Trade Liberalization in a Dynamic Setting:
Implications of a New WTO Round

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ABSTRACT

This paper explores the impacts of a new WTO Round of trade liberalization over the period from 2000 to 2010, using a model that allows for short run unemployment, adjustment costs in capital formation, international flows of financial assets and forward looking expectations of the announced policy changes. The focus of the paper is on the dynamic adjustment from 2000 to 2020 and the implications for short run global adjustment. So as to provide a metric for judging the scale of the results, the results are compared to policy in which there is a transfer of foreign aid to Asia Crisis countries. This policy is normalized so that the present value of consumption is equal for the recipient countries under both policies. The trade reforms lead to much higher global consumption for the same return to the Asia Crisis countries.

In addition, the paper considers the endogeniety of total factor productivity growth in manufacturing industries to changes in tariffs. This implements, in general equilibrium, the empirical results in Chand (1999). It is shown that these growth effects can lead to large gains to trade liberalization relative to the standard assumption of exogenous TFP growth but also can accentuate the adjustment process with short term policy implications.

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1. Introduction

There are a large number of studies on the consequences for long run resource allocation of reducing barriers to international trade[1] and an emerging literature of the gains to financial market liberalization[2]. Yet the shorter run adjustments to trade liberalization, such as the implications for unemployment, which are the focus of much public debate, is given far less attention by researchers. This neglect partly reflects the nature of the trade liberalization debate in the literature and partly reflects the fact that the traditional models that has been used to examine trade liberalization, have been computable general equilibrium (CGE) models. These models are used because they have a comparative advantage in analysis of long run resource allocation issues in general equilibrium. The alternative global modeling tools such as multi-country macro-econometric models[3], are less well suited because these usually assume a single good in each economy. Thus the relative price adjustment, which is key to the resource allocation issue within countries, is assumed away.

For these reasons, the dynamic adjustment to trade liberalization is a little researched area[4]. Studies by Baldwin (1992), Francois et al (1997) and others do introduce the dynamic implications of trade liberalization but these approaches tend to focus on the impact of trade liberalization on economic growth through factor accumulation or increasing returns to scale in which "dynamics" is used in the sense of the implications for long run growth rather than in the context of the short run cyclical adjustment process that is the workhorse approach of

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1 For example see the volume by Martin and Winters (1997), Deardorff and Stern (1986), Hertel (1997), Shoven and Whalley (1984) and Whalley (1985).

2 see for example McKibbin (1997)

3 for example the IMF Multimod model Masson et al (1988). Also see Bryant et al (1993) for a survey of these models.

4 Other studies that focus on short run dynamics for individual countries or groups of countries

macroeconomists.

Computable General Equilibrium (CGE) models have become a popular tool for calculating the various direct and indirect effects of trade liberalization and have given a range of useful insights. The sorts of mechanisms that these models capture are clear. In the case of unilateral liberalization, a reduction in trade barriers tends to reduce import prices which increases the purchasing power of consumers, thus making consumers directly better off. The change in relative prices induces firms to reallocate resources away from protected sectors towards other more efficient activities which tends to raise economic efficiency in the economy. In aggregate this would be measured as a rise in productivity growth in the economy, although TFP growth at the sectoral level may not change. It is also possible that TFP growth could be increased at the sectoral level (due perhaps to more efficient resource allocation at a more dis-aggregated level) or because of direct effects on TFP growth. CGE models are particularly useful for calculating how much the efficiency gains will be and how much consumption will rise a result of these processes in the longer run.

Once dynamic elements are incorporated into the analysis, a rich mixture of results can emerge. The removal of a tariff will likely increase the return to capital in some sectors and stimulate overall investment in the economy. This is likely through more efficient use of resources at the sectoral level raising overall economy-wide productivity growth and hence increasing the return to capital. In addition some sectors will gain directly from the removal of tariffs that act as an implicit tax on their inputs. In addition, higher income that results from trade liberalization will raise the demand for a wide range of products which would also raise the

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include Kouparitsas (1997)

return to capital in the short term. Higher investment may be financed out of domestic saving and therefore may be delayed as consumers prefer not to reduce current consumption significantly to take advantage of the higher return to capital. Once allowance is made for highly mobile international financial capital then the higher returns can quickly be exploited but only through large changes in the balance of payments. If domestic saving does not increase as the return to capital rises from trade liberalization, and these additional investments are made by foreign owners of capital, then additional GDP will be generated in the economy. However, this need not show up directly as a domestic consumption gain because the returns from the higher production will be repatriated to foreign owners of capital (see Manchester and McKibbin (1995)). Thus is it important to evaluate trade liberalization in terms of income or consumption gains, rather than changes in production or GDP when international financial flows are taken into account.

In all evaluations of trade liberalization, understanding the dynamic path of adjustment is crucial because during the adjustment period, policymakers may withdraw from the liberalization process if economic adjustments are perceived to be politically costly or are misunderstood and lead to counterproductive policy changes. For example, large capital inflows in response to trade liberalization announcements could cause significant deterioration in the current account which if misunderstood could cause a counterproductive change in macroeconomic policy.

The gains to an economy from the liberalization of a foreign economy are also transmitted through a number of channels. The reduction in trade barriers in foreign economies (ceteris paribus) will stimulate the demand for exports from the home economy. This will raise income in the home economy although not by the full value of increased exports because these exports need to be produced with resources that otherwise would be domestically consumed.

Secondly owners of capital in the home economy may be able to invest in the liberalizing economy leading to additional income gains if those investments realize a higher rate of return than in the home economy.

In addition, the role of expectations can be important when a trade reform is phased-in, because financial markets will quickly incorporate expected changes in rates of return, into their evaluation of asset prices.

Other interesting dynamic stories arise in the case where an economy has sticky labor markets or adjustment costs in allocating physical capital, so that resource reallocation does not occur smoothly. Combine these rigidities in models where asset prices adjust quickly in response to international financial capital flows yet other prices are more sticky then overshooting of the exchange rate (e.g. Dornbusch (1976)) during the adjustment process can complicate the standard insights.

The goal of this paper is to present results on the gains to a further WTO round of trade liberalization in a dynamic intertemporal general equilibrium model. In this model considerable care is taken in modeling the short run dynamic adjustment process associated with adjustment costs, sticky wages, endogenous investment, forward looking households and firms and international financial flows[5].

The metric for determining whether trade liberalization gains are “large” or “small” has always been an issue. In this paper the comparisons are made between trade reform and foreign aid in which transfers are made from industrial economies to economies currently in stress in

5 Although in the spirit of modern macroeconomic theory, the model only has relative simple dynamics and does not introduce time series estimates of the dynamic process although in

Asia (Indonesia, Korea, the Philippines and Thailand). The amount of foreign aid is calculated such that the present value of consumption gains from the year 2000 to 2015, is equal to the present value of the consumption gains for the receiving countries from trade liberalization, over the same period. It is found that the aid required is large but also costly for the rest of the world.

In the second part of the paper an attempt is made to endogenize total factor productivity growth in the manufacturing sectors as a function of tariff changes following the empirical evidence in Chand (1999)

This paper makes a number of points that have been written about elsewhere. The first is that timing of trade reforms matters for the short run adjustment because international financial flows bring the implications of future changes in rates of return resulting from trade reforms, into the present. Thus the credible announcement of a policy can be important. Secondly, adjustment costs, including labor market rigidities, can imply short run losses despite clear long run gains resulting from more efficient use of resources. These timing issues matter for policy makers with a short-term horizon. Thirdly, that international capital flows can make a large difference to the short-term adjustment of the balance of payments and real exchange rate changes, relative to the long term implications.

Section 2 gives a brief overview of the theoretical basis of the Asia Pacific G-Cubed model, which is the basis of this study. The results for a further WTO Round of trade liberalization (with a conservative goal of a reduction in tariffs of one third), including both goods and service liberalization, are analyzed in section 3. A comparison between foreign aid and a new WTO Round as a way to help economies in Asia recover from the recent crisis, is

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principle this can be done by following the approach in McKibbin, Pagan and Robertson (1998).

considered in section 4. Section 5 considers endogenizing total factor productivity growth at the sectoral level using the empirical model of Satish Chand (1999). This study estimates the link between tariff reductions and productivity growth in manufacturing. Finally, a summary and conclusion is given in section 6.

