecom Equipment

Variable	OLS (1)	2SLS (1)	3SLS (1)
Intercept	7.4175	16.2238	23.0714**
	(1.02)	(1.34)	(2.09)
ln(GDP)	-0.9776	-2.3646	-3.1285**
	(-1.17)	(-1.50)	(-2.20)
ln(Ex)	-0.0236	0.0039	0.0033
	(-0.43)	(0.07)	(0.06)
$\ln(P^{Tel})$	1.7018**	2.4257***	2.6689***
	(2.77)	(2.97)	(3.42)
Op^{Tel}	0.0369	-0.0189	0.03245
	(0.48)	(-0.21)	(0.40)
$\ln(\sum_{i=1}^{5} sub_i + wl)$	1.7211*	3.1596*	3.8517**
	(1.98)	(1.92)	(2.59)
N	24	24	24
R^2	0.90	0.89	
Adj. R^2	0.88	0.86	
System R^2			0.98
Jarque-Bera[35]	2.85	0.02	0.76
Joint Koenker-Bassett (F)[36]	1.02	1.50	1.22
Reset (F)[37]	1.70	1.80	1.89

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[35] The 5% critical value for the Jarque-Bera statistic is 5.99.

[36] The 5% critical value for the Koenker Bassett statistic is 2.49.

[37] The 5% critical value for the F statistic is 3.14.

Table 4-12

Openness in Telecommunications Services and Growth
Supply of Telecom Services Equation Regression Results: High Income Countries

Dependent Variable: Investment in Telecom Infrastructure plus Imports

	OLS	2SLS	3SLS
Variable	(1)	(1)	(1)
Intercept	-3.8229	-7.4950	-7.3926
	(-0.53)	(-1.01)	(-1.01)
$\ln(P^{Tel})$	3.0742**	3.6638***	3.6530***
	(2.71)	(3.13)	(3.14)
ln(GA)	0.2749**	0.2866**	0.3192***
	(2.46)	(2.84)	(3.27)
ln(WL)	0.0894	0.0966*	0.0791
	(1.55)	(1.85)	(1.59)
Op^{Tel}	0.3330**	0.3097**	0.2679**
	(2.49)	(2.53)	(2.22)
N	24	24	24
R^2	0.66	0.66	
Adj. R^2	0.59	0.59	
System R^2			0.98
Jarque-Bera[38]	3.16	5.23	6.27
Joint Koenker-Bassett (F)[39]	1.02	1.50	1.22
Reset (F)[40]	0.52	0.60	0.30

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[38] The 5% critical value for the Jarque-Bera statistic is 5.99.

[39] The 5% critical value for the Koenker Bassett statistic is 2.49.

[40] The 5% critical value for the F statistic is 3.14.

the magnitude of the negative effect of the decrease in the employment of national factors, and hence the total effect of liberalizing trade in telecommunication services is positive. It is important to note that the above explanations are hypothesis and not conclusions.

Models (2), (3), and (4) were estimated to look at the effect of removing an independent variable from the regression on the significance of the coefficient estimates of other explanatory variables. It seems that there are no noticeable changes with regard to the significance level of the parameter estimates when we exclude the openness in trade variable or when we include a dummy variable accounting for lower middle-income and upper middle-income countries together instead of including two separate dummies accounting for both categories of countries independently.

Before interpreting other equations in our models, it is worth emphasizing that the purpose of incorporating the demand, import, and supply of telecommunication services equations in the model is to control for them as much as possible. In addition, it is reassuring that most of the estimates in all equations do conform to economic theory and other related empirical evidence.

Results of the estimation of the demand for telecommunication services equation for the whole sample, low and middle-income and high income-countries are reported in Tables 4-2, 4-6, and 4-10 respectively. The parameter estimate of the GDP per capita appears to be positive and significantly associated with the quantity demanded for all samples, in all models, and all estimation methodologies. This result suggests that the income elasticity is positive and that telecommunication services are normal services as opposed to inferior services. The estimate of the elasticity for the whole sample is

roughly 1.39 suggesting that if per capita income increases (decreases) by one percent, demand for telecommunication services increases (decreases) by 1.39 percent. Estimates of the price coefficient are not significant for the 3SLS estimation (model 1) for the whole sample case. However estimates of the price coefficient for the low and middle-income countries are negative and in most cases larger than one and highly significant (models 2,3, and 4) suggesting that the demand for telecommunication services in low and middle-income countries is indeed price elastic. Model (2) of the 3SLS estimation for the low and middle-income countries reveal that a one percent increase in the average price of telecommunication services leads to a 2.86 percent decrease in the number of telecommunication services subscribers. On the other hand, estimates of the price coefficient for high-income countries are all negative and insignificant suggesting that the demand for telecommunication services in high-income countries is inelastic. Those results do match the reality. Indeed, telecommunication services are becoming necessary services in high income-countries. Most households and businesses in developed countries are connected to the internet and to any form of telephone services and telecommunication services are becoming a part of a regular monthly consumption of most households and businesses in high-income countries. The coefficient on the total population is positive and highly significant in models (1) and (3) across all samples. To the extent that population and GDP are proportionally related, an increase in the total population will generate significant increase in the number of telecommunication services subscribers.

For the import of telecommunication equipment equation, we find that income is fairly significant across different specifications and different methodologies and sample

estimation. However, the income elasticity of the demand for import of telecommunication equipments is inelastic and positive (models 2 and 4) for low-income countries and negative and elastic for high-income countries. The results for low and middle-income countries reveal the fact that if income changes by a certain percentage citeris paribus, the percentage change in demand for import of telecommunication equipment will be less than that of income per capita. This is fairly conformable with the reality in low and middle-income countries. In the case of high-income countries, the estimation results of the 3SLS suggest that an increase of income by one percent leads to a decrease of the demand for imports of telecommunication equipment by 3.13 percent. This result is surprising since we expect that an increase in income will lead to an increase in imports of telecommunication equipment. However, in the case of high-income countries, an increase in income may lead to more investment in research for technology, leading to a decrease in the national price of telecommunication equipment, and hence to a decrease in the import of telecommunication equipment. Estimates of the price coefficient reveal that the price elasticity for the demand of import of telecommunication equipment is positive, elastic and highly significant[41]. The exchange rate doesn't seem to be a determinant of import of telecommunication equipment. One possible explanation of this result is that exchange rates being rather very different across countries and even within certain income level groups. Coefficient estimates on the openness in trade of telecommunication services index are positive and fairly significant for the whole sample but only significant at the 10 percent level for low and middle-income countries. In the case of high-income countries this coefficient is positive but not

[41] We obtained negative coefficient estimates for specifications (2) and (4) for low and middle-income countries. This result can be due because of the exclusion of the number of subscribers and waiting list from those two specifications.

significant. One possible explanation of this is that telecommunication equipment falls in the category of goods and not services. However, one can argue that in order to supply the service, a country needs to have that equipment; therefore we considered the import of telecommunication equipment as a part of the supply of telecommunication services. In general this result is still reasonable since the sign of the coefficient matches our expectations. The demand of telecommunication services seems to be highly associated with the import of telecommunication equipment suggesting that import of telecommunication equipment increases when the number of subscribers and the number of people waiting for connection to the public network increases. This result is not surprising since suppliers of telecommunication services need to have an incentive to import telecommunication equipment and this incentive is reflected by the amount of current subscribers as well as the potential ones.

Results for the supply of telecommunication services equation reveal that the price of telecommunication services is inversely related to the quantity supplied in the case of low and middle-income countries. This unanticipated result suggests that as prices become larger, supply shrinks. One possible explanation of this, as Roller and Waverman (2001) suggest, is that the market structure in low and middle-income countries is very different across each state. As we see below, this result will change when we run the model for only high-income countries. In this latter case, the supply elasticity for telecommunication services is 3.65 indicating that an increase (decrease) of one percent in the price leads to an increase (decrease) of 3.65 percent in quantity supplied. We also find that the geographic area is positively related to supply in all sample estimation. The waiting list for mainlines per capita is inversely related to supply in the case of the whole

sample suggesting that countries with a large waiting list invest less in telecommunication infrastructure and import less telecommunication equipment. However this result will not survive once we split the sample. In both the high-income and the low and middle-income cases, the coefficient estimate of the waiting list is not statistically significant suggesting that supply does not react in response to excess demand, possibly because of technical or capacity constraint. As expected, openness in trade in telecommunication services is positively related to supply. However, in some cases it is not highly significant.

The Effect of Openness in Telecommunication and Financial Services on Growth

Methodology

The empirical implementation of the augmented model integrating both telecommunication and financial services sectors requires the estimation of the following system of equations:

GNP growth equation:

$$(12') \quad \begin{aligned} G_j = {} & a_0 + a_1 \ln Gov_j + a_2 Inf_j + a_3 pop_j + a_4 \ln Inv_j^{Tel} + a_5 \ln(BA_j / GDP_j) + a_6 \ln Op_j + a_7 Op_j^{Tel} \\ & + a_8 Op_j^{Fin} + a_9 [\ln(y_j) Op_j^{Tel} Op_j^{Fin}] + \varepsilon_j^1 \end{aligned}$$

Demand for telecommunication services equation:

$$(9') \quad \ln(\sum_{i=1}^{5} Sub_{ij} + WL_j) = b_0 + b_1 \ln(GDP_j / POP_j) + b_2 \ln P_j^{Tel} + b_3 \ln POP_j + \varepsilon_j^2$$

Import of telecommunication equipment equation:

$$(10') \quad \begin{aligned} \ln M_j^{Tel} &= c_0 + c_1 \ln GDP_j + c_2 \ln P_j^{Tel} + c_3 \ln Ex_j + c_4 Op_j^{Tel} \\ &+ c_5 \ln(\sum_{i=1}^{5} Sub_{ij} + WL_j) + \varepsilon_j^3 \end{aligned}$$

Supply of telecommunication services equation:

$$(11') \quad \ln(M_j^{Tel} + Inv_j^{Tel}) = d_0 + d_1 \ln P_j^{Tel} + d_2 \ln GA_j + d_3 \ln WL_j^{Tel} + d_4 Op_j^{Tel} + \varepsilon_j^4$$

Demand for financial services equation:

$$(13') \ln(BA_j / GDP_j) = e_0 + e_1 r_j + e_2 \ln Inf_j + e_3 \ln(GDP_j / POP_j) + e_4 \ln(POP_j) + \varepsilon_j^5$$

Supply of financial services equation:

$$(14') \quad \ln(B_j) = p_0 + p_1 \ln(GA_j) + p_2 \left[\ln(y_j) Op_j^{Fin}\right] + p_3 r_j + \varepsilon_j^6$$

where BA_j / GDP_j is the total bank assets to GDP ratio of country j. This variable is a proxy measure for the size of the demand for banking operations in the country of interest. Op_j^{Fin} is the openness index of trade in financial services for country j; this index takes values from 1 to 8 with higher values indicating more openness. In order to account for the effect between the interaction of the openness in telecommunication services and the openness of financial services on economic growth, we included an interaction parameter representing the product of the initial GNP (y_j) by the openness index of telecommunication services (Op_j^{Tel}) and the openness of financial services (Op_j^{Fin}). It is worth noting that this interaction variable accounts also for the convergence rate. As previously mentioned, we expect that the coefficient on the government consumption to GDP ratio (a_1), the inflation rate (a_2), the population growth rate (a_3), and the interaction variable (a_9) to be negative. Coefficient estimates in front of investment in

telecommunication infrastructure and the total bank asset to GDP ratio are expected to be positive. Equations (9'), (10'), and (11') reflect the demand and supply in the telecommunication services sector and are specified in the same manner as in the previous model. Equation (13') states that the demand for banking operations measured by the average total bank assets to GDP ratio ($\ln(BA_j / GDP_j)$) is a function of the average real interest rate[42] (r_j), the average inflation rate (Inf_j), the average GDP per capita (GDP_j / POP_j) and the average total population (POP_j). We expect the coefficient estimates in front of the average real interest rate (e_1), the average GDP per capita (e_3), and the average total population (e_4) to be positive. The parameter estimate in front of the average inflation rate (e_2) is expected to be negative. Equation (14') estimates the supply of banking services. The dependant variable B_j represents the number of banks per 100,000 people in country j. A better measure of the supply of banking services would be the number of bank branches in each country. One can argue that with the new technology, at least in developed countries, the number of bank branches is no longer relevant because of online banking. On the other hand, because of the strict regulation of the banking sector in many countries, many banks are merging; hence the number of banks will decline while the number of branches remains the same. For the purpose of this study and because of the lack of data, the number of banks will be used instead of the number of bank branches. Explanatory variables for the number of banks include the average geographical area (GA_j), the average real interest rate (r_j) and an interaction variable to account for the effect of development and openness in financial services

[42] The real interest rate is defined as the lending interest rate adjusted for inflation as measured by the GDP deflator.

sector on the supply of banking services. We expect that the coefficient estimate in front of the average geographical area (p_1), the interaction variable (p_2), and the average real interest rate (p_3) to be all positive.