2. The Asia-Pacific G-Cubed model

The Asia Pacific G-Cubed multi-country model is based on the G-Cubed model developed in McKibbin and Wilcoxen (1999). It combines the approach taken in the MSG2 model of McKibbin and Sachs (1991) with the dis-aggregated, econometrically-estimated, intertemporal general equilibrium model of the U.S. economy by Jorgenson and Wilcoxen (1989). The MSG2 model is a more traditional macroeconomic model with one sector per country. The Jorgenson-Wilcoxen model has 35 separate industries, each of which is represented by an econometrically estimated cost function. The Asia Pacific G-Cubed model has 6 sectors in each of 18 economies.

The G-Cubed model was constructed to contribute to the current policy debate on global warming, trade policy and international capital flows, but it has many features that make it useful for answering a range of issues in environmental regulation, microeconomic and macroeconomic policy questions. It is a world model with substantial regional dis-aggregation and sectoral detail. In addition, countries and regions are linked both temporally and intertemporally through trade and financial markets. The model contains a strong foundation for analysis of both short run macroeconomic policy analysis as well as long run growth consideration of alternative

macroeconomic policies. Intertemporal budget constraints on households, governments and nations (the latter through accumulations of foreign debt) are imposed. To accommodate these constraints, forward looking behavior is incorporated in consumption and investment decisions. There is considerable sectoral detail. By integrating sectoral detail with clearly specified macroeconomic behavior, the model attempts to integrate the two distinct fields of economic modeling. Overall, the model is designed to provide a bridge between computable general equilibrium models and macroeconomic models by integrating the more desirable features of both approaches. The Asia Pacfic G-Cubed model differs from the G-Cubed model because of the focus on the Asia-Pacific region as well as having 6 sectors compared to 12 for G-Cubed. The theoretical structure is essentially the same.

The key features of the Asia Pacific G-Cubed model are summarized in Table 1. The country and sectoral breakdown of the model are summarized in Table 2. The model consists of eighteen economic regions with six sectors in each region (there are also two additional sectors in each region that produce the capital good for firms and the household capital good). The regions in the model can be divided into two groups: 15 core countries/regions and three others. For the core regions, the internal macroeconomic structure as well as the external trade and financial linkages are completely specified in the model. Our approach for each country is to first model them assuming the theoretical structure we use for the "generic" country but calibrating each country to actual country data. We then proceed country by country to impose institutional features, market structures, market failures or government regulations that cause certain aspects of these economies to differ from our generic country model. In this paper we have only just begun this process, therefore the countries we represent in the region are endowed with

resources, trading patterns, saving and investment patterns etc that are based on actual data for these countries. However, in many important ways may not be truly representative of these countries because of institutional factors that we are still implementing into the model.

Each core economy or region in the model consists of several economic agents: households, the government, the financial sector and the 6 production sectors listed in table 2. Each of these economic actors interact in a variety of markets, both domestic and internationally.

Each of the six sectors within each country is represented by a single firm in each sector which chooses its flexible inputs (labor, energy, materials) and its level of investment in order to maximize its stock market value subject to a multiple-input production function (KLEM), knowledge that physical capital is costly to adjust once it is in place, and subject to a vector of prices it takes to be exogenous. Energy and materials are an aggregate of inputs of intermediate goods. These intermediate goods are, in turn, aggregates of imported and domestic commodities which are taken to be imperfect substitutes. Due to data limitations we assume that all agents in the economy have identical preferences over foreign and domestic varieties of each particular commodity. We represent these preferences by defining six composite commodities that are produced from imported and domestic goods.

Following McKibbin and Sachs (1991), we assume that the capital stock in each sector changes according to the rate of fixed capital formation and the rate of geometric depreciation. The investment process is assumed to be subject to rising marginal costs of installation, with total real investment expenditures in sector equal to the value of direct purchases of investment plus the per unit costs of installation. These per unit costs, in turn, are assumed to be a linear function of the rate of investment. One advantage of using an adjustment cost approach is that the

adjustment cost parameter can be varied for different sectors to capture the degree to which capital is sector specific.

The price of labor is determined by assuming that labor is mobile between sectors in each region, but is immobile between regions. Thus, wages will be equal across sectors. The wage is assumed to adjust to varying degrees based on labor market institutions in the different economies. In the long run, labor supply is given by the exogenous rate of population growth, but in the short run, the hours worked can fluctuate depending on the demand for labor. For a given nominal wage, the demand for labor will determine short run unemployment in each industry. This will vary across industries depending on the composition of demand for each sectors good.

The solution of the optimization problem also gives that the rate of gross investment in sector h is a function of "Tobin's q" for that sector. Following the MSG2 model, it is assumed that investment in each sector is a weighted average of forward looking investment and investment out of current profits.

Households consume a basket of composite goods and services in every period and also demand labor and capital services. Household capital services consist of the service flows of consumer durables plus residential housing. Households receive income by providing labor services to firms and the government, and from holding financial assets. In addition, they also receive transfers from the government.

Aggregate consumption is chosen to maximize an intertemporal utility function subject to the constraint that the present value of consumption be equal to human wealth plus initial financial assets. Human wealth in real terms is defined as the expected present value of future stream of after tax labor income of households. Financial wealth is the sum of real money balance, real government bonds in the hand of the public, net holding of claims against foreign residents and the value of capital in each sector. The solution to this maximization problem is the familiar result that aggregate consumption is equal to a constant proportion of private wealth, where private wealth is defined as financial wealth plus human wealth. However, based on the evidence cited by Campbell and Mankiw (1987) and Hayashi (1982)) we follow the approach in the MSG2 model and assume that only a portion of consumption is determined by these intertemporally-optimizing consumers and that the remainder is determined by after tax current income. This can be interpreted as liquidity constrained behavior or a permanent income model in which household expectations regarding income are backward-looking. Either way we assume that total consumption is a weighted average of the forward looking consumption and backward-looking consumption.

Once the level of overall consumption has been determined, spending is allocated among goods and services based on relative prices.

We take each region's real government spending on goods and services to be a fixed share of GDP and assume that it is allocated among final goods (consisting of both domestically produced and imported goods), services and labor in fixed proportions, which we set to 1992 values. Total government outlays include purchases of goods and services plus interest payments on government debt, investment tax credits and transfers to households. Government revenue is

generated from sales tax, corporate income tax and personal income taxes, and by issuing government debt. We assume that agents will not hold government bonds unless they expect the bonds to be paid off eventually. This transversality condition implies that the current level of debt will be equal to the present value of future budget surpluses.[2]

The implication of these constraints is that a government running a budget deficit today must run an appropriate budget surplus as some point in the future. Otherwise, the government would be unable to pay interest on the debt and agents will not be willing to hold it. To ensure that the constraint holds at all points in time we assume that the government levies a lump sum tax in each period equal to the value of interest payments on the outstanding debt.[3] In effect, therefore, any increase in government debt is financed by consols, and future taxes are raised enough to accommodate the increased interest costs. Thus, any increase in the debt will be matched by an equal present value increase in future budget surpluses. Other fiscal closure rules are possible, such as requiring the ratio of government debt to GDP to be unchanged in the long run. These closures have interesting implications but are beyond the scope of this paper.

The regions in the model are linked by flows of goods and assets. Flows of goods are determined by the import demands described above (based on demand for goods for consumption, investment and government uses).

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[2] Strictly speaking, public debt must be less than or equal to the present value of future budget surpluses. For tractability we assume that the government is initially fully leveraged so that this constraint holds with equality.

[3] In the model the tax is actually levied on the difference between interest payments on the debt and what interest payments would have been if the debt had remained at its base case level. The remainder, interest payments on the base case debt, is financed by ordinary taxes.

Trade imbalances are financed by flows of financial assets between countries (except where capital controls are in place). We assume that existing wedges between rates of return in different economies are generated by various restrictions that generate a risk premium on country denominated assets. These wedges are assumed to be exogenous during simulation. Thus when the model is simulated the induced changes in expected rates of return in different countries generate flows of financial capital reacting to return differentials at the margin.

Determining initial net asset positions and hence base-case international capital flows is non-trivial. We assume that capital flows are composed of portfolio investment, direct investment and other capital flows. These alternative forms of capital flows are perfectly substitutable ex ante, adjusting to the expected rates of return across economies and across sectors. Within an economy, the expected return to each type of asset (i.e. bonds of all maturities, equity for each sector etc) are arbitraged, taking into account the costs of adjusting physical capital stock and allowing for exogenous risk premia. Because physical capital is costly to adjust, any inflow of financial capital that is invested in physical capital (i.e. direct investment) will also be costly to shift once it is in place. The decision to invest in physical assets is based on expected rates of return. However, if there is an unanticipated shock then ex-post returns could vary significantly. Total net capital flows for each economy in which there are open capital markets are equal to the current account position of that country. The global net flows of private capital are constrained to zero.

The data used in the model comes from a number of sources. Unlike the G-Cubed model, we have not yet estimated the CES production elasticities of substitution. We currently assume the production function are Cobb-Douglas.

The input-output tables for the Asia-Pacific economies are from the Institute of Developing Economies although we are currently testing the implication of using the GTAP version 4 database. By the calibration technique used, we are assuming that all countries share the same production technology but differ in their endowments of primary factors and patterns of final demands.

Trade shares are based on the United Nations SITC (Standard Industry Trade Classification) data for 1996 with sectors aggregated from 4 digit levels to map as closely as possible to the SIC (Standard Industry Classification) used in the U.S. input/output data. This data is from the International Economic Databank at the ANU.

The parameters on shares of optimizing versus backward looking behavior are taken from the MSG2 model. These are based on a range of empirical estimates (see Campbell and Mankiw (1987) and Hayashi (1982)) as well as a tracking exercise used to calibrate the MSG2 model to the experience of the 1980s (see McKibbin and Sachs (1991)). It is important to stress that the results in this paper are very sensitive to the range of parameters used in the model. In particular the substitution possibilities in production are important. It is worth stressing that the adjustment cost model of capital accumulation implies that short run changes in inputs for a given relative price change will be lower than the long run substitution possibilities (despite having the same partial substitution elasticities in the short and long runs) precisely because physical capital is fixed in the very short run and therefore substitution possibilities are reduced.

The model is solved using the same software as the MSG2 model and outlined in Appendix C of McKibbin and Sachs (1991). The model has approximately 7,400 equations in its current form with 140 jumping or forward looking variables, and 263 state variables and is

therefore a very complex numerical problem to solve. For further details on theory underlying the model, the reader should refer to McKibbin and Wilcoxen (1999).

3. Results for another WTO Round

This section presents results for trade liberalization in each country, under the assumption that a new WTO Round would reduce tariffs from 2000 to 2010 by one third of the initial tariff in 2000. The initial tariffs are taken from the GTAP version 4 database as aggregated by the Centre for International Economics. These are given in table 3. The policy is assumed to be announced and taken as completely credible, in the year 2000. It is implemented smoothly over the period from 2000 to 2010 with tariffs falling by equal amounts in each year up until 2010.

Results for each country/regional grouping are presented in this section. There are a vast number of results and in this section a subset are presented to illustrate various key points about the dynamic adjustment story.

To generate the results we first solve the model from 1996 to 2070 to generate a model baseline based on a range of assumptions. One set of assumption is that the year 2000 tariff rates are constant forever. Other crucial assumptions needed for generating the baseline include assumptions about population growth and sectoral productivity growth by country as well as fiscal and monetary policy settings. The issue of projection using a model such as that used in this paper is discussed in detail in Bagnoli et al (1996).

Once the baseline is generated, each simulation is run and results are reported as a percentage deviation from this baseline for all variable except trade balances which are percent of

baseline GDP deviation from baseline.

It is important to stress that macroeconomic policy is assumed not to respond to undesirable fluctuations in short run economic activity. Monetary policy is assumed to be targeting a stock of nominal money balances in each economy. Fiscal policy is defined as a set of fixed tax rates (apart from a lump sum tax on households that varies to satisfy the intertemporal budget constraint facing the government) and government spending constant relative to simulated GDP. With higher output, tax revenues rise implying a move towards fiscal surplus in each economy.

Figures 1 through 14 contain an annual time path for each country, for a number of aggregate variables, from 1999 to 2020. Again recall that the results in each figure are the percentage deviation from what otherwise would have occurred by 2020, relative to the baseline projection of the model without any trade liberalization.

First refer to the results for real GDP in Figure 1. By 2020, all OECD economies in figure 1 and all non-OECD economies in figure 2, are shown to have higher GDP relative to what would have been the case without the new WTO Round. For OECD economies, these gains range from 0.4% to 0.68% whereas for non-OECD economies the gains are higher ranging from 0.4% to nearly 2.5%. The GDP figures are the impacts on production location rather than on any welfare measure. This is because with international financial capital mobility, agents can invest in any economies and therefore production can migrate over time. Thus production location or GDP will not be a good indicator of the income flows to the owners of that capital. This is seen more clearly in the results for the consumption gains shown in figures 3 and 4. In these figures, the consumption gains are larger than the GDP gains. In particular, notice that the consumption

gains tend to be front loaded relative to the production gains. This front loading occurs because the economies undertaking the largest liberalization (mostly outside the OECD) experience the largest long run gains and therefore wish to intertemporally substitute some of these gains by raising current consumption relative to future consumption. They can do this through borrowing from international capital markets. In the very short term, some economies experience a decline in GDP because the short run rigidities in the labor markets and adjustment costs hinder rapid reallocation of resources. These effects are nonetheless small relative to the gains over time. In table 5 there are some calculations of the change in the present value of consumption in $US 1996 billions for all countries. For all countries these gains in consumption are positive.

The importance of international financial flows is seen in figures 5 and 6. For OECD economies, exports rise. For non-OECD economies, exports tend to initially fall and then rise over time. This reversal of the direction of export growth, is due to the large capital flows into the economies undertaking more liberalization. This capital inflow leads to a real exchange rate appreciation in these economies. The trade balance actually needs to initially go into deficit in the economies attracting capital (Figures 7 and 8) because this is the flip side of the capital inflow. This is achieved through a fall in exports relative to imports. Thus, although trade liberalization leads to a rise in all exports by 2020 as conventional in CGE models, this is only achieved after a decade of lower export growth in many of the non-OECD economies, driven by the dynamic adjustment of capital flows.

The real exchange rates in figures 9 and 10 show clearly that the US and ROECD economies tend to lose capital and the other economies tend to attract capital. Those countries attracting capital experience a real exchange rate appreciation. Note that the trade balances in

figures 7 and 8 move eventually into surplus for the borrowing economies because to service the build up of foreign debt, they need to eventually export relatively more than they import. This is achieved through gradual depreciation of the real exchange rate over time, after the initial jump appreciation as seen in figures 9 and 10. Note again that because the countries undertaking most liberalization experience higher GDP gains, they also have larger long run real exchange rate depreciation because of the Armington consumption assumptions in which goods are distinguished by their place of production. With more goods from the liberalizing economies their relative prices must eventually fall.

The impact on total employment is shown in figure 11 for OECD economies and figure 12 for non-OECD economies. Recall that in this model, labor is mobile within economies but immobile across economies and that the nominal wage is sticky in the short run. Thus a shock that causes sectors to release resources may not have these resources re-absorbed if there is insufficient increase in labor demand in other sectors or if real wages rise in some sectors. In these results, the price level falls for most sectors. Thus OECD employment tends to be below baseline for several years before rising above baseline as wages fall and overall demand rises. As demand rises, real wages then start to rise. By 2020 employment has returned to baseline (by assumption) and the gains from liberalization are manifested as higher real wages. A similar pattern emerges in the non-OECD economies, although the employment losses are more sustained because the price falls are larger. In addition, the exchange rate appreciation in the economies undertaking more liberalization makes imported intermediate inputs cheaper and thus there is substitution away from labor in these economies in the short run. Over time, a similar pattern of rising real wages and employment returning to baseline is evident for the non-OECD

economies.

Finally, results are shown for short term real interest rates in figures 13 and 14. In the short run, the real interest rate is determined by the assumption about monetary policy given sticky wages, yet in the longer term the real interest rate is driven by changes in the marginal product of capital. As with many variables in these results, the short-run response is the opposite of the longer run response. By 2020 the marginal product of capital is higher and therefore real interest rates are above base. In the short run, interest rates fall because for a given supply of money, real money balances rise as prices fall. These movements in real interest rates from falling to rising are much larger in non-OECD economies because the price movements are larger in the short run and the increase in the marginal product of capital are larger over time.