We used the same misspecification testing approach as we did for the previous model. The Jarque-Bera, Koenker Bassett's, and Reset tests will be used to test for normality, heteroscedasticity and linearity respectively. To check for identification, the order condition of identifiability was used. The model is indeed identified. (For each specification)

Data

The same sample is used to run the cross-country regression[43]. Data on the real interest rate were extracted from the World Development Indicators (2002) published by the World Bank. Data on the bank assets to GDP ratio and on the number of banks were taken from Barth, Caprio, and Levine (2001). These data are based on a survey funded by the World Bank to collect information on the structure and regulation of commercial banks around the world. Responses to the surveys were received between 1998 and 2000. Data on the openness in financial services sector were taken from Mattoo, Rathindran and Subramanian (2001). In their paper, Mattoo, Rathindran and Subramanian constructed the openness index for the financial services sector based on the market structure, the foreign equity, and Dailami's (2000) capital control index [44]. They used inferred data based on

[43] Refer to Appendix 1 for a comprehensive list of countries used for this regression.
[44] Dailami's index takes into consideration the coding of rules, regulations and administrative procedures that can affect the flow of capital. For more detail about how Dailami constructed this index, refer to Dailami (2000).

each country's commitment to the General Agreement on Trade in Services (GATS). The index ranks from 1 to 8 with higher ranking indicating more financial openness.

Estimation Results

Results from the regressions are shown in Tables 4-13, 4-14, 4-15, 4-16, 4-17, and 4-18. The estimated parameters[45] for the aggregate growth production function indicate that population growth rate is negatively and significantly related to GNP growth at the 1 5 percent level. Inflation rate and government consumption to GDP ratio are also negatively related to GNP growth but the coefficient estimates are not significant. On the other hand, investment in telecommunication infrastructure is inversely related to growth. This is surprising as it suggests that growth is higher with less investment in telecommunication infrastructure. This result occurred when we included the financial sector in the regression. However, it is worth noting that the coefficient estimate is not statistically significant. The parameter estimate in front of the bank assets to GDP ratio is positive and significant at the 10 percent level suggesting that an increase in the bank assets to GDP ratio by one point will lead to an increase in GNP growth by 0.75 percentage point. This result is satisfying since it has been shown in the literature that financial operations are an important for a healthy growing economy. Coefficient estimates in front of the openness index of trade in telecommunication services as well as the index of openness in trade in financial services are positive and significantly associated with growth.

[45] Only 3SLS estimation results will be discussed.

Table 4-13

Openness in Telecommunication and Financial Services and Growth
Growth Equation Regression Results: Whole Sample

Dependent Variable: Growth of Per Capita GNP (1989-2000)

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	0.0533	0.0567	0.0276	0.0514*	0.0583	0.0441	-0.0144	0.0514**	0.0290	0.0196	-0.0830	0.0368
	(0.98)	(1.45)	(0.48)	(1.90)	(0.86)	(1.13)	(-0.21)	(2.11)	(0.44)	(0.53)	(-1.34)	(1.58)
ln(Gov)	-0.0109	-0.0108	-0.0063	-0.0076	-0.0115	-0.0122*	-0.0121	-0.0076	-0.0100	-0.0111	-0.0093	-0.0056
	(-1.33)	(-1.35)	(-1.09)	(-1.00)	(-1.65)	(-1.75)	(-1.52)	(-1.11)	(-1.49)	(-1.69)	(-1.30)	(-0.86)
ln(Inf)	-0.0026	-0.0026*	-0.0022	-0.0036**	-0.0021	-0.0019	-0.0012	-0.0036***	-0.0008	-0.0004	0.0002	-0.0027**
	(-1.42)	(-1.67)	(-1.11)	(-2.55)	(-1.30)	(-1.27)	(-0.65)	(-2.83)	(-0.52)	(-0.26)	(0.12)	(-2.25)
pop	-0.0059*	-0.0059*	-0.0060*	-0.0067**	-0.0056*	-0.0052*	-0.0042	-0.0067**	-0.0059**	-0.0053*	-0.0037	-0.0065**
	(-1.87)	(-1.91)	(-1.77)	(-2.32)	(-1.91)	(-1.86)	(-1.28)	(-2.58)	(-2.11)	(-2.02)	(-1.26)	(-2.59)
$ln(Inv^{Tel})$	-0.0007	-0.0008	0.0000		-0.0012	-0.0008	0.0011		-0.0008	-0.0005	0.0025	
	(-0.45)	(-0.62)	(0.01)		(-0.53)	(-0.55)	(0.49)		(-0.41)	(-0.39)	(1.25)	
ln(bankass/GDP)	0.0041	0.0041	0.0035		0.0066*	0.0072**	0.0085*		0.0075*	0.0089***	0.0118***	
	(1.32)	(1.42)	(1.06)		(1.71)	(2.17)	(1.95)		(2.00)	(2.85)	(3.01)	
ln(Op)	0.0005		0.0021		-0.0011		0.0025		0.0006		0.0035	
	(0.09)		(0.38)		(-0.21)		(0.42)		(0.11)		(0.66)	
Op^{Tel}	0.0061**	0.0061***	0.0054**	0.0057**	0.0062***	0.0061***	0.0053**	0.0057***	0.0065***	0.0065***	0.0057**	0.0066***
	(2.62)	(2.79)	(2.19)	(2.53)	(3.08)	(3.23)	(2.36)	(2.82)	(3.35)	(3.64)	(2.78)	(3.42)
Op^{Fin}	0.0027	0.0027	0.0028	0.0030*	0.0025	0.0026*	0.0029*	0.0030*	0.0031**	0.0030**	0.0039**	0.0035**
	(1.57)	(1.59)	(1.49)	(1.75)	(1.67)	(1.74)	(1.70)	(1.94)	(2.12)	(2.14)	(2.55)	(2.37)
Op^{Tel} x Op^{Fin} x ln(GNI89)	-0.0001**	-0.0001***	-0.0001**	-0.0001***	-0.0001***	-0.0001***	-0.0001**	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***
	(-2.71)	(-2.87)	(-2.25)	(-2.77)	(-3.24)	(-3.31)	(-2.65)	(-3.08)	(-3.45)	(-3.53)	(-3.25)	(-3.46)
di1	-0.0048	-0.0049	-0.0012	-0.0031	-0.0039	-0.0038	0.0006	-0.0031	-0.0013	-0.0019	0.0081	-0.0007
	(-0.52)	(-0.54)	(-0.13)	(-0.51)	(-0.49)	(-0.49)	(0.07)	(-0.57)	(-0.17)	(-0.26)	(1.00)	(-0.14)
di2	-0.0103	-0.0104			-0.0093	-0.0104			-0.0073	-0.0096		
	(-1.29)	(-1.33)			(-1.31)	(-1.54)			(-1.06)	(-1.53)		
di3	0.0032	0.0032			0.0029	0.0034			0.0028	0.0032		
	(0.47)	(0.47)			(0.50)	(0.58)			(0.51)	(0.59)		
di4			0.0004				0.0007				0.0044	
			(0.06)				(0.11)				(0.74)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.51	0.51	0.41	0.38	0.52	0.52	0.42	0.38				
Adj. R^2	0.32	0.34	0.20	0.25	0.32	0.34	0.20	0.27				
System R^2									0.86	0.72	0.70	0.59
Jarque-Bera[46]	0.70	0.68	0.26	6.43	0.73	0.94	0.98	6.43	0.76	0.92	1.73	6.18
Joint Koenker-Basset[47] (F)	0.88	0.11	0.35	0.61	0.87	0.09	0.42	0.53	0.70	0.20	0.24	0.55
Reset (F)[48]	6.70	6.66	5.59	7.54	5.48	5.51	2.39	7.54	3.45	2.45	0.83	5.24

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[46] The 5% critical value for the Jarque-Bera statistic is 5.99.

[47] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[48] The 5% critical value for the F statistic is 3.0.

Table 4-14

Openness in Telecommunication and Financial Services and Growth
Demand for Telecommunication Services Equation Regression Results: Whole Sample

Dependent Variable: Number of Subscribers plus the Waiting List

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	-8.8562***	9.8311**	6.2901	21.3046***	-9.1624***	12.4631**	6.7490	23.8682***	-8.2499***	16.3440***	10.1654**	25.4457***
	(-6.93)	(2.28)	(1.45)	(4.61)	(-6.40)	(2.56)	(1.33)	(4.25)	(-5.81)	(3.54)	(2.11)	(4.87)
ln(GDP/POP)	1.4019***	1.2200***			1.4020***	1.2149***			1.3365***	0.9922***		
	-23.72	(5.02)			(24.86)	(5.15)			(24.14)	(4.69)		
$\ln(P^{Tel})$	-0.4931***	-0.8764	-0.6380	-0.9653	-0.4344**	-1.3000*	-0.6897	-1.3851	-0.4617**	-1.6088**	-0.7993	-1.6435*
	(-3.41)	(-1.47)	(-1.12)	(-1.28)	(-2.51)	(-1.84)	(-1.01)	(-1.51)	(-2.69)	(-2.38)	(-1.19)	(-1.92)
ln(POP)	0.8803***		0.7786***		0.8772***		0.7700***		0.8680***		0.6057***	
	(25.13)		(5.71)		(25.95)		(5.79)		(25.91)		(5.19)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.96	0.41	0.47	0.03	0.97	0.42	0.47	0.05				
Adj. R^2	0.96	0.38	0.44	0.01	0.96	0.39	0.45	0.03				
System R^2									0.86	0.72	0.70	0.59
Jarque-Bera[49]	3.08	0.42	2.13	0.52	4.07	0.37	2.08	0.53	4.16	0.03	1.27	0.63
Joint Koenker-Basset (F)[50]	0.88	0.11	0.35	0.61	0.87	0.09	0.42	0.53	0.70	0.20	0.24	0.55
Reset (F)[51]	0.56	0.91	1.71	1.42	0.55	1.72	1.75	1.42	0.51	2.12	1.97	1.41

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[49] The 5% critical value for the Jarque-Bera statistic is 5.99.

[50] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[51] The 5% critical values for the F statistic is 3.0.

Table 4-15

Openness in Telecommunication and Financial Services and Growth
Import of Telecommunication Equipment Equation Regression Results: Whole Sample

Dependent Variable: Import of Telecom Equipment

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	2.0261	-2.9672	2.0680	-3.5174	-2.9859	-3.5408	-3.3905	-4.4627*	-2.6979	-3.9698*	-3.1699	-2.4088
	(1.18)	(-1.36)	(1.21)	(-1.57)	(-1.46)	(-1.47)	(-1.65)	(-1.79)	(-1.37)	(-1.72)	(-1.58)	(-1.01)
ln(GDP)	-0.0036	0.7498***	-0.0264	0.7516***	0.5290***	0.7582***	0.4971***	0.7592***	0.5288***	0.7779***	0.6036***	0.6878***
	(-0.03)	(11.89)	(-0.22)	(11.50)	(5.46)	(12.73)	(5.17)	(12.14)	(5.96)	(14.22)	(6.75)	(11.85)
$\ln(P^{Tel})$	0.8102***	0.4325*	0.8332***	0.4888*	0.6497**	0.4926*	0.7267***	0.6114*	0.6628***	0.5072*	0.6289**	0.5804*
	(4.42)	(1.75)	(4.69)	(1.93)	(2.60)	(1.71)	(2.92)	(2.01)	(2.75)	(1.80)	(2.58)	(1.96)
ln(Ex)	-0.0174	-0.0766*			-0.0526	-0.0755*			-0.0569*	-0.0726**		
	(-0.59)	(-1.94)			(-1.63)	(-2.03)			(-1.94)	(-2.25)		
Op^{Tel}	0.0867**	0.1475***	0.0839**	0.1428***	0.1036**	0.1457***	0.09437**	0.1431***	0.1131***	0.1188***	0.0617*	0.1381***
	(2.65)	(3.31)	(2.61)	(3.10)	(2.68)	(3.48)	(2.43)	(3.25)	(3.12)	(3.21)	(1.81)	(3.34)
$\ln(\sum_{i=1}^{5} sub_i + wl)$	0.7977***		0.8222***		0.2976***		0.3420***		0.2708***		0.2028**	
	(6.25)		(6.87)		(2.75)		(3.22)		(2.73)		(2.16)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.94	0.88	0.94	0.87	0.91	0.88	0.91	0.87				
Adj. R^2	0.93	0.87	0.93	0.86	0.90	0.87	0.90	0.86				
System R^2									0.86	0.72	0.70	0.59
Jarque-Bera[52]	9.22	6.83	9.78	8.02	9.75	5.54	11.24	4.97	6.92	4.98	8.26	2.93
Joint Koenker-Basset (F)[53]	0.88	0.11	0.35	0.61	0.87	0.09	0.42	0.53	0.70	0.20	0.24	0.55
Reset (F)[54]	1.90	0.63	1.65	0.17	2.20	0.60	1.60	0.15	2.15	0.69	1.73	0.15

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[52] The 5% critical value for the Jarque-Bera statistic is 5.99.

[53] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[54] The 5% critical value for the F statistic is 3.0.

Table 4-16

Openness in Telecommunication and Financial Services and Growth
Supply of Telecommunication Services Equation Regression Results: Whole Sample

Dependent Variable: Investment in Telecom Infrastructure plus Imports

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	16.880***	22.3345***	18.7861***	17.4725***	20.9623***	28.0981***	21.5716***	18.7922***	19.7636***	29.0626***	24.0533***	24.1392***
	(4.57)	(6.03)	(4.25)	(4.77)	(4.60)	(6.31)	(3.92)	(4.27)	(4.78)	(7.22)	(4.65)	(6.06)
$\ln(P^{Tel})$	-0.3230	-0.9382*	-0.0470	0.0882	-0.9504	-1.8567***	-0.4559	-0.1221	-0.8628	-1.7834***	-0.7571	-0.7275
	(-0.61)	(-1.69)	(-0.07)	(0.15)	(-1.43)	(-2.72)	(-0.57)	(-0.18)	(-1.42)	(-2.86)	(-0.99)	(-1.13)
ln(GA)	0.3755***	0.4540***			0.3881***	0.4587***			0.4183***	0.3030***		
	(4.31)	(4.81)			(4.63)	(4.93)			(5.18)	(4.02)		
ln(WL)	-0.0661	-0.1526***	-0.0326		-0.0905*	-0.1751***	-0.0479		-0.0592	-0.1212***	-0.0238	
	(-1.31)	(-3.14)	(-0.54)		(-1.77)	(-3.59)	(-0.79)		(-1.32)	(-3.03)	(-0.45)	
Op^{Tel}	0.2940***		0.3965***	0.4241***	0.2573***		0.3745***	0.4187***	0.2564***		0.2406**	0.1650***
	(3.34)		(3.87)	(4.81)	(2.92)		(3.67)	(4.88)	(3.24)		(2.66)	(3.30)
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.59	0.46	0.38	0.38	0.59	0.48	0.38	0.38				
Adj. R^2	0.54	0.42	0.33	0.35	0.54	0.44	0.33	0.34				
System R^2									0.86	0.72	0.70	0.59
Jarque-Bera[55]	0.01	0.35	0.75	0.55	0.28	1.19	0.84	0.53	1.00	0.72	0.39	0.36
Joint Koenker-Basset (F)[56]	0.88	0.11	0.35	0.61	0.87	0.09	0.42	0.53	0.70	0.20	0.24	0.55
Reset (F)[57]	0.91	1.94	1.32	0.36	1.18	3.24	0.94	0.30	1.17	3.08	0.10	0.12

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[55] The 5% critical value for the Jarque-Bera statistic is 5.99.

[56] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[57] The 5% critical value for the F statistic is 3.0.

Table 4-17

Openness in Telecommunication and Financial Services and Growth
Demand for Financial Services Regression Results: Whole Sample

Dependent Variable: Bank Assets to GDP Ratio

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	2.6077*	2.0929**	2.2198	-0.4008	2.6077*	2.0929**	2.2198	-0.4008	3.6712***	2.9174***	2.6756*	0.0597
	(1.86)	(2.07)	(1.51)	(-0.38)	(1.98)	(2.18)	(1.59)	(-0.39)	(2.84)	(3.18)	(1.97)	(0.06)
r	0.0237**	0.0237**		0.0015	0.0237**	0.0237**		0.0015	0.0223**	0.0237**		0.0013
	(2.28)	(2.30)		(0.14)	(2.43)	(2.42)		(0.14)	(2.39)	(2.63)		(0.13)
ln(Inf)	-0.3389***	-0.3467***	-0.2594***		-0.3389***	-0.3467***	-0.2594***		-0.3233***	-0.3594***	-0.2119***	
	(-4.42)	(-4.65)	(-3.60)		(-4.71)	(-4.89)	(-3.79)		(-4.66)	(-5.40)	(-3.23)	
ln(GDP/POP)	0.3363***	0.3376***	0.3821***	0.5539***	0.3363***	0.3376***	0.3821***	0.5539***	0.2654***	0.2485**	0.3665***	0.5027***
	(3.16)	(3.21)	(3.47)	(4.74)	(3.37)	(3.37)	(3.65)	(4.92)	(2.72)	(2.59)	(3.60)	(4.67)
ln(POP)	-0.0311		-0.0309		-0.0311		-0.0309		-0.0580		-0.0558	
	(-0.54)		(-0.50)		(-0.57)		(-0.53)		(-1.08)		(-1.00)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.59	0.59	0.54	0.36	0.59	0.59	0.54	0.36				
Adj. R^2	0.55	0.56	0.50	0.33	0.55	0.56	0.50	0.33				
System R^2									0.86	0.72	0.70	0.59
Jarque-Bera[58]	6.58	6.95	29.90	31.90	6.58	6.95	29.90	31.92	7.35	5.34	38.53	32.75
Joint Koenker-Basset (F)[59]	0.88	0.11	0.35	061	0.87	0.09	0.42	0.53	0.70	0.20	0.24	0.55
Reset (F)[60]	1.91	2.54	2.22	0.40	1.91	2.54	2.22	0.40	1.84	2.63	1.64	0.40

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[58] The 5% critical value for the Jarque-Bera statistic is 5.99.

[59] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[60] The 5% critical value for the F statistic is 3.0.

Table 4-18

Openness in Telecommunication and Financial Services and Growth
Supply of Financial Services Regression Results: Whole Sample

Dependent Variable: Number of Banks per 100000 People

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	-0.3240	-0.3336	-2.5608***	-0.3237	-0.3237	-0.3336	-2.5608***	-0.3237	0.2497	0.9986	-2.1093***	1.1053
	(-0.27)	(-0.28)	(-3.73)	(-0.27)	(-0.28)	(-0.29)	(-3.87)	(-0.28)	(0.22)	(0.90)	(-3.30)	(1.07)
ln(GA)	-0.1747**	-0.1823**		-0.1747**	-0.1747**	-0.1823**		-0.1747**	-0.1952**	-0.2708***		-0.2381***
	(-2.20)	(-2.36)		(-2.20)	(-2.31)	(-2.45)		(-2.31)	(-2.64)	(-3.78)		(-3.59)
Op^{Fin} x ln(GNI89)	0.0293***	0.0298***	0.0316***	0.0293***	0.0293***	0.0298***	0.0316***	0.0293***	0.0250***	0.0259***	0.0254**	0.0195**
	(2.99)	(3.10)	(3.10)	(2.99)	(3.15)	(3.22)	(3.22)	(3.15)	(2.90)	(2.93)	(2.68)	(2.29)
r	-0.0085		-0.0162	-0.0085	-0.0085		-0.0162	-0.0085	-0.0154		-0.0247	-0.0143
	(-0.48)		(-0.89)	(-0.48)	(-0.51)		(-0.93)	(-0.51)	(-1.03)		(-1.50)	(-0.93)
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.31	0.31	0.23	0.31	0.31	0.31	0.23	0.31				
Adj. R^2	0.26	0.27	0.19	0.26	0.26	0.27	0.19	0.26				
System R^2									0.86	0.72	0.70	0.59
Jarque-Bera[61]	1.90	2.09	3.09	1.90	1.90	2.09	3.09	1.90	1.65	1.91	2.99	1.57
Joint Koenker-Basset (F) [62]	0.88	0.11	0.35	0.61	0.87	0.09	0.42	0.53	0.70	0.20	0.24	0.55
Reset (F)[63]	1.70	1.12	3.04	1.70	1.70	1.12	3.04	1.70	0.76	0.42	2.94	0.35

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[61] The 5% critical value for the Jarque-Bera statistic is 5.99.

[62] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[63] The 5% critical value for the F statistic is 3.0.

As in the previous model, the total effect of the openness in trade of telecommunication services and financial services on economic growth can be computed by taking the first partial derivative of growth with respect to each of the openness indices. The total effect of openness in trade of telecommunication services is equal on average to 0.00078 (with a standard error of 0.000851) indicating that an increase of one unit in the index will lead on average to an increase of 0.078 percentage point in the GNP per capita growth rate. The difference in results between the previous model and this one is in the sign of the total effect of openness in trade of telecommunication services. The dissimilarity in the signs is the result of the incorporation of the financial services in the model and accounting for any positive externality going from the telecommunication services to the financial services sector through the interaction variable. On the other hand, the total effect of the openness in trade of financial services is equal on average to –0.0026 (with a standard error of 0.00142) indicating that an increase of one unit in the financial index will lead on average to a decrease in GNP per capita growth by 0.26 percentage points. Computing the thresholds[64] give a result of $11,527.81 for the telecommunication services sector and $117.82 for the financial services sector. This means that countries with an initial income per capita below $11,527.81 will benefit from openness in trade of telecommunication services. This result is quite reasonable since we expect the threshold to increase when we account for the positive externality. On the other hand, the threshold

[64] In order to compute the thresholds for the telecommunication services and the financial services sectors, we solved the following equations respectively for $\overline{\ln GNI89}$:

$$\frac{\partial G}{\partial Op^{Tel}} = 0.0065 - 0.0001\,(\overline{Op^{Fin}})(\overline{\ln GNI\ 89}) = 0$$

$$\frac{\partial G}{\partial Op^{Fin}} = 0.0031 - 0.0001\,(\overline{Op^{Tel}})(\overline{\ln GNI\ 89}) = 0$$

where $\overline{Op^{Fin}}$ and $\overline{Op^{Tel}}$ are the averages of the openness indices of trade in financial and telecommunication services respectively.

for the financial services seems to be low, indicating that only countries with an initial per capita income below $117.82 will benefit from the openness in financial services. This might be the result of financial market structure being rather dissimilar across countries. Finally the total openness measure as well as the dummy variables are not significant. Parameter estimates of the demand for telecommunication services equation indicate that both average GDP per capita and the average total population are positively associated to the demand with a high significance level. Results of the estimation of the import of telecommunication equipment equation reveal that the parameter estimate of the average GDP is positively associated with import and highly significant indicating that the size of the economy is an important determinant of imports. The average exchange rate is negatively related to import at the 10 percent level. This result is conformable with the theory since we expect imports to decrease when the domestic currency depreciates. On the other hand, the coefficient estimate of the average price is positive and highly significant suggesting that an increase in the price of telecommunication services will lead to an increase in the import of telecommunication equipment. The parameter estimate in front of the openness in trade of telecommunication services is positive and highly significant which reflects the impact of openness in telecommunication services sector on the import of telecommunication equipment. Also, the coefficient estimate in front of the total number of subscriber and the waiting list is positive and highly significant indicating that import does respond to a high and unmet demand. Table 4-16 shows the results from the supply of telecommunication services equation estimation. The parameter estimate of the average price is negative. This is again surprising since it indicates that supply is inversely related

to the price. However the coefficient is not statistically significant (except for model 2) suggesting that supply of telecommunication services is rather inelastic. This might be the result of the variety of market structure across countries. In fact, out of 42 countries, 16 have their openness in telecommunication services index equal or below 5 and 16 have their index equal to 9, which suggest that there are big dissimilarities among the market structures in the studied sample. Coefficient estimate of the openness in trade of telecommunication services is positive and highly significant, suggesting that more openness leads to more supply of telecommunication services. This also indicates that countries with higher openness have on average a higher investment in telecommunication infrastructure and higher imports of telecommunication equipment since we measured the supply of telecommunication services by the sum of the investment of telecommunication infrastructure and the import of telecommunication equipment. The waiting list is negatively related to supply of telecommunication services and highly significant in model (2). This explains the fact that the reason behind the waiting lists is the shortage in the supply of telecommunication services. It is worth noting that the estimation results from equations (9'), (10'), and (11') do not change drastically between the previous and the integrated model. Table 4-17 presents the estimation results from the demand for banking services. The coefficient estimate of the average real interest rate is positive and statistically significant at the 5 percent level. This result is not surprising since it suggests that the lending real interest rate is high because of the high demand for bank loans and services. However, once we exclude the inflation rate from the regression as in model (4), the interest rate coefficient estimate becomes insignificant. Average inflation rate is inversely associated with demand for banking

operation at the one percent statistical level. This result is indeed surprising since one can expect a high demand for banking services during an economic expansion and usually inflation is associated with an economic expansion. However this result is attributed to the fact that the data sample is very diverse. Indeed, the data sample includes countries which experienced high inflation rate during the period 1989-2000 without experiencing an economic expansion. Coefficient estimate of the average GDP per capita is positive and highly significant suggesting that countries with higher GDP per capita have a higher demand for banking services. This result matches our expectation and indicates that the demand for banking services is income elastic. Finally the coefficient estimate of the average total population is negative but not statistically significant, indicating that the population level does not affect the demand for banking services. This result might be due to the fact that many developing countries have a large but poor population as opposed to developed countries with small but rich population. On average the impact of the size of the population on the demand of banking operations might not be captured because of the dissimilarity of the population size as well as the wealth of the population among the countries.