Note also that all asset prices (exchange rates, interest rates etc) jump at the announcement of the policy but also appear to jump again when the tariffs stop changing. This reflects the role of adjustment costs and is explained theoretically in McKibbin and Wilcoxen (1998).

Overall, a new WTO Round leads to higher GDP and consumption for all countries. In the short run, the countries that undertake the most liberalization experience an increase in the aggregate return to capital which attracts foreign capital, tending to appreciate their exchange rate and worsen their current account and trade account. They also experience the larger falls in employment in the short run because of larger falls in goods prices with sticky wages. Over time they also begin to experience the larger gains than economies with less liberalization to undertake. Consumption is higher in present value terms for all countries as shown in Table 5.

4. An increase in Foreign Aid to Asia Crisis Countries

In order to get a metric for evaluating the gains to the world from trade liberalization under a new Round, a simulation is run in which foreign aid is transferred from the United States, Japan, Australia and other OECD economies (in proportion to GDP shares) to the Asia economies recently experiencing crises - Indonesia, Korea, Philippines and Thailand. This aid is assumed to begin in 2000 and be phases out at 10% per year thereafter. The level of aid is set equal to that required to leave the present value of consumption in the crisis economies the same as would be achieved under the WTO Round. It is assumed that donor countries increase their fiscal deficits to pay for this (ultimately to be paid by higher taxes) and that recipient countries receive this directly as government revenue, which reduces their fiscal deficits.

The comparison of discounted present value of consumption for each country are contained in table 4. The four recipient countries have approximately the same value of consumption under both simulations. The key point is that most other countries, except those that trade intensively with the recipient countries tend to be worse off, not only relative to the trade liberalization simulation, but also relative to the baseline. The reason for this is that the transfer does not create anything new except in the case where existing distortions may have affected the allocation of capital globally. Trade liberalization on the other hand leads to more efficient use of resources for all economies as well as lowering the costs of capital for economies in which distortions are keeping the cost of capital is high. The amount of aid required to make the crisis countries as well of as under the trade liberalization scenario is around $US 144 billion in the year 2000 falling by 10% per year thereafter. This is a very large package which leaves countries

not receiving the aid, worse off. In contrast, the WTO Round leaves the rest of the world significantly better off (around $US 1,300 billion in terms of the present value of consumption). Thus trade liberalization through a new Round may be a better way to address some of the short-term problems facing the Asia crisis economies, as well as being a better option for the rest of the world.

The dynamic adjustment under increased foreign aid is also quite interesting and a some results are presented in figures 15 through 28.

The transfer in aid improves the current account of recipient countries but has ambiguous effects on the trade balance of these economies. The transfer clearly raises consumption in recipient countries (figure 18) and lowers consumption in donor countries (figure 17) although the GDP effects are not quite so clear-cut because the increase in imports of recipient countries can raises GDP in donor countries depending on trade links.

5. Endogenous Productivity Growth

This section introduces an empirical model of endogenous total factor productivity growth in the manufacturing industries. It is implemented using the results of Chand (1999) in which he tests a number of specifications but finds a robust and statistically significant relationship between cuts in manufacturing tariffs in Australia and total factor productivity growth in Manufacturing. This is a careful time series study on eight two digit ANZSIC industries from 1968/69 to 1994/95. The estimates for the relationship range from a 1 percent cut

in tariffs raising productivity growth by between 0.18% to 1.11%. In this section I use a midpoint of 0.5%. It is also assumed that the growth effect eventually disappears after 2050. In other words, in the short run productivity growth changes by the estimated effects, but in the long run only the level of productivity is higher than would otherwise have been the case.

Results for this alternative specification are contained in figures 19 through 29. Clearly the results are very different from the standard model presented in section 3 above. In figure 19, the gains for GDP in OECD economies are between 1.5% and 4.3% whereas for non-OECD economies they are up to 13%. A similar magnification of the gains are shown for consumption in figures 21 and 22. It is clear that with a higher TFP growth rate, the rise in consumption in the short term is even more magnified in non-OECD economies. This is also reflected in the large capital flows implicit in the trade balance deterioration shown in figure 24 and the large real exchange rate appreciation (figure 25 and 26).

The larger gains from trade liberalization when productivity growth is endogenous is clear. In addition to raising the gains, these results suggest that this effect also increases the fluctuations in asset prices and current account balances. This is not a problem in theory, indeed it is optimal for this to occur, however it does suggest problems for policy makers who do not understand these adjustments to the global economy when trade liberalization is undertaken.

6. Conclusion

This paper has offered empirical estimates of the long run gains, and short run

adjustment, to another WTO Round of trade liberalization in which remaining tariffs are reduced by one third over the period from the year 2000 to 2010. It is shown that significant gains are possible. In addition, relative to foreign aid, a new WTO Round is a much more desirable way both to stimulate the Asia Crisis economies in the near term, and generate higher incomes for the world economy in the medium term.

In addition, the empirical results of Chand (1999) linking total factor productivity growth to tariff changes, lead to very large gains from another round of trade liberalization. This suggests that the standard models may significantly underestimate the gains from trade liberalization. These gains however also point to greater fluctuations in asset prices and capital flows which need to be understood in the context of optimal resource reallocation both with economies and over time. Managing the adjustment process is likely to be a challenge for policy makers and would best be handled not by direct intervention but by greater research into better understanding the rich dynamics that can arises in the short run adjustment to trade liberalization.

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- Specification of the demand and supply sides of economies;
- Integration of real and financial markets of these economies with explicit arbitrage linkage real and financial rates of return;
- Intertemporal accounting of stocks and flows of real resources and financial assets;
- Imposition of intertemporal budget constraints so that agents and countries cannot forever borrow or lend without undertaking the required resource transfers necessary to service outstanding liabilities;
- Short run behavior is a weighted average of neoclassical optimizing behavior based on expected future income streams and Keynesian current income;
- The real side of the model is dis-aggregated to allow for production of multiple goods and services within economies;
- International trade in goods, services and financial assets;
- Full short run and long run macroeconomic closure with macro dynamics at an annual frequency around a long run Solow/Swan/Ramsey neoclassical growth model.
- The model is solved for a full rational expectations equilibrium at an annual frequency from 1996 to 2070.

Table 1: Key Features of the Asia Pacific G-Cubed Model

Table 2: Overview of the AP-GCUBED Model

Regions:	***Sectors***:
United States	Energy
Japan	Mining
Australia	Agriculture
Rest of the OECD	Non Durable Manufacturing
India	Durable Manufacturing
Korea	Services
Thailand	
Indonesia	
China	
Malaysia	
Singapore	
Taiwan	
Hong Kong	
Philippines	
Oil Exporting Developing Countries	
Eastern Europe and the former Soviet Union	
Other Developing Countries	
Agents	***Markets***:
Households	Final Goods
Firms	Services
Governments	Factors of production
	Money
	Bonds
	Equities
	Foreign Exchange

Table 3a: Initial Tariff Rates

	Agriculture	Energy	Mining	Durable Manufacturing	Non Durable Manufacturing
United States	0.3	0.08	0.1	1.06	3.49
Japan	90.52	0.04	0.01	0.47	6.36
Australia	0.61	0.48	0.4	8.46	5.15
New Zealand	0.07	0	0.4	4.19	2.93
Indonesia	5.86	3.34	1.5	9.42	8.76
Malaysia	5.58	2.35	1.3	5.56	12.89
Philippines	22.38	0	1.9	17.09	2.02
Singapore	6.53	0	0.0	0.14	4.62
Thailand	15.72	0.28	1.2	21.6	21.39
China	14.56	8.71	3.2	36.09	32.72
Taiwan	21.05	6.82	0.9	7.16	13.65
Korea	23.24	1.14	1.7	7.51	11.88
Hong Kong	0.0	0.0	0.0	0.0	0.0
India	15.88	13.8	3.2	41.76	46.94
ROECD	5.44	1.17	0.08	3.48	8.91

Source: Centre for International Economics aggregations based on GTAP 4 data.

Table 3b: Reduction in services costs as a result of another Round

	Service
United States	1.43
Japan	1.53
Australia	1.59
New Zealand	1.72
Indonesia	1.97
Malaysia	1.92
Philippines	2.06
Singapore	2.23
Thailand	2.24
China	2.24
Taiwan	1.73
Korea	1.69
Hong Kong	2.5
India	2.1
ROECD	1.42

Source: Calculations by Centre for International Economics, Canberra.

Table 4: Transfers to Crisis Countries in $US billion 1996

	2000	2001	2002	2003	2004	2005	2010	2015
Receiving Countries								
Indonesia	40.46	26.54	21.76	17.85	14.63	12	4.45	1.65
Philippines	12.22	8.02	6.57	5.39	4.42	3.62	1.34	0.5
Thailand	29.5	19.35	15.87	13.01	10.67	8.75	3.24	1.2
Korea	61.95	40.64	33.32	27.33	22.41	18.37	6.81	2.53
Donor Countries								
United States	49.53	32.49	26.64	21.85	17.91	14.69	5.45	2.02
Japan	29.72	19.49	15.99	13.11	10.75	8.81	3.27	1.21
Australia	2.48	1.62	1.33	1.09	0.9	0.73	0.27	0.1
ROECD	62.41	40.94	33.57	27.53	22.57	18.51	6.86	2.54

Table 5: Present Value of Consumption from 2000 to 2015

	Tariff Cuts	Transfers
United States	$359.64	($13.87)
Japan	$261.83	($11.40)
Australia	$26.40	($0.18)
New Zealand	$5.24	($0.00)
Indonesia	$33.88	$33.05
Malaysia	$4.68	$0.72
Philippines	$8.65	$8.80
Singapore	$7.02	$0.61
Thailand	$23.65	$23.48
China	$39.68	($1.96)
India	$23.34	($0.16)
Taiwan	$13.09	($2.40)
Korea	$24.83	$24.56
Hong Kong	$14.81	($1.24)
ROECD	$475.34	($5.17)

Figure 1: Impact of a new WTO Round on Real GDP
(OECD Economies)

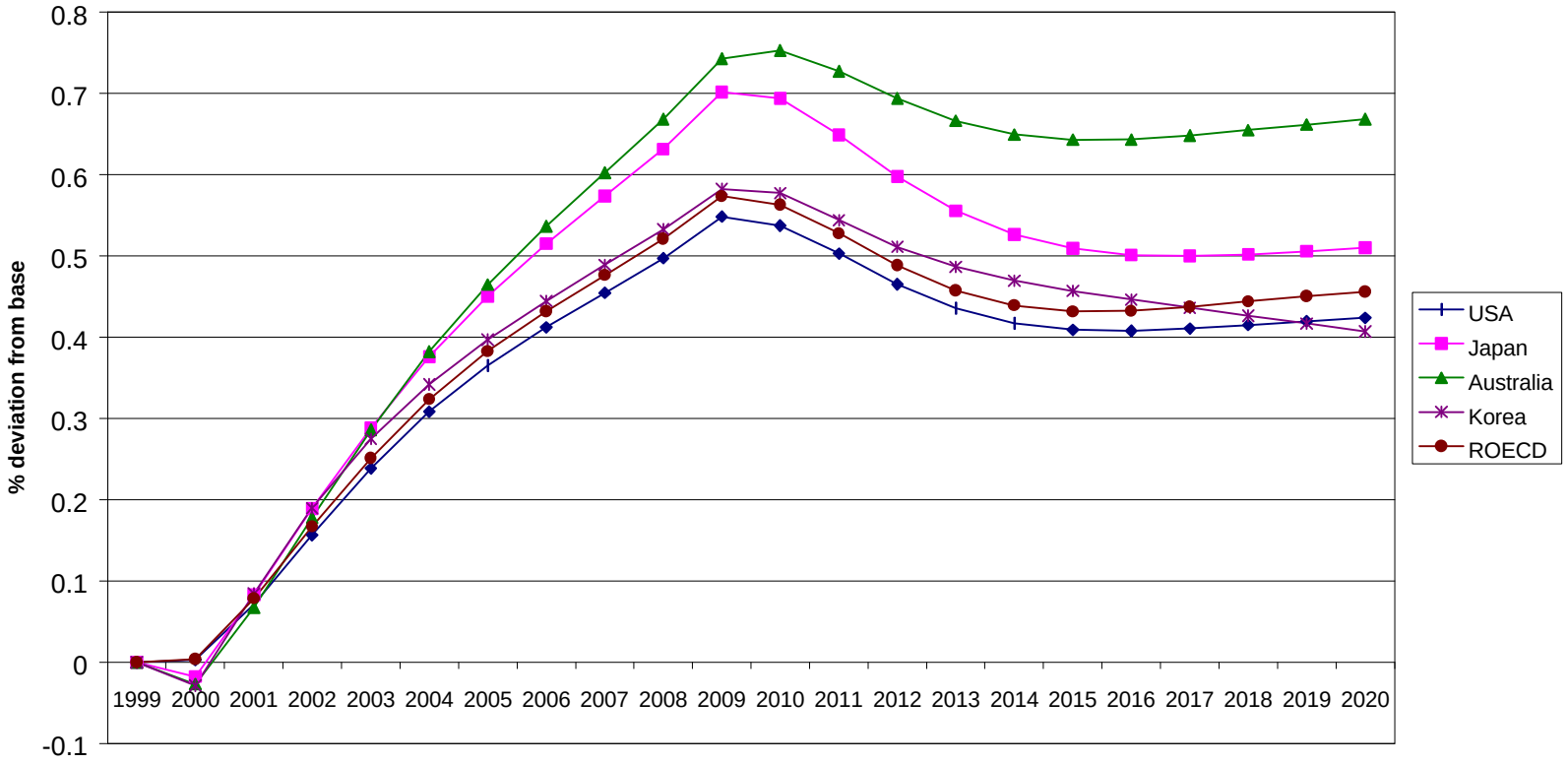

Figure 2: Impact of a new WTO Round on Real GDP (non OECD)

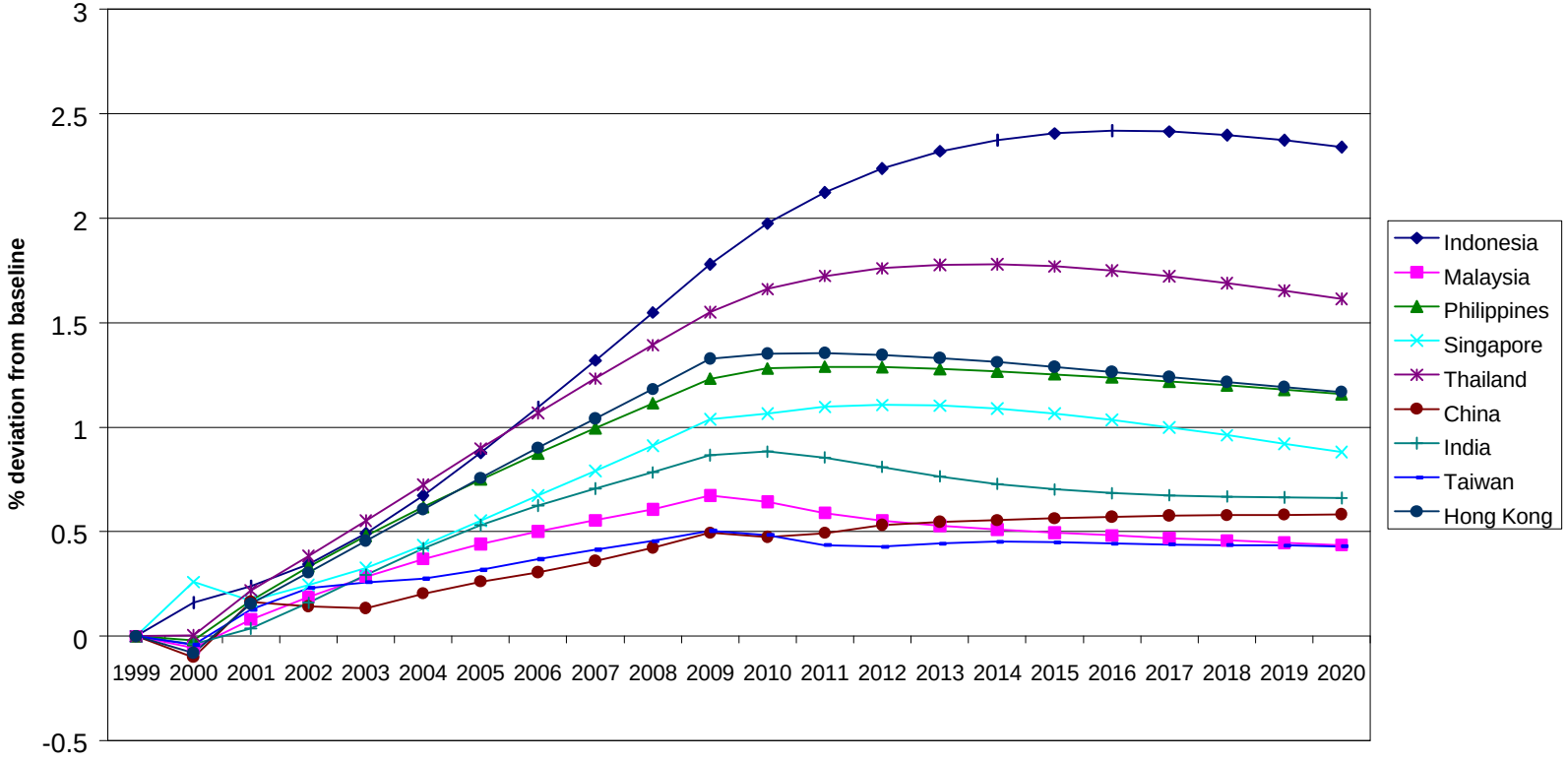

Figure 3: Impact of a new WTO Round on Real Consumption (OECD Economies)