Table 4-18 presents the results from the supply of banking operations equation estimation. The parameter estimate of the average geographical surface area is negative and highly significant. This result is unexpected since it suggests that larger countries have fewer banks than smaller countries. However, the result can be attributed to the nature of the measure of the supply of banking services and the technology development in developed countries. In the case of the former, recall that because of the lack of data reflecting the number of bank branches, we measured the supply of banking operations

by the number of banks in each country. This measure might not be as accurate as the number of branches since in many countries, because of strict banking regulations, banks are merging. Hence, if many banks are merging in a certain country , the number of banks will decline whereas the number of bank branches will remain the same assuming that after the mergers all the branches will stay in operation. In the case of the latter, the result may be credited to the new technology and the Internet connection, which boosted the use of Automated Teller Machines (ATM) and online banking. In countries like the USA or England, in order to serve their customers, many banks are relying on ATM machines and online banking instead of opening new branches. Indeed ATM machines and online banking are becoming cheaper to manage than a bank branch. Hence, measuring the supply of banking operations through the number of banks does not capture well the effect of the geographical surface area on the supply of banking services. The supply of banking services does not respond to the change in the average real lending interest rate. This might be because in most countries banks usually deal with nontraditional banking operations like insurance and stock exchange. Hence the lending operations might not be the major operation of the banks and lending interest rates might not be the only incentive for banks to open and operate. The coefficient estimate of the interaction variable is positive and highly significant suggesting that the effect of openness in trade of financial services on the supply of banking services does depend on the level of development of the country of interest, and the effect of development on the supply of banking services depends on the openness in trade of financial services.

The effect of development on the supply of financial services[65] is equal to 0.1748 (with a standard error of 0.059913) indicating that an increase of one percent in the logarithm of the initial GNP will lead to an increase in the number of banks by 0.1748 percent. This states that more developed countries have more banks. This result matches our expectation since more developed countries are usually associated with a better financial structure than developing countries.

Model Extensions

The effect of Openness in Telecommunication Services on the Financial Services Sector

It is important to notice that the specification for equation (14') does not test for the externality effect of openness in trade of telecommunication services on the financial services sector. One reason for testing for this externality is that telecommunication is a network service. The more open a country is in trading telecommunication services, the easier the trade in financial services would be, and more banks might be willing to open and operate in this country.

To test whether the externality does exist, equation (14') is respecified as follow:

$$(14'') \quad \ln(B_j) = p_0 + p_1 \ln(GA_j) + p_2\left[\ln(y_j) Op_j^{Fin} Op_i^{Tel}\right] + p_3 r_j + \varepsilon_j^6$$

[65] The effect is computed as follows:

$$\frac{\partial \ln B}{\partial \ln GNI\ 89} = 0.025 \times \overline{Op^{Fin}}$$

where $\overline{Op^{Fin}}$ is the average of the openness in trade of financial services index.

where the interaction factor $\left[\ln(y_j)Op_j^{Fin}Op_i^{Tel}\right]$ stresses the fact that the effect of openness in financial services on the supply of banking services depends on initial income and on the openness in trade of telecommunication services.

Estimation Results

The estimation results of (12')-(13') and (14'') are given in tables 4-19, 4-20, 4-21, 4-22, 4-23, and 4-24. The OLS results for the first 5 equations are the same as the results from the previous model since each equation is estimated separately. As expected, most of the 2SLS and 3SLS parameter estimates in equations (12')-(13') change slightly compared to the one of the previous model. Notice that the coefficient in front of the interaction factor in table 4-24 is still positive and significant at the 5% level. The total effect of openness in financial services on the supply of banking services[66] is equal to 0.1077 (with a standard error of 0.042756) indicating that an increase in the index of openness of financial services by one unit leads to an increase in the logarithm of the number of banks by 0.1077 units (approximately an increase by one bank). On the other hand, the effect of development on the supply of banking services[67] is equal to 0.0858 (with a standard error of 0.03406) indicating that an increase in the level of initial GNI by one percent leads to an increase in the supply of banking services by 0.0858 percent. This result is not surprising since one would expect

[66] The effect is computed as follows:
$\frac{\partial \ln B}{\partial Op^{Fin}} = 0.0019(\overline{Op^{Tel}}.\overline{\ln GNI89})$

[67] The effect is computed as follows:
$\frac{\partial \ln B}{\partial \ln GNI89} = 0.0019(\overline{Op^{Fin}}.\overline{Op^{Tel}})$

Table 4-19

Openness in Telecommunication and Financial Services and Growth: Externality Effect Growth Equation Regression Results: Whole Sample

Dependent Variable: Growth of Per Capita GNP (1989-2000)

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	0.0533	0.0566	0.0276	0.0514*	0.0583	0.0441	-0.0144	0.0514**	0.0295	0.0223	-0.0852	0.0406*
	(0.98)	(1.45)	(0.48)	(1.90)	(0.86)	(1.13)	(-0.21)	(2.11)	(0.45)	(0.60)	(-1.38)	(1.74)
ln(Gov)	-0.0109	-0.0108	-0.0096	-0.0076	-0.0115	-0.0122*	-0.0121	-0.0076	-0.0100	-0.0113*	-0.0092	-0.0060
	(-1.33)	(-1.35)	(-1.09)	(-1.00)	(-1.65)	(-1.75)	(-1.52)	(-1.11)	(-1.49)	(-1.72)	(-1.29)	(-0.90)
ln(inf)	-0.0026	-0.0026*	-0.0022	-0.0036**	-0.0022	-0.0019	-0.0012	-0.0036***	-0.0008	-0.0004	0.0002	-0.0029**
	(-1.42)	(-1.67)	(-1.11)	(-2.55)	(-1.30)	(-1.27)	(-0.65)	(-2.83)	(-0.51)	(-0.31)	(0.11)	(-2.33)
Pop	-0.0059*	-0.0059*	-0.0060*	-0.0067**	-0.0056*	-0.0052*	-0.0042	-0.0067**	-0.0060**	-0.0053*	-0.0036	-0.0065**
	(-1.87)	(-1.91)	(-1.77)	(-2.32)	(-1.91)	(-1.86)	(-1.28)	(-2.58)	(-2.13)	(-2.03)	(-1.25)	(-2.60)
$\ln(inv^{Tel})$	-0.0007	-0.0008	0.0000		-0.0012	-0.0008	0.0011		-0.0009	-0.0006	0.0027	
	(-0.45)	(-0.62)	(0.01)		(-0.53)	(-0.55)	(0.49)		(-0.41)	(-0.45)	(1.31)	
ln(bankass/GDP)	0.0041	0.0041	0.0035		0.0066*	0.0072**	0.0085*		0.0077*	0.0091***	0.0117***	
	(1.32)	(1.42)	(1.06)		(1.71)	(2.17)	(1.95)		(2.03)	(2.90)	(2.99)	
ln(Op)	0.0005		0.0021		-0.0011		0.0025		0.0008		0.0040	
	(0.09)		(0.38)		(-0.21)		(0.42)		(0.15)		(0.75)	
Op^{Tel}	0.0061**	0.0061***	0.0054**	0.0057**	0.0062***	0.0061***	0.0053**	0.0057***	0.0065***	0.0065***	0.0057**	0.0066***
	(2.62)	(2.79)	(2.19)	(2.53)	(3.08)	(3.23)	(2.36)	(2.82)	(3.32)	(3.63)	(2.81)	(3.36)
Op^{Fin}	0.0027	0.0027	0.0028	0.0030*	0.0025*	0.0026*	0.0029*	0.0030*	0.0027*	0.0027*	0.0036**	0.0031**
	(1.57)	(1.59)	(1.49)	(1.75)	(1.67)	(1.74)	(1.70)	(1.94)	(1.88)	(1.90)	(2.38)	(2.08)
Op^{Tel} x Op^{Fin} x ln(GNI89)	-0.0001**	-0.0001***	-0.0001**	-0.0001**	-0.0001***	-0.0001***	-0.0001**	-0.0001***	-0.0001***	-0.0001***	0.0001***	-0.0001***
	(-2.71)	(-2.87)	(-2.25)	(-2.77)	(-3.24)	(-3.31)	(-2.65)	(-3.08)	(-3.35)	(-3.44)	(-3.23)	(-3.37)
di1	-0.0048	-0.0049	-0.0025	-0.0031	-0.0039	-0.0038	0.0006	-0.0031	-0.0009	-0.0014	0.0081	-0.0010
	(-0.52)	(-0.54)	(-0.13)	(-0.51)	(-0.49)	(-0.49)	(0.07)	(-0.57)	(-0.12)	(-0.20)	(1.01)	(-0.20)
di2	-0.0103	-0.0104			-0.0093	-0.0104			-0.0069	-0.0092		
	(-1.29)	(-1.33)			(-1.31)	(-1.54)			(-1.01)	(-1.45)		
di3	0.0032	0.0032			0.0029	0.0034			0.0031	0.0035		
	(0.47)	(0.47)			(0.50)	(0.58)			(0.55)	(0.65)		
di4			0.0004				0.0007				0.0048	
			(-0.06)				(0.11)				(0.82)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.51	0.51	0.41	0.38	0.51	0.52	0.42	0.38				
Adj. R^2	0.32	0.34	0.20	0.25	0.31	0.34	0.20	0.25				
System R^2									0.86	0.71	0.69	0.58
Jarque-Bera[68]	0.70	0.68	0.26	6.43	0.73	0.94	0.98	6.43	0.65	0.81	1.64	6.60
Joint Koenker-Basset (F)[69]	0.86	0.11	0.65	0.59	0.84	0.09	0.73	0.51	0.72	0.19	0.57	0.54
Reset (F)[70]	6.70	6.66	5.59	7.54	5.48	5.51	2.39	7.54	3.66	2.56	1.05	5.41

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[68] The 5% critical value for the Jarque-Bera statistic is 5.99

[69] The 5% critical value for the Joint Koenker-Basset statistic is 2.10

[70] The 5% critical value for the F statistic is 3.0.