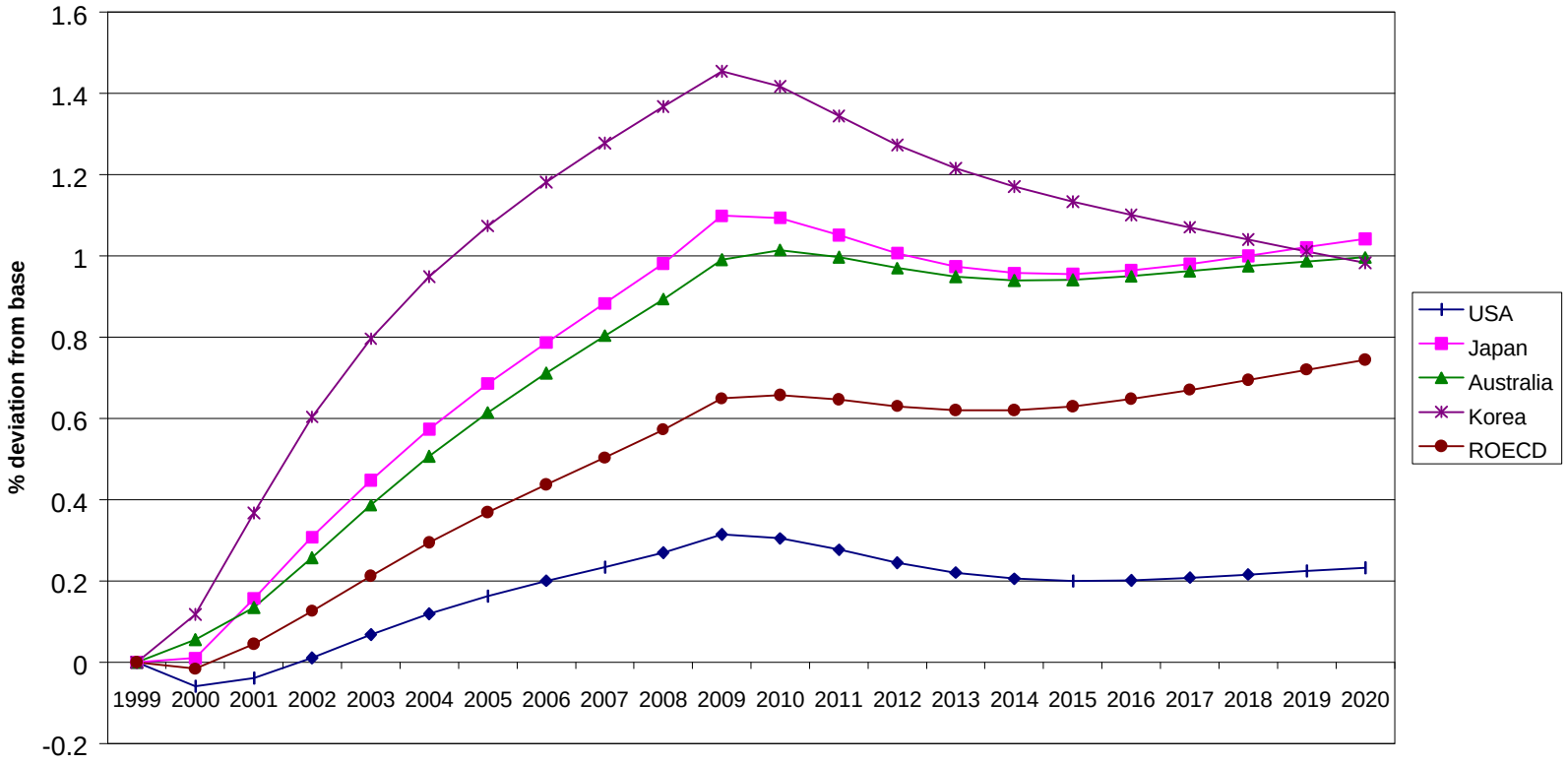

Figure 4: Impact of a new WTO Round on Real Consumption (non OECD)

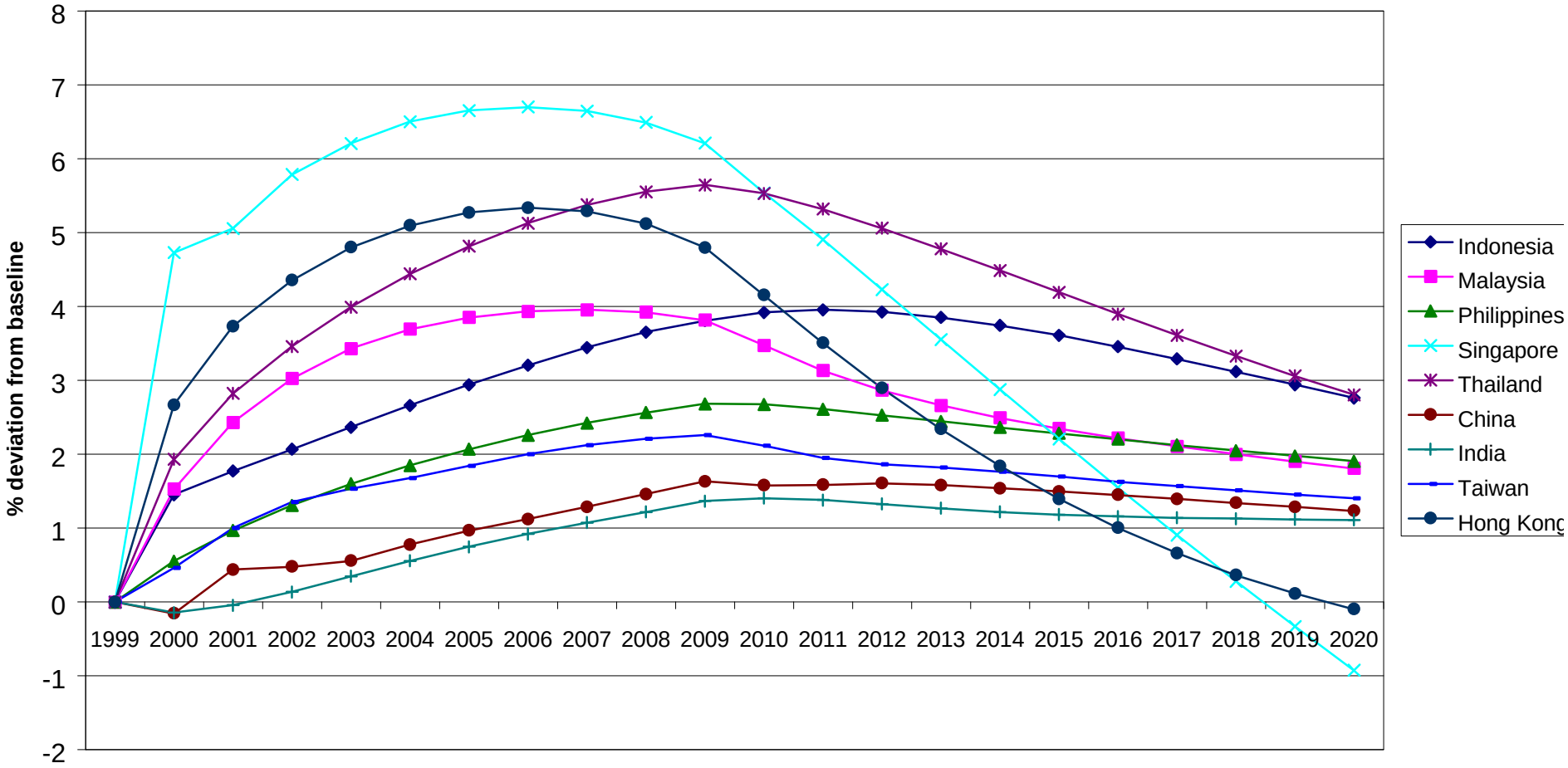

Figure 5: Impact of a new WTO Round on Real Exports (OECD Economies)