Table 4-20

Openness in Telecommunication and Financial Services and Growth: Externality Effect
Demand for Telecommunication Services Equation Regression Results: Whole Sample

Dependent Variable: Number of Subscribers plus the Waiting List

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	-8.8562***	9.8311**	6.2901	21.3046***	-9.1624***	12.4631**	6.7490	23.8682***	-8.2917***	16.4279***	10.3179**	25.6730
	(-6.93)	(2.28)	(1.45)	(4.61)	(-6.40)	(2.56)	(1.33)	(4.25)	(-5.84)	(3.54)	(2.16)	(4.89)
ln(GDP/POP)	1.4019***	1.2200***			1.4020***	1.2149***			1.3400***	0.9988***		
	(23.72)	(5.02)			(24.86)	(5.15)			(24.18)	(4.71)		
ln(avprice)	-0.4931***	-0.8764	-0.6379	-0.9653	-0.4344**	-1.2999*	-0.6897	-1.3851	-0.4625**	-1.6321**	-0.8511	-1.6807
	(-3.41)	(-1.47)	(-1.12)	(-1.28)	(-2.51)	(-1.84)	(-1.01)	(-1.51)	(-2.69)	(-2.39)	(-1.28)	(-1.96)
ln(POP)	0.8803***		0.7786***		0.8772***		0.7700***		0.8686***		0.6155***	
	(25.13)		(5.71)		(25.95)		(5.79)		(25.94)		(5.32)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.96	0.41	0.47	0.03	0.96	0.42	0.47	0.05				
Adj. R^2	0.96	0.38	0.44	0.01	0.96	0.39	0.45	0.02				
System R^2									0.86	0.71	0.69	0.58
Jarque-Bera[71]	3.08	0.42	2.13	0.52	4.07	0.36	2.08	0.53	4.15	0.04	1.30	0.64
Joint Koenker-Basset (F)[72]	0.86	0.11	0.65	0.59	0.84	0.09	0.73	0.51	0.72	0.19	0.57	0.54
Reset (F)[73]	0.56	0.91	1.71	1.42	0.55	1.72	1.75	1.42	0.51	2.12	2.01	1.41

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[71] The 5% critical value for the Jarque-Bera statistic is 5.99.

[72] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[73] The 5% critical value for the F statistic is 3.0.

Table 4-21

Openness in Telecommunication and Financial Services and Growth: Externality Effect
Import of Telecommunication Equipment Equation Regression Results: Whole Sample

Dependent Variable: Import of Telecom Equipment

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	2.0261	-2.9672	2.0680	-3.5175	-2.9860	-3.5407	-3.3905	-4.4627*	-2.5102	-3.8401	-3.1816	-2.1956
	(1.18)	(-1.36)	(1.21)	(-1.57)	(-1.46)	(-1.47)	(-1.65)	(-1.79)	(-1.26)	(-1.65)	(-1.57)	(-0.91)
ln(GDP)	-0.0036	0.7498***	-0.0264	0.7516***	0.5290***	0.7582***	0.4971***	0.7592***	0.5127***	0.7743***	0.5987***	0.6819***
	(-0.03)	(11.89)	(-0.22)	(11.50)	(5.46)	(12.73)	(5.17)	(12.14)	(5.68)	(14.04)	(6.61)	(11.65)
$\ln(P^{Tel})$	0.8102***	0.4325*	0.8332***	0.4888*	0.6497**	0.4926*	0.7267***	0.6114*	0.6638**	0.5004*	0.6281**	0.5674*
	(4.42)	(1.75)	(4.69)	(1.93)	(2.60)	(1.71)	(2.92)	(2.01)	(2.71)	(1.76)	(2.56)	(1.90)
ln(Ex)	-0.0174	-0.0766*			-0.0526	-0.0755**			-0.0558*	-0.0711**		
	(-0.59)	(-1.94)			(-1.63)	(-2.03)			(-1.87)	(-2.17)		
Op^{Tel}	0.0867**	0.1475***	0.0839**	0.1428***	0.1036**	0.1457***	0.0944**	0.1431***	0.1059***	0.1191***	0.0624*	0.1409***
	(2.65)	(3.31)	(2.61)	(3.10)	(2.68)	(3.48)	(2.43)	(3.25)	(2.86)	(3.17)	(1.79)	(3.35)
$\ln(\sum_{i=1}^{5} sub_i + wl)$	0.7977***		0.8222***		0.2976***		0.3420***		0.2880***		0.2117**	
	(6.25)		(6.87)		(2.75)		(3.22)		(2.87)		(2.22)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.94	0.88	0.94	0.87	0.91	0.88	0.91	0.87				
Adj. R^2	0.93	0.87	0.93	0.86	0.90	0.87	0.90	0.86				
System R^2									0.86	0.71	0.69	0.58
Jarque-Bera[74]	9.22	6.83	9.78	8.03	9.74	5.54	11.24	4.97	7.33	5.08	9.02	2.99
Joint Koenker-Basset (F)[75]	0.86	0.11	0.65	0.59	0.84	0.09	0.73	0.51	0.72	0.19	0.57	0.54
Reset (F)[76]	1.90	0.63	1.65	0.17	2.20	0.60	1.60	0.15	2.17	0.68	1.74	0.15

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[74] The 5% critical value for the Jarque-Bera statistic is 5.99.

[75] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[76] The 5% critical value for the F statistic is 3.0.

Table 4-22

Openness in Telecommunication and Financial Services and Growth: Externality Effect
Supply of Telecommunication Services Equation Regression Results: Whole Sample

Dependent Variable: Investment in Telecom Infrastructure plus Imports

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	16.8180***	22.3345***	18.7861***	17.4725***	20.9623***	28.0981***	21.5716***	18.7922***	19.2307***	29.3646***	23.9505***	24.3942
	(4.57)	(6.03)	(4.25)	(4.77)	(4.60)	(6.31)	(3.92)	(4.27)	(4.78)	(7.26)	(4.65)	(6.39
$\ln(P^{Tel})$	-0.3230	-0.9383*	-0.0470	0.0882	-0.9504	-1.8567**	-0.4559	-0.1221	-0.8089	-1.8262***	-0.7541	-0.781
	(-0.61)	(-1.69)	(-0.07)	(0.15)	(-1.43)	(-2.72)	(-0.57)	(-0.18)	(-1.37)	(-2.92)	(-0.99)	(-1.27
ln(GA)	0.3755***	0.4540***			0.3881***	0.4587***			0.4080***	0.3022***		
	(4.31)	(4.81)			(4.63)	(4.93)			(5.05)	(4.00)		
ln(WL)	-0.0661	-0.1526***	-0.0326		-0.0905*	-0.1752***	-0.0479		-0.0496	-0.1244***	-0.0191	
	(-1.31)	(-3.14)	(-0.54)		(-1.77)	(-3.59)	(-0.79)		(-1.14)	(-3.08)	(-0.36)	
Op^{Tel}	0.2940***		0.3965***	0.4241***	0.2573***		0.3745***	0.4187***	0.2934***		0.2467***	0.1766
	(3.34)		(3.87)	(4.81)	(2.92)		(3.67)	(4.88)	(3.70)		(2.72)	(3.54
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.59	0.46	0.38	0.38	0.59	0.48	0.38	0.38				
Adj. R^2	0.54	0.42	0.33	0.35	0.54	0.44	0.33	0.34				
System R^2									0.86	0.71	0.69	0.58
Jarque-Bera[77]	0.01	0.35	0.75	0.55	0.28	1.19	0.84	0.53	0.73	0.71	0.35	0.33
Joint Koenker-Basset (F)[78]	0.86	0.11	0.65	0.59	0.84	0.09	0.73	0.51	0.72	0.19	0.57	0.54
Reset (F)[79]	0.91	1.94	1.32	0.36	1.18	3.24	0.94	0.30	1.15	3.02	0.09	0.12

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[77] The 5% critical value for the Jarque-Bera statistic is 5.99.

[78] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[79] The 5% critical value for the F statistic is 3.0.

Table 4-23

Openness in Telecommunication and Financial Services and Growth: Externality Effect
Demand for Financial Services Equation Regression Results: Whole Sample

Dependent Variable: Bank Assets to GDP Ratio

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	2.6078*	2.0930**	2.2198	-0.4008	2.6077*	2.0929**	2.2198	-0.4008	3.6158***	2.8901***	2.6197*	0.07
	(1.86)	(2.07)	(1.51)	(-0.38)	(1.98)	(2.18)	(1.59)	(-0.39)	(2.79)	(3.15)	(1.94)	(0.0
r	0.0237**	0.0237***		0.0015	0.0237**	0.0237**		0.0015	0.0220**	0.0234**		0.00
	(2.28)	(2.30)		(0.14)	(2.43)	(2.42)		(0.14)	(2.36)	(2.60)		(0.1
ln(Inf)	-0.3389***	-0.3470***	-0.2594***		-0.3389***	-0.3467***	-0.2594***		-0.3218***	-0.3535***	-0.2123***	
	(-4.42)	(4.65)	(-3.60)		(-4.71)	(-4.89)	(-3.79)		(-4.64)	(-5.32)	(-3.25)	
ln(GDP/POP)	0.3363***	0.3376***	0.3821***	0.5539***	0.3363***	0.3376***	0.3821***	0.5539***	0.2693***	0.2504**	0.3586***	0.501
	(3.16)	(3.21)	(3.47)	(4.74)	(3.37)	(3.37)	(3.65)	(4.92)	(2.76)	(2.61)	(3.54)	(4.6
ln(POP)	-0.0311		-0.0309		-0.0311		-0.0310		-0.0569		-0.0482	
	(-0.54)		(-0.50)		(-0.57)		(-0.53)		(-1.06)		(-0.87)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.59	0.59	0.54	0.36	0.59	0.59	0.54	0.36				
Adj. R^2	0.55	0.56	0.50	0.33	0.55	0.56	0.50	0.33				
System R^2									0.86	0.71	0.69	0.5
Jarque-Bera[80]	6.58	6.95	29.9	31.92	6.58	6.95	29.9	31.92	7.66	5.94	39.51	32.8
Joint Koenker-Basset (F)[81]	0.86	0.11	0.65	0.59	0.84	0.09	0.73	0.51	0.72	0.19	0.57	0.5
Reset (F)[82]	1.91	2.54	2.22	0.40	1.91	2.54	2.22	0.40	1.85	2.62	1.71	0.4

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[80]The 5% critical value for the Jarque-Bera statistic is 5.99.

[81] The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[82] The 5% critical value for the F statistic is 3.0.

Table 4-24

Openness in Telecommunication and Financial Services and Growth: Externality Effect
Supply of Financial Services Equation Regression Results: Whole Sample

Dependent Variable: Number of Banks per 100000 People

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	1.1525	1.1554	-1.4496***	1.1525	1.1525	1.1554	-1.4496***	1.1525	1.3561	2.1365**	-0.8787**	2.4024*
	(1.14)	(1.15)	(-3.11)	(1.14)	(1.19)	(1.20)	(-3.23)	(1.19)	(1.42)	(2.28)	(-2.03)	(2.87)
ln(GA)	-0.2284***	-0.2328***		-0.2284***	-0.2284***	-0.2328***		-0.22874***	-0.2264***	-0.2917***		-0.2855*
	(-2.83)	(-3.00)		(-2.83)	(-2.97)	(-3.11)		(-2.97)	(-3.00)	(-4.02)		(-4.37)
Op^{Fin} x Op^{Tel} x log(GNI89)	0.0023***	0.0023***	0.0020**	0.0023***	0.0023***	0.0023***	0.0020**	0.0023***	0.0019**	0.0017**	0.0009	0.0012
	(2.78)	(2.92)	(2.25)	(2.78)	(2.92)	(3.03)	(2.34)	(2.92)	(2.52)	(2.30)	(1.07)	(1.66)
r	-0.0043		-0.0162	-0.0043	-0.0043		-0.0162	-0.0043	-0.0133		-0.0291*	-0.0160
	(-0.24)		(-0.85)	(-0.24)	(-0.25)		(-0.88)	(-0.25)	(-0.88)		(-1.68)	(-1.04)
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.29	0.29	0.15	0.29	0.29	0.29	0.15	0.29				
Adj. R^2	0.24	0.26	0.10	0.24	0.24	0.26	0.10	0.24				
System R^2									0.86	0.71	0.69	0.58
Jarque-Bera[83]	2.27	2.41	3.00	2.27	2.27	2.41	3.00	2.27	2.02	2.28	2.54	1.60
Joint Koenker-Basset (F)[84]	0.86	0.11	0.65	0.59	0.84	0.09	0.73	0.51	0.72	0.19	0.57	0.54
Reset (F)[85]	1.09	1.02	2.77	1.09	1.09	1.02	2.77	1.09	0.36	0.82	0.10	0.17

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[83]The 5% critical value for the Jarque-Bera statistic is 5.99.

[84]The 5% critical value for the Joint Koenker-Basset statistic is 2.10.

[85] The 5% critical value for the F statistic is 3.0.

that the more developed a country is, the more enhanced its banking supply infrastructure. The externality effect of the openness in trade of telecommunication services on the supply of banking services[86] is equal to 0.1152 (with a standard error of 0.045716) indicating that an increase of the index of openness in trade of telecommunication services by one unit leads to and increase in the logarithm of the number of banks by 0.1152 (approximately an increase by one bank).