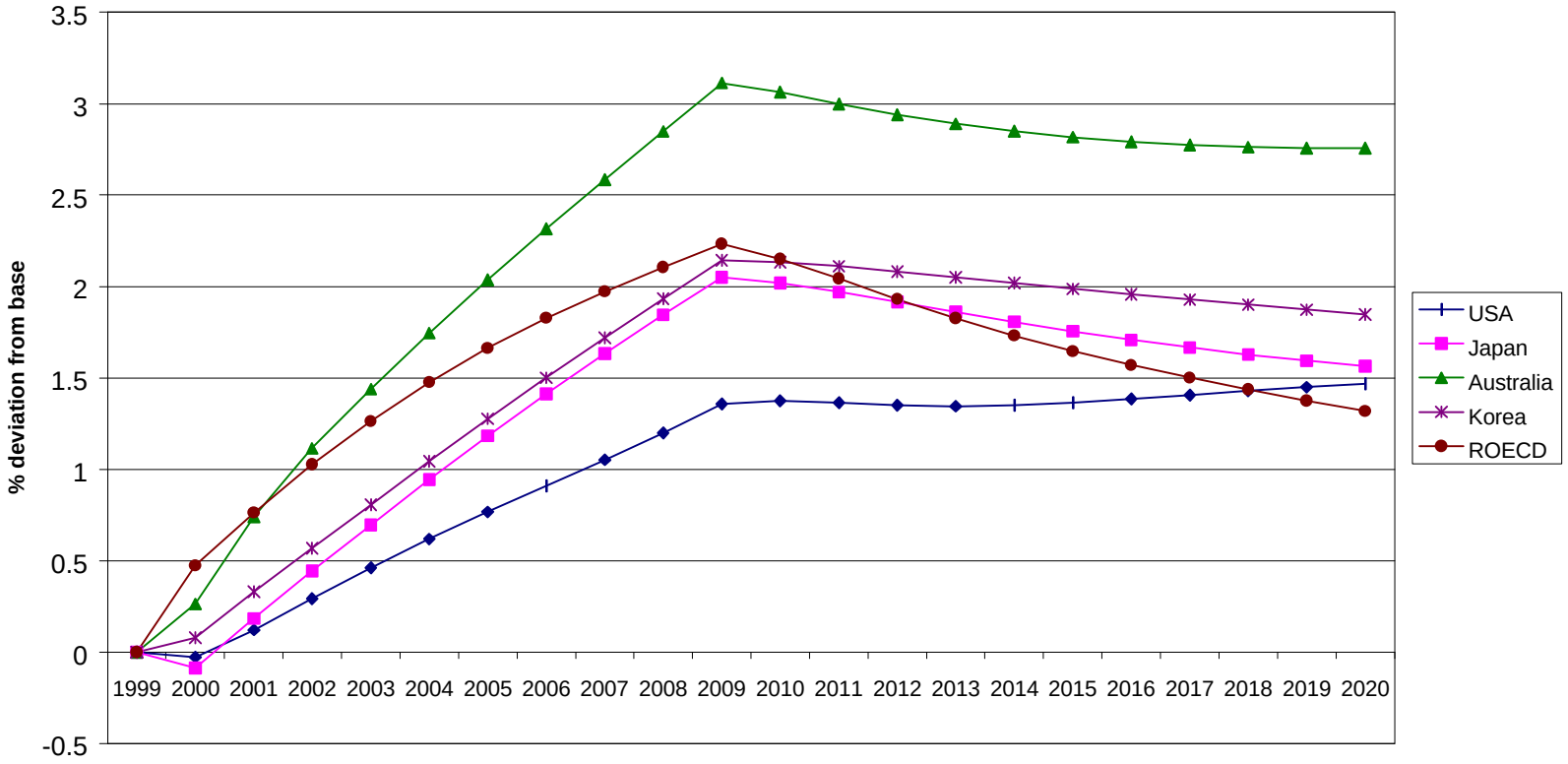

Figure 6: Impact of a new WTO Round on Real Exports (non OECD)

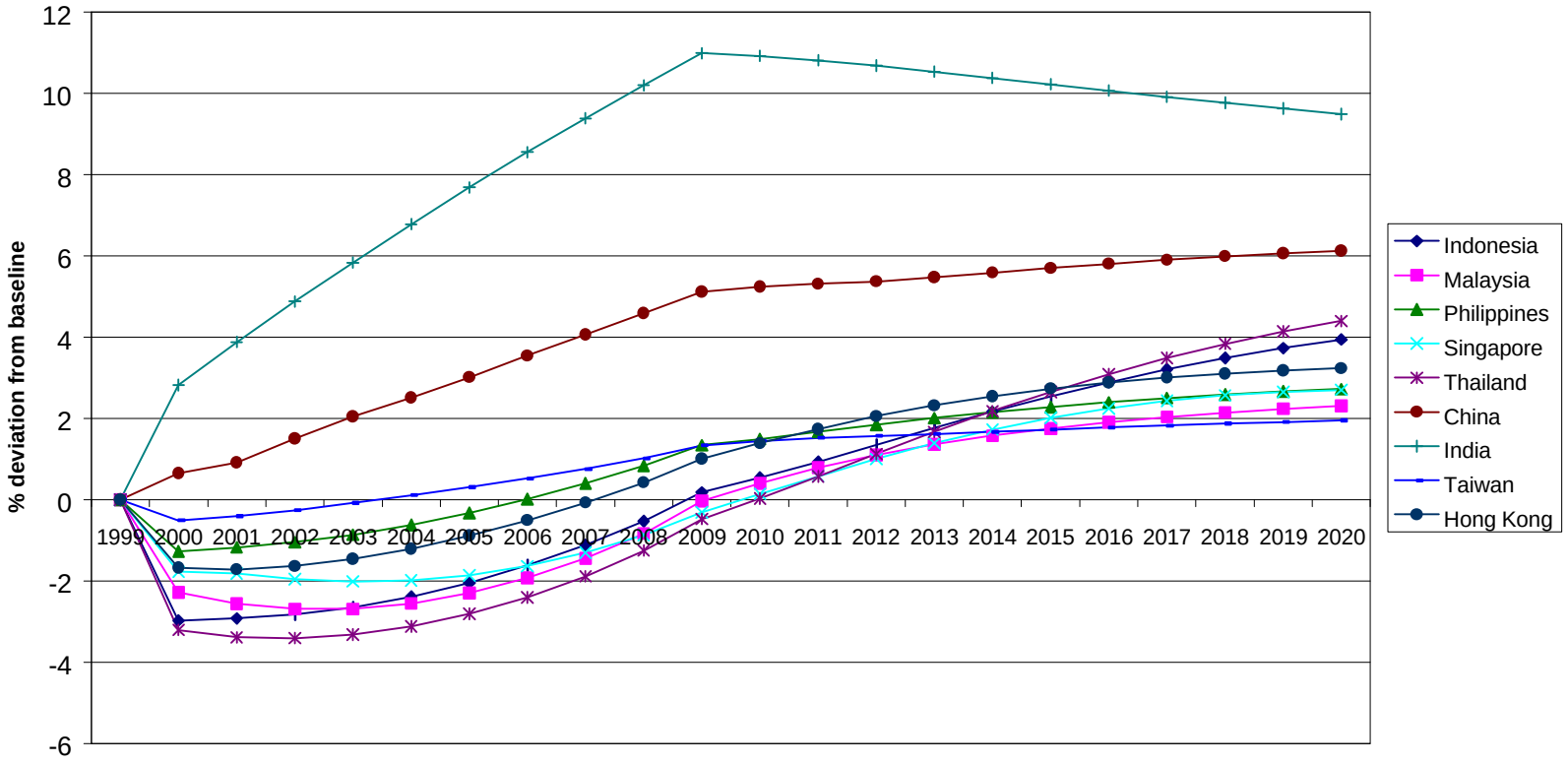

Figure 7: Impact of a new WTO Round on Trade Balances (OECD Economies)