It is worth noticing that geographical area is still inversely related to the quantity supplied of financial services and highly significant. Indeed, the parameter estimate suggests that an increase in geographical area by one percent leads to a decrease in the number of banks by 0.2264 percent.

The Effect of Openness in Trade in Services on Economic Growth

As an alternative exploration for the model, we construct a composite index for openness in trade of services. The composite index is simply the unweighted average of the telecommunication and financial services indices scaled on a range of 1 to 10. The new model to be estimated becomes as follows:

GNP growth equation:

$$(12'') \quad \begin{aligned} G_j = {} & a_0 + a_1 \ln Gov_j + a_2 Inf_j + a_3 pop_j + a_4 \ln Inv_j^{Tel} + a_5 \ln(BA_j / GDP_j) + a_6 \ln Op_j + a_7 Op_j^{Serv} \\ & + a_8[\ln(y_j) Op_j^{Serv}] + \varepsilon_j^1 \end{aligned}$$

Demand for telecommunication services equation:

$$(9'') \quad \ln(\sum_{i=1}^{5} Sub_{ij} + WL_j) = b_0 + b_1 \ln(GDP_j / POP_j) + b_2 \ln P_j^{Tel} + b_3 \ln POP_j + \varepsilon_j^2$$

[86] The effect is computed as follows:

$$\frac{\partial \ln B}{\partial \ln Op^{Tel}} = 0.0019(\overline{Op^{Fin}} . \overline{\ln GNI89})$$

Import of telecommunication equipment equation:

$$(10'') \quad \begin{aligned} \ln M_j^{Tel} &= c_0 + c_1 \ln GDP_j + c_2 \ln P_j^{Tel} + c_3 \ln Ex_j + c_4 Op_j^{Serv} \\ &+ c_5 \ln(\sum_{i=1}^{5} Sub_{ij} + WL_j) + \varepsilon_j^3 \end{aligned}$$

Supply of telecommunication services equation:

$$(11'') \quad \ln(M_j^{Tel} + Inv_j^{Tel}) = d_0 + d_1 \ln P_j^{Tel} + d_2 \ln GA_j + d_3 \ln WL_j^{Tel} + d_4 Op_j^{Serv} + \varepsilon_j^4$$

Demand for banking services equation:

$$(13'') \ln(BA_j / GDP_j) = e_0 + e_1 r_j + e_2 \ln Inf_j + e_3 \ln(GDP_j / POP_j) + e_4 \ln(POP_j) + \varepsilon_j^5$$

Supply of banking services equation:

$$(14'') \quad \ln(B_j) = p_0 + p_1 \ln(GA_j) + p_2 \left[\ln(y_j) Op_j^{Serv}\right] + p_3 r_j + \varepsilon_j^6$$

where Op_j^{Serv} is the unweighted average of the telecommunication and financial services openness indices scaled over 10. To check for identification, the order condition of identifiability was used. The model is indeed identified (For each specification). A Hausman specification error test was used to test for simultaneity (Gujaraty, 2003, pp.754-756). This test was done by estimating the reduced form regressions for the investment in telecommunication infrastructure and the total bank asset to GDP ratio. From those regressions, the calculated residuals were then included in the GNP growth equation. A joint F test was used to test the null hypothesis that simultaneity does not exist for both variables. The calculated F statistic was significant at the 5 percent level for models (2) and (3)[87]. This result emphasizes Roller and Waverman (2001) argument that the model should be estimated with a simultaneous regression approach.

[87] The test was not done for model (4) because in the growth equation of model (4) investments in telecommunication infrastructure as well as the bank assets to GDP ratio were excluded.

Estimation Results

Regressions results are shown in Tables 4-25, 4-26, 4-27, 4-28, 4-29, and 4-30. The parameter estimates[88] of the aggregate growth production function reveal that both the composite index for openness in trade of services and the interaction factor are highly significant. The total effect of openness in trade in services on economic growth is equal to –0.00095 (with a standard error of 0.001082), indicating that an increase of one unit in the composite index of openness in services trade leads to a decrease of 0.095 percentage points in GNP per capita growth. As seen in the first part of the study, this result appears to be similar to the one we encountered with the openness in telecommunication and growth model. In order to investigate the reason behind the negative sign of the total effect of openness in trade of services on economic growth, we computed the threshold which is equal to $3,828; suggesting that countries that have an initial income (GNP per capita in 1989 adjusted for PPP) above $3,828 are hurt from openness in trade of services whereas countries that have an initial per capita GNP under $3,828 will benefit from openness in trade of services. Following Mattoo Rathindran and Subramanian (2001), we hypothesize that the negative total effect of openness in trade of services on growth is attributed to the decrease in employment of national factors of production. It is worth noting that the parameter estimates of the logarithm of the ratio of the bank assets to GDP is positive and highly statistically significant, indicating that an increase of one unit in this variable leads to an increase of 0.93 percentage point in the per capita income growth. On the other hand, although the parameter estimate of the logarithm of investment is not statistically significant, it is still promising that the sign of the coefficient is positive suggesting that the more

[88] Only the 3SLS results will be discussed.

investment in telecommunication infrastructure a nation has, the higher the growth rate of GNP per capita will be.

Results of the estimation of the demand for telecommunication services equation are reported in table 4-26. The parameter estimate of GDP appears to be positive and significantly associated with the quantity demanded of telecommunication services. This suggests that an increase in income per capita by one percent leads to an increase in the quantity demanded of telecommunication services by 1.35 percent. Since the income elasticity is positive, we can support our statement that telecommunication services are normal goods. Estimate of the price coefficient is negative and significant at the 10 percent statistical level. It is important to notice that the own price elasticity of telecommunication services is less than one suggesting that the telecommunication services demand is inelastic.

Results for the import of telecommunication equipment equation show that the estimate of the average price coefficient is positive suggesting that an increase of one percent in the average price of telecommunication services leads to an increase of 0.40 percent in the import of telecommunication equipment. It is worth noting that the exchange rate is still significant at the 10 percent level and negatively associated with imports. Estimate of the composite coefficient is positive and highly significant indicating that a one unit increase in the openness in trade of services lead to a 0.15 unit increase in the logarithm of the import of telecommunication equipment. Also the coefficient estimate of the total subscribers is positive and highly significant. Those results are reassuring since they are comparable to the ones we obtained in previous model estimations.

Results for the supply of telecommunication services equation are shown in Table 4-28. Although the results are very comparable to the previous ones, it is important to note that the parameter estimate of the composite coefficient is positive and highly associated with the supply of telecommunication services. On the other hand, the coefficient estimate of the waiting list is negative, suggesting that the larger the waiting list is the less supply of telecommunication services the nation has. However this coefficient is not statistically significant.

The demand for banking services equation estimation results show that interest rate is associated with the bank assets to GDP ratio. The coefficient estimate of 0.0204 indicates that an increase in the interest rate by one percent leads to an increase in the logarithm of the bank assets to GDP ratio by 0.0204 units. As explained in the previous results, this outcome is expected since one can anticipate a rise in real lending interest rate when the demand for loans is high. The coefficient estimate of the inflation rate is negative and highly significant, indicating that an increase of the inflation rate by one percent leads to a decrease in the bank assets to GDP ratio by 0.3141 percent. This result was not expected since one can expect a higher demand for loans during an economic expansion leading to higher inflation rate. However, this result is attributed to the diversity of the data sample. On the other hand an increase of one percent of the income leads to an increase of 0.3161 percent in the demand for banking services. This outcome is not surprising since countries with higher income usually have more investment activities leading to more demand for loans.

Results for the supply of banking services equation estimation show that the geographical area is highly associated with the number of banks in a country. The

coefficient estimate of the geographical area suggests that a one percent increase in the geographical area leads to a 0.2158 percent decrease in the number of banks. As explained for the previous results, this outcome can be attributed to two reasons. The first reason is related to the regulation of the banking industry in certain countries. An example would be Canada, which has a larger geographical area but very few banks. The second reason is related to technology and the barriers to entry into the banking industry in certain countries. The effect of openness in trade in services on the supply of banking services[89] is equal to 0.1640 (with a standard error of 0.065087) meaning that an increase of one unit in the composite index leads to an increase of 0.1640 in the logarithm of number of banks (approximately an increase by one bank). This result is reasonable since banks would be willing to enter the market in more developed countries where the telecommunication industry is more developed and competitively opened to international trade. On the other hand, the effect of development on the supply of banking services[90] is equal to 0.1489 (with a standard error of 0.059085) meaning that an increase of one percent in the initial GNP per capita leads to a 0.1489 percent increase in the number of banks once we take into consideration the openness in trade of services. This result is also expected since one can conjecture that the more developed the country is the more banks it has. However this statement should have

[89] The effect is computed as follows:
$\frac{\partial \ln B}{\partial Op^{Serv}} = 0.0188(\overline{\ln GNI89})$

[90] The effect is computed as follows:
$\frac{\partial \ln B}{\partial \ln GNI89} = 0.0188\overline{Op^{Serv}}$ where $\overline{Op^{Serv}}$ is the average of the composite index for openness in trade of services.

some reservation since some of the developed countries in our sample still have a limited number of banks.

Table 4-25

Openness in Telecommunication and Financial Services and Growth with a Composite index Growth Equation Regression Results: Whole Sample

Dependent Variable: Growth of Per Capita GNP (1989-2000)

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	0.0390	0.0685*	0.0243	0.0810***	0.0527	0.0541	0.0032	0.0810***	-0.0130	0.0259	-0.0704	0.0728***
	(0.76)	(1.87)	(0.42)	(3.30)	(0.87)	(1.45)	(0.05)	(3.62)	(-0.24)	(0.72)	(-1.11)	(3.30)
ln(Gov)	-0.0155**	-0.0159**	-0.0138	-0.0121*	-0.0168**	-0.0181**	-0.016**	-0.0121*	-0.0164**	-0.0170**	-0.0124*	-0.0109
	(-2.09)	(-2.17)	(-1.63)	(-1.65)	(-2.54)	(-2.72)	(-2.06)	(-1.81)	(-2.58)	(-2.68)	(-1.74)	(-1.65)
ln(inf)	-0.0019	-0.0025	-0.0012	-0.0029**	-0.0014	-0.0014	-0.0002	-0.0029**	0.0001	-0.0003	0.0011	-0.0025*
	(-1.10)	(-1.61)	(-0.60)	(-2.02)	(-0.89)	(-0.96)	(-0.12)	(-2.21)	(0.07)	(-0.21)	(0.62)	(-1.94)
Pop	-0.0048	-0.0046	-0.0053	-0.0063**	-0.0045*	-0.0037	-0.0039	-0.0063**	-0.0041	-0.0038	-0.0033	-0.0060**
	(-1.62)	(-1.59)	(-1.59)	(-2.08)	(-1.71)	(-1.38)	(-1.23)	(-2.27)	(-1.62)	(-1.49)	(-1.15)	(-2.21)
ln(inv)	0.0015	0.0009	0.0011		0.0006	0.0007	0.0014		0.0022	0.0011	0.0031	
	(0.96)	(0.64)	(0.61)		(0.27)	(0.50)	(0.58)		(1.16)	(0.72)	(1.35)	
ln(bankass/GDP)	0.0036	0.0042	0.0031		0.0058	0.0083**	0.0083*		0.0093**	0.0112***	0.0117***	
	(1.20)	(1.46)	(0.90)		(1.49)	(2.44)	(1.84)		(2.67)	(3.45)	(2.86)	
ln(Op)	0.0040		0.0053		0.0022		0.0042		0.0060		0.0073	
	(0.83)		(0.97)		(0.46)		(0.73)		(1.28)		(1.40)	
Op^{Serv}	0.0154***	0.0154***	0.0075	0.0067	0.0131**	0.0152***	0.0082	0.0067*	0.0165***	0.0162***	0.0126**	0.0086**
	(2.77)	(2.78)	(1.31)	(1.61)	(2.61)	(2.89)	(1.43)	(1.77)	(3.28)	(3.24)	(2.43)	(2.32)
Op^{Serv} x ln(GNI89)	-0.0018***	-0.0018***	-0.0008	-0.0007*	-0.0015**	-0.0018***	-0.0010	-0.0007*	-0.0020***	-0.0019***	-0.0015**	-0.0009**
	(-2.77)	(-2.80)	(-1.26)	(-1.71)	(-2.53)	(-2.86)	(-1.39)	(-1.88)	(-3.22)	(-3.13)	(-2.36)	(-2.33)
di1	-0.0287**	-0.0296**	-0.0091	-0.0091	-0.0235*	-0.0280**	-0.0091	-0.0091	-0.0276**	-0.0252**	-0.0101	-0.0093
	(-2.06)	(-2.14)	(-0.64)	(-1.33)	(-1.91)	(-2.18)	(-0.67)	(-1.46)	(-2.28)	(-2.06)	(-0.82)	(-1.51)
di2	-0.0251**	-0.0254**			-0.0203**	-0.0253**			-0.0242**	-0.0227**		
	(-2.28)	(-2.33)			(-2.14)	(-2.52)			(-2.57)	(-2.38)		
di3	-0.0057	-0.0057			-0.0039	-0.0053			-0.0059	-0.0043		
	(-0.68)	(-0.68)			(-0.52)	(-0.70)			(-0.82)	(-0.59)		
di4			-0.0014				-0.0021				-0.0017	
			(-0.15)				(-0.23)				(-0.21)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.52	0.50	0.35	0.30	0.50	0.51	0.35	0.30				
Adj. R^2	0.34	0.35	0.14	0.18	0.32	0.35	0.15	0.18				
System R^2									0.86	0.71	0.70	0.59
Jarque-Bera[91]	1.31	1.42	0.31	5.27	1.02	1.56	0.41	5.27	1.92	1.53	0.99	6.01
Joint Koenker-Basset (F)[92]	0.98	0.25	0.61	0.55	0.83	0.36	0.67	0.57	0.85	0.31	0.65	0.62
Reset (F)[93]	4.59	3.56	1.26	2.57	4.32	4.20	0.36	2.59	2.21	1.77	0.61	1.72

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[91] The 5% critical value for the Jarque-Bera statistic is 5.99.

[92] The 5% critical value for the Koenker-Basset statistic is 2.10.

[93] The 5% critical value for the F statistic is 3.0.

Table 4-26

Openness in Telecommunication and Financial Services and Growth with a Composite index
Demand for Telecommunication Services Equation Regression Results: Whole Sample

Dependent Variable: Number of Subscribers plus the Waiting List

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	-8.8562***	9.8311**	6.2901	21.3046***	-10.1456***	9.1213*	5.5676	19.7939***	-9.3184***	13.1656**	8.6216*	21.4955*
	(-6.93)	(2.28)	(1.45)	(4.61)	(-6.76)	(1.72)	(1.05)	(3.06)	(-6.29)	(2.58)	(1.69)	(3.49)
ln(GDP)	1.4019***	1.2200***			1.4060***	1.2214***			1.3500***	1.0080***		
	(23.72)	(5.02)			(24.51)	(5.21)			(23.79)	(4.63)		
$\ln(P^{Tel})$	-0.4931***	-0.8764	-0.6379	-0.9653	-0.3139	-0.7622	-0.5488	-0.7179	-0.3252*	-1.1114	-0.5785	-0.9965
	(-3.41)	(-1.47)	(-1.12)	(-1.28)	(-1.59)	(-0.98)	(-0.71)	(-0.68)	(-1.70)	(-1.46)	(-0.77)	(-0.99)
ln(POP)	0.8803***		0.7786***		0.8898***		0.7892***		0.8745***		0.6174***	
	(25.13)		(5.71)		(26.28)		(6.02		(25.90)		(5.27)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.96	0.41	0.47	0.03	0.96	0.40	0.47	0.01				
Adj. R^2	0.96	0.38	0.44	0.01	0.96	0.37	0.44	0.01				
System R^2									0.86	0.71	0.70	0.59
Jarque-Bera[94]	3.08	0.42	2.13	0.52	6.83	0.42	2.22	0.60	7.20	0.15	1.41	0.52
Joint Koenker-Basset (F)[95]	0.98	0.25	0.61	0.55	0.83	0.36	0.67	0.57	0.85	0.31	0.65	0.62
Reset (F)[96]	0.56	0.91	1.71	1.42	0.51	0.72	1.64	1.37	0.49	1.79	1.77	1.42

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[94] The 5% critical value for the Jarque-Bera statistic is 5.99.

[95] The 5% critical value for the Koenker-Basset statistic is 2.10.

[96] The 5% critical value for the F statistic is 3.0.

Table 4-27

Openness in Telecommunication and Financial Services and Growth with a Composite Index Import of Telecommunication Equipment Equation Regression Results: Whole Sample

Dependent Variable: Import of Telecom Equipment

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	1.5025	-3.2640	1.5440	-3.6764*	-1.9208	-2.7325	-2.3440	-3.6496	-0.8360	-1.3672	-1.5824	-1.5412
	(0.88)	(-1.60)	(0.92)	(-1.77)	(-0.97)	(-1.19)	(-1.18)	(-1.53)	(-0.44)	(-0.62)	(-0.81)	(-0.66)
ln(GDP)	0.0444	0.7468***	0.0260	0.7436***	0.5128***	0.7427***	0.4887***	0.7354***	0.4637***	0.6754***	0.5360***	0.6498***
	(0.35)	(12.97)	(0.21)	(12.60)	(5.99)	(13.75)	(5.75)	(13.13)	(5.63)	(13.90)	(6.61)	(12.33)
$\ln(P^{Tel})$	0.7467***	0.3685	0.7661***	0.4190*	0.4344	0.2983	0.5175*	0.4438	0.4033	0.3049	0.4343	0.4662
	(4.13)	(1.59)	(4.39)	(1.78)	(1.64)	(1.00)	(1.98)	(1.38)	(1.63)	(1.03)	(1.67)	(1.46)
ln(Ex)	-0.0136	-0.0643*			-0.0468	-0.0656*			-0.0518*	-0.0561*		
	(-0.48)	(-1.73)			(-1.54)	(-1.86)			(-1.85)	(-1.95)		
Op^{Serv}	0.1213***	0.2140***	0.1196**	0.2172***	0.1511***	0.2146***	0.1481***	0.2213***	0.1532***	0.2522***	0.1067**	0.2154***
	(2.93)	(4.09)	(2.93)	(4.05)	(3.24)	(4.36)	(3.15)	(4.32)	(3.45)	(5.27)	(2.45)	(4.36)
$\ln(\sum_{i=1}^{5} sub_i + wl)$	0.7505***		0.7695***		0.3060***		0.3347***		0.3295***		0.2607***	
	(5.78)		(6.30)		(3.14)		(3.47)		(3.57)		(2.93)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.95	0.89	0.94	0.89	0.92	0.89	0.92	0.89				
Adj. R^2	0.94	0.88	0.93	0.88	0.91	0.88	0.91	0.88				
System R^2									0.86	0.71	0.70	0.59
Jarque-Bera[97]	16.67	7.03	17.61	10.53	33.26	9.09	35.82	8.98	31.74	4.36	34.54	3.17
Joint Koenker-Basset (F)[98]	0.98	0.25	0.61	0.55	0.83	0.36	0.67	0.57	0.85	0.31	0.65	0.62
Reset (F)[99]	1.08	0.29	0.93	0.09	1.38	0.34	1.10	0.08	1.37	0.26	1.26	0.07

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[97] The 5% critical value for the Jarque-Bera statistic is 5.99.

[98] The 5% critical value for the Koenker-Basset statistic is 2.10.

[99] The 5% critical value for the F statistic 3.0.

Table 4-28

Openness in Telecommunication and Financial Services and Growth with a Composite Index
Supply of Telecommunication Services Equation Regression Results: Whole Sample

Dependent Variable: Investment in Telecom Infrastructure plus Imports

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	15.7500***	15.7500***	18.9320***	17.6469***	15.6587***	17.3383***	17.2187**	15.2542***	16.7681***	17.8639***	19.3319***	20.8117***
	(4.26)	(4.26)	(4.10)	(4.68)	(3.05)	(3.54)	(2.60)	(2.95)	(3.78)	(4.30)	(3.05)	(4.48)
$\ln(P^{Tel})$	-0.4449	-0.4449	-0.2763	-0.1611	-0.4314	-0.6787	-0.0284	0.2223	-0.6934	-0.5067	-0.1701	-0.2725
	(-0.89)	(-0.89)	(-0.43)	(-0.28)	(-0.59)	(-0.98)	(-0.03)	(0.27)	(-1.10)	(-0.83)	(-0.19)	(-0.36)
ln(GA)	0.4099***	0.4099***			0.4098***	0.4125***			0.4295***	0.24499***		
	(4.94)	(4.94)			(5.25)	(5.27)			(5.63)	(3.80)		
ln(WL)	-0.0544	-0.0545	-0.0311		-0.0539	-0.0632	-0.0219		-0.0347	-0.0153	-0.0043	
	(-1.09)	(-1.09)	(-0.49)		(-1.05)	(-1.24)	(-0.33)		(-0.79)	(-0.42)	(-0.07)	
Op^{Serv}	0.4028***	0.4028***	0.4825***	0.5188***	0.4036***	0.3888***	0.4968***	0.5253***	0.4117***	0.3940***	0.3180**	0.2049***
	(3.64)	(3.64)	(3.47)	(4.45)	(3.70)	(3.59)	(3.58)	(4.63)	(4.10)	(4.33)	(2.50)	(3.09)
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.61	0.61	0.36	0.34	0.60	0.60	0.34	0.34				
Adj. R^2	0.56	0.56	0.29	0.31	0.56	0.56	0.29	0.31				
System R^2									0.86	0.71	0.70	0.59
Jarque-Bera[100]	0.53	0.53	1.64	1.57	0.53	0.55	1.45	1.22	0.86	0.65	0.86	0.74
Joint Koenker-Basset (F)[101]	0.98	0.25	0.61	0.55	0.83	0.36	0.67	0.57	0.85	0.31	0.65	0.62
Reset (F)[102]	0.24	0.24	1.49	0.98	0.24	0.32	1.94	1.95	0.32	0.24	0.87	0.32

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[100] The 5% critical value for the Jarque-Bera statistic is 5.99.

[101] The 5% critical value for the Koenker-Basset statistic is 2.10.

[102] The 5% critical value for the F statistic is 3.0.

Table 4-29

Openness in Telecommunication and Financial Services and Growth with a Composite INdex Demand for Financial Services Equation Regression Results: Whole Sample

Dependent Variable: Bank Assets to GDP Ratio

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	2.6077*	2.0929**	2.2198	-0.4008	2.6077*	2.0928**	2.2198	-0.4008	3.0990**	2.1095**	1.8827	-0.23
	(1.86)	(2.07)	(1.51)	(-0.38)	(1.98)	(2.18)	(1.59)	(-0.39)	(2.38)	(2.23)	(1.39)	(-0.2
r	0.0237**	0.0237**		0.0015	0.0237**	0.0237**		0.0015	0.0204**	0.0191**		0.00
	(2.28)	(2.30)		(0.14)	(2.43)	(2.42)		(0.14)	(2.17)	(2.07)		(0.3
ln(Inf)	-0.3389***	-0.3467***	-0.2594***		-0.3389***	-0.3467***	-0.2594***		-0.3141***	-0.3280***	-0.2098***	
	(-4.42)	(-4.65)	(-3.60)		(-4.71)	(-4.89)	(-3.79)		(-4.46)	(-4.78)	(-3.16)	
ln(GDP)	0.3363***	0.3376***	0.3821***	0.5538***	0.3363***	0.3376***	0.3821***	0.5539***	0.3161***	0.3355***	0.4024***	0.534
	(3.16)	(3.21)	(3.47)	(4.74)	(3.37)	(3.37)	(3.65)	(4.92)	(3.20)	(3.40)	(3.91)	(4.9
ln(POP)	-0.0311		-0.0309		-0.0311		-0.0309		-0.0512		-0.0279	
	(-0.54)		(-0.50)		(-0.57)		(-0.53)		(-0.95)		(-0.50)	
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.59	0.59	0.54	0.36	0.59	0.59	0.54	0.36				
Adj. R^2	0.55	0.56	0.50	0.33	0.55	0.56	0.50	0.33				
System R^2									0.86	0.71	0.70	0.5
Jarque-Bera[103]	6.58	6.95	29.91	31.92	6.58	6.95	29.91	31.92	9.66	11.37	41.91	30.0
Joint Koenker-Basset (F)[104]	0.98	0.25	0.61	0.55	0.83	0.36	0.67	0.57	0.85	0.31	0.65	0.6
Reset (F)[105]	1.91	2.54	2.22	0.40	1.91	2.54	2.22	0.40	1.85	2.76	1.27	0.3

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[103] The 5% critical value for the Jarque-Bera statistic is 5.99.

[104] The 5% critical value for the Koenker-Basset statistic is 2.10.

[105] The 5% critical value for the F statistic is 3.0.

Table 4-30

Openness in Telecommunication and Financial Services and Growth with a Composite Index Supply of Financial Services Regression Results: Whole Sample

Dependent Variable: Number of Banks per 100000 People

	OLS				2SLS				3SLS			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	0.4744	0.4659	-2.0272***	0.4744	0.4744	0.4659	-2.0272***	0.4744	0.6965	1.4349	-1.3218**	1.6243*
	(0.43)	(0.43)	(-3.01)	(0.43)	(0.45)	(0.45)	(-3.12)	(0.45)	(0.67)	(1.40)	(-2.09)	(1.71)
ln(GA)	-0.2223***	-0.2273***		-0.2223***	-0.2223***	-0.2274***		-0.2223***	-0.2158***	-0.2812***		-0.2591*
	(-2.76)	(-2.94)		(-2.76)	(-2.91)	(-3.05)		(-2.91)	(-2.87)	(-3.86)		(-3.80)
Op^{Serv} x ln(GNI89)	0.0222***	0.0226***	0.0200**	0.0222***	0.0222***	0.0226***	0.0200**	0.0222***	0.0188**	0.0183**	0.0111	0.0131*
	(2.79)	(2.93)	(2.34)	(2.79)	(2.93)	(3.04)	(2.43)	(2.93)	(2.52)	(2.50)	(1.38)	(1.81)
r	-0.0050		-0.0163	-0.0050	-0.0050		-0.0163	-0.0050	-0.0131		-0.0259	-0.0122
	(-0.28)		(-0.86)	(-0.28)	(-0.29)		(-0.89)	(-0.29)	(-0.85)		(-1.50)	(-0.75)
N	42	42	42	42	42	42	42	42	42	42	42	42
R^2	0.29	0.29	0.15	0.29	0.29	0.29	0.15	0.30				
Adj. R^2	0.24	0.26	0.11	0.24	0.24	0.26	0.11	0.24				
System R^2									0.86	0.71	0.70	0.59
Jarque-Bera[106]	2.44	2.69	3.23	2.44	2.44	2.69	3.23	2.44	2.21	2.52	2.75	1.90
Joint Koenker-Basset (F)[107]	0.98	0.25	0.61	0.55	0.83	0.36	0.67	0.57	0.85	0.31	0.65	0.62
Reset (F)[108]	2.18	2.18	2.51	2.18	2.18	2.18	2.51	2.19	0.84	1.37	1.10	0.44

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% respectively. The figures between parentheses indicate the values of t-statistics.

[106] The 5% critical value for the Jarque-Bera statistic is 5.99

[107] The 5% critical value for the Koenker-Basset statistic is 2.10.

[108] The 5% critical value for the F statistic is 3.0.

CHAPTER V

CONCLUSION

The purpose of this project was to measure the effects of openness in international trade of services on economic growth and to explain the reasons behind the persistent existence of barriers for international trade in services. Two sectors were of major interest, telecommunications and banking sectors. In order to address those issues, two simultaneous econometric models were built and estimated. The first model addressed the issue of openness in trade of telecommunication services and incorporated four equations accounting for production growth, import, demand and supply of telecommunication services. In the second model, the banking sector was added to the telecommunication sector and six equations were estimated simultaneously.

Results showed that openness in trade of services does affect economic growth. Whether the effect is beneficial depends on the level of development of each country. Low and middle-income countries benefit from openness whereas high-income countries do not gain from openness in trade of telecommunication and banking services. We hypothesized that the gain in the case of low and middle-income countries was related to the spillover of technology from the trading partners to the home country whereas the loss in the case of high-income countries was related to the loss in national employment due to foreign competition.

The above results imply that liberalizing international trade in services poses substantial challenges to low, middle, and high-income countries. Concerning low and

middle-income countries, the benefits from the spillover of technology from the trading partners to the home country overcome the loss in national employment when restrictions to international trade in services are removed. This result implies that openness in trade of services benefit low and middle-income countries. Does this mean that policymakers should remove all barriers related to international trade in services? When it comes to liberalizing trade in services, policymakers in low and middle-income countries have raised many concerns. Among them are the sovereignty of the home country, the loss in national employment, and other political concerns. In many instances, countries have treated trade negotiations on the basis of reciprocity consideration. One of the difficulties in analyzing the cost-benefit of openness of trade in services is to account for all the factors that politicians may think of. For instance, it would be very difficult to account for and try to quantify, the sovereignty issue, or try to measure all the political factors that politicians might use in order to argue against openness in trade of services. However, from previous low- and middle-income countries' experiences, the removal of restrictions on trade in services has provided considerable welfare gain. As Stephenson (1999) mentions, the mixture of deregulation and liberalization in the telecommunication sector of Latin American and some Asian countries has improved their network services and decreased the cost of their provision. In such cases, both consumers and suppliers would benefit from liberalizing trade in services. Therefore, low and middle-income countries ought to remove trade barriers related to services subject to certain reservations. Liberalizing international trade in services should be implemented by policies that favor foreign integration through regulations that would protect the sovereignty as well as the domestic economic and political environment of the home country.

The question of liberalizing international trade in services is more complex with regard to high-income countries. Results show that high-income countries do not gain from openness in trade of services. However, those results were only statistically significant at the 10 percent level. We hypothesized that the loss in the case of high-income countries is related to the decrease in national employment in the services sector once barriers to international trade in services have been removed. The reason for this loss might be due to services sectors being well developed in high-income countries and thus they account for a large share of national income. Any integration with foreign competition might result in a loss of national employment. Does this mean that high income-countries should not allow any foreign competition in the services sector? The answer for this question is more complex than it seems. Not allowing foreign competition might result in high domestic market power and the possibility of collusion among domestic incumbents. Within such a context, domestic consumers will suffer from a decrease in consumer surplus due to an increase in services prices. On the other hand, allowing foreign competition might affect negatively economic growth because of the loss in national employment. Policymakers in high-income countries should be cautious when formulating policies oriented towards openness in trade of services. They should consider openness in trade of services with certain reservations. The outcomes of such policies should be oriented towards a potential gain in national employment when considering the introduction of foreign competition in the domestic market. Such potential gain in national employment might be obtained by restricting the flow of foreign labor to domestic markets. Certainly, such regulation might incur some welfare losses, but policymakers and economists should measure the costs and benefits from

those restrictions and decide accordingly whether to remove the barriers to trade in services.

The future of international trade in services depends on research in the fields of economics, politics and engineering. All those disciplines should unite their efforts in order to ensure a perfect development and application of the WTO agreements. There must be a synergy between economics, which promotes the theory of efficiency; politics, which promotes sovereignty and diplomatic relations; and engineering, which encourage the spread of compatible technology. Certainly, regulatory authorities should implement some policies in order to direct and ensure a stable open economy in a global world.

There remain many extensions and explorations that can be done to this study. First our data were limited to 1989-2000 period because of the availability of the openness in trade of telecommunication and financial services indices. An extension to this study would be to develop indices that take into consideration the time factor. This way, the approach to address the issues studied in this project would be oriented towards a panel data study instead of a cross-country analysis. With a panel data analysis, time and technological change could be incorporated into the model through a time element.

Second, our study covered 64 countries with dissimilar telecommunication and financial industry characteristics. Even within some income groups, the financial and telecommunication services sectors were very heterogeneous. Individual country studies would give further insights on each nation's specific needs with respect to openness in trade of services.

Third, other variables and interaction terms can be added to this study in order to investigate the cross sectoral or cross market effect of openness in trade of services. One

market of interest might be the labor market. Indeed, adding the labor market to this model by estimating a supply and demand equation for domestic labor would allow the modeler to estimate the effect of openness in trade of services on the labor market. This would give the modeler more assurance about the negative or the positive effects of openness in trade of services on the national employment that have been hypothesized previously in the analysis. Another sector of interest would be the education sector. Education might be added to this study in order to investigate the effect of openness in trade of services on education. More specifically, telecommunication might have a positive impact on education.

Fourth, the waiting list variable measures the unmet demand for telecommunication services. This might reflect disequilibrium in the market for telecommunication services and can be explained by incorporating another behavioral equation to the model.

Fifth, a threshold regression approach can be applied in order to statistically split the sample and then investigate whether the level of development affects the impact of openness in the services sector on growth. This approach developed by Hansen (1999) lets the level of economic development establish the existence as well as the statistical significance of a threshold level rather than classifying the countries arbitrarily according to their income. However, this method has been applied only to one equation and therefore it might not be applicable to a system of simultaneous equations.

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Appendix 1

Country Coverage by Income Groups

Low Income	Lower Middle Income	Upper Middle Income	High Income (OECD)	High Income (non OECD)
Benin	Bolivia	Argentina	Belgium	Cyprus
Gambia	Colombia	Brazil	Canada	Hong Kong
Ghana	Ecuador	Chile	Denmark	Israel
India	Egypt	Costa Rica	Finland	Malta
Indonesia	El Salvador	Gabon	France	Singapore
Kenya	Honduras	Hungary	Germany	
Lesotho	Jamaica	Korea	Greece	
Malawi	Morocco	Malaysia	Iceland	
Mozambique	Peru	Mauritius	Italy	
Nicaragua	Philippines	Mexico	Japan	
Nigeria	Sri lanka	Panama	Netherland	
Zimbabwe	Thailand	Poland	New Zealand	
	Tunisia	South Africa	Norway	
		Uruguay	Portugal	
		Venezuela	Spain	
			Sweden	
			Switzerland	
			United Kingdom	
			United States	

Appendix 2: Descriptive Statistics and Variable Definition

Variable	Description	N	Mean	Standard Deviation	Minimum	Maximum
G [a]	Growth rate of per capita gross national product (1989-2000)	64	0.03157	0.01396	-0.01410	0.06232
Gov [b]	Average (1989-2000) government consumption as a percentage of GDP	64	15.63	5.01	7.77	29.08
Inf [b]	Average (1989-2000) Inflation rate based on the GDP deflator	64	62.27	209.81	0.57	1197.54
pop [b]	Average (1989-2000) population growth rate	64	1.47	0.92	-0.34	3.57
Inv^{Tel} [a]	Average (1989-2000) investment in telecommunication infrastructure	64	1.99E+09	4.65E+09	2820302	2.6E+10
Op [b]	Openness in trade measured by the average (1989-2000) sum of the imports and exports as a percentage of GDP	64	77.16	54.44	18.02	345.54
Op^{Tel} [b]	Openness index in the telecommunication sector	64	6.03	2.7	1	9
$GNI89$ [b]	Per capita gross national product in 1989	64	8355	6932.68	420	24360
GDP/POP [b]	Average (1989-2000) Per capita gross domestic product	64	10307.68	8250.66	523.92	27750.5
P^{Tel} [a]	Average (1989-2000) price of telecommunication services	64	502.14	221.94	115.67	1399.11
M^{Tel} [a]	Average (1989-2000) imports of telecommunication equipment	64	8.97E+08	1.8E+09	4519667	1.2E+10
POP [b]	Average (1989-2000) total population	64	45539366	1.21E+08	266575	9.2E+08
GDP [b]	Average (1989-2000) gross domestic product	64	4.03E+11	1.02E+12	1.6E+09	7.3E+12
Ex [b]	Average (1989-2000) exchange rate	64	380.31	1212.19	0.36614	7410.49
Sub [a]	Average (1989-2000) number of telecommunication services subscribers	64	15476066	41156429	23241.4	3E+08
WI [a]	Average (1989-2000) number of unmet application waiting for connection to the public switched network	64	232689.6	472098.5	0	2493016
GA [b]	Average (1989-2000) geograpghic surface area	64	881265	2008571	320	9970610
BA/GDP [a]	Total bank assets to gross domestic product ratio	42	135.95	115.91	6	539
r [b]	Average (1989-2000) real interest rate (in percent)	42	8.7	10.08	-7.65	65.01
B [a]	Number of commercial banks per 100,000 people	42	0.91	1.4	0	5.5
Op^{Fin} [b]	Openness index in the financial sector	42	6.67	1.96	1	8
Op^{Serv} [b]	Unweighted average of the openness in financial and telecommunication services indices scaled over 10.	42	7.33	2.34	1.18	10

[a] Variable treated as endogenous; [b] Variable treated as exogenous.

#2

VITA

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