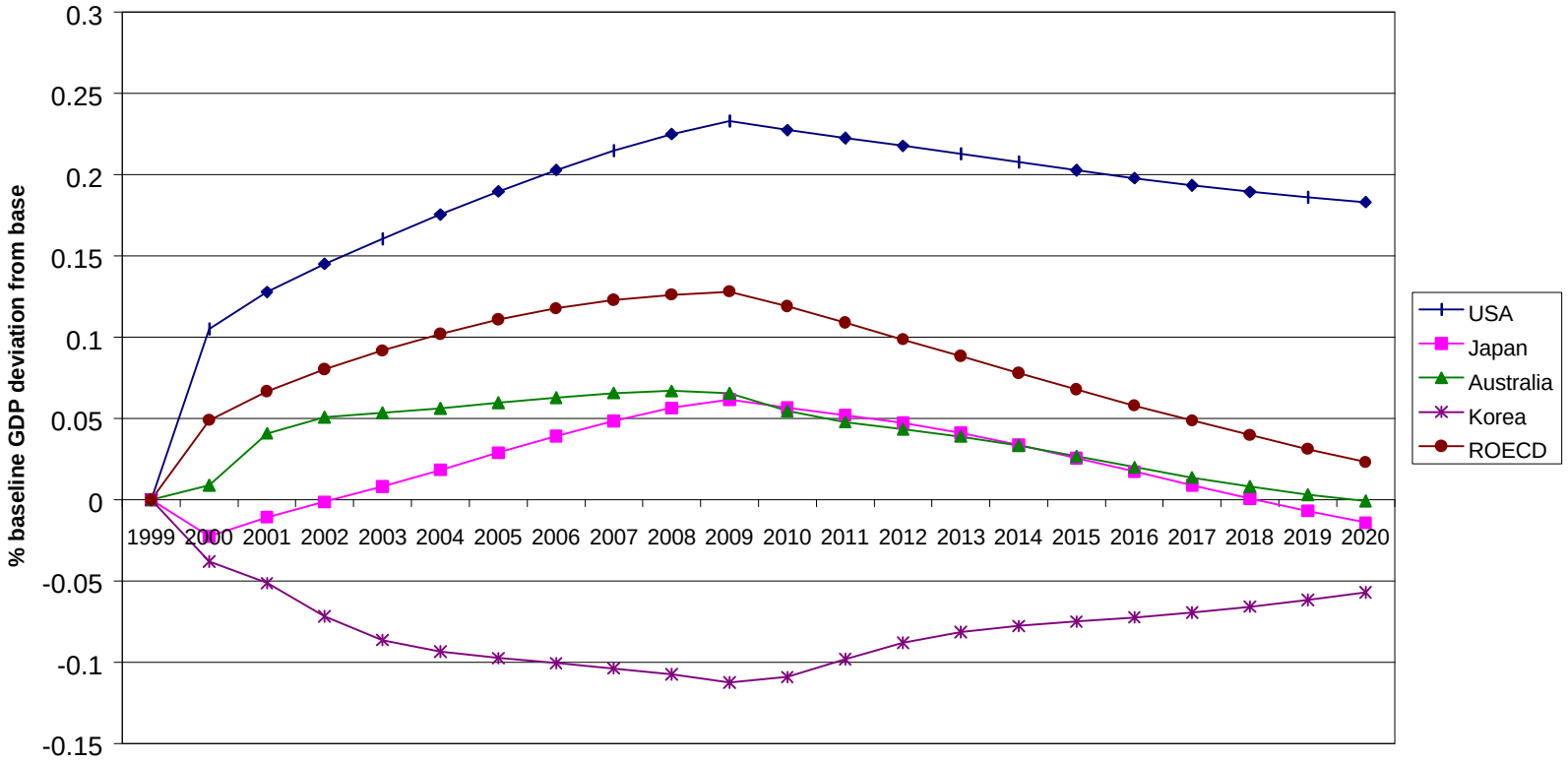

Figure 8: Impact of a new WTO Round on Trade Balances (non OECD)

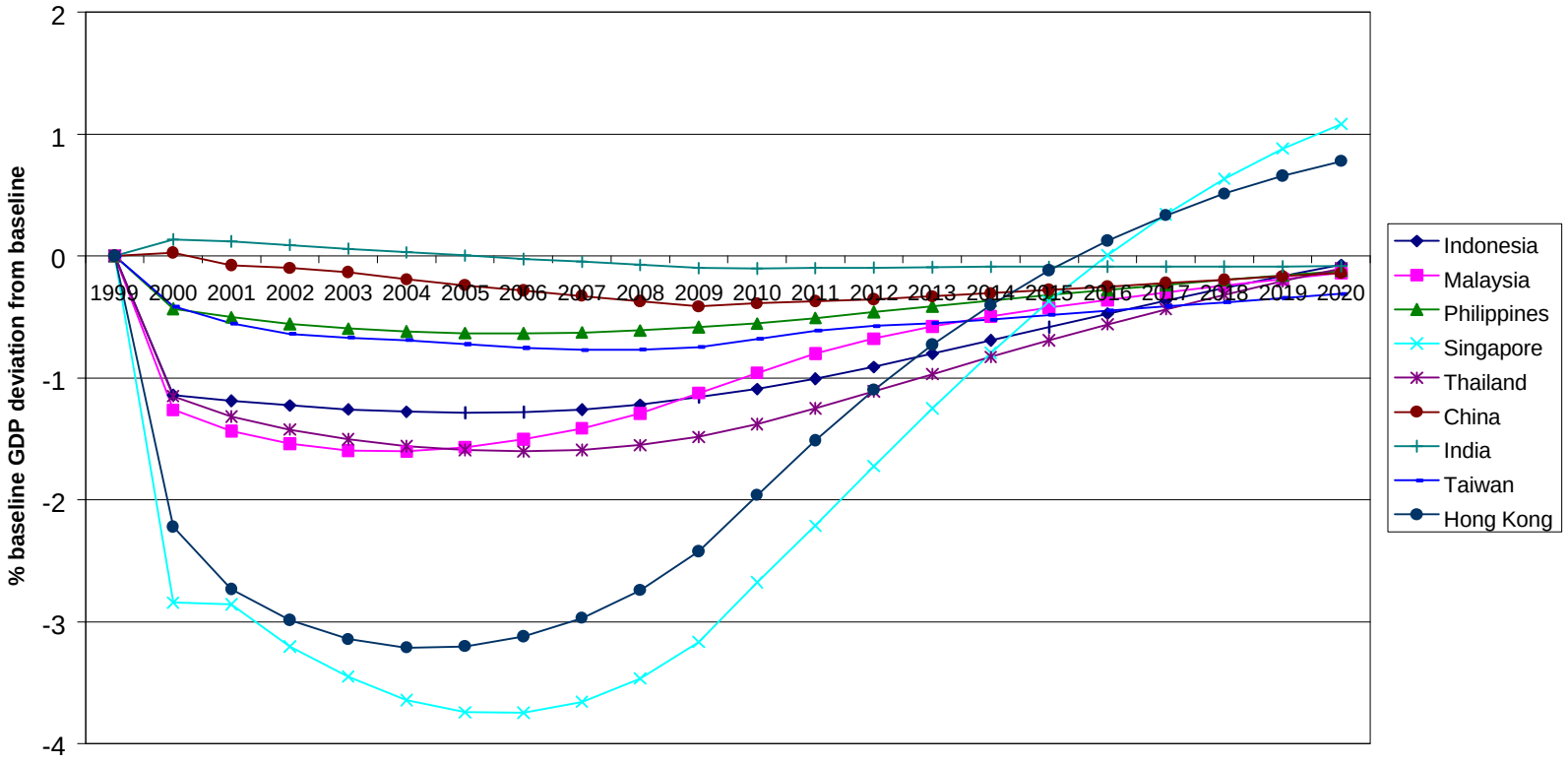

Figure 9: Impact of a new WTO Round on Real Effective Exchange Rates (OECD Economies)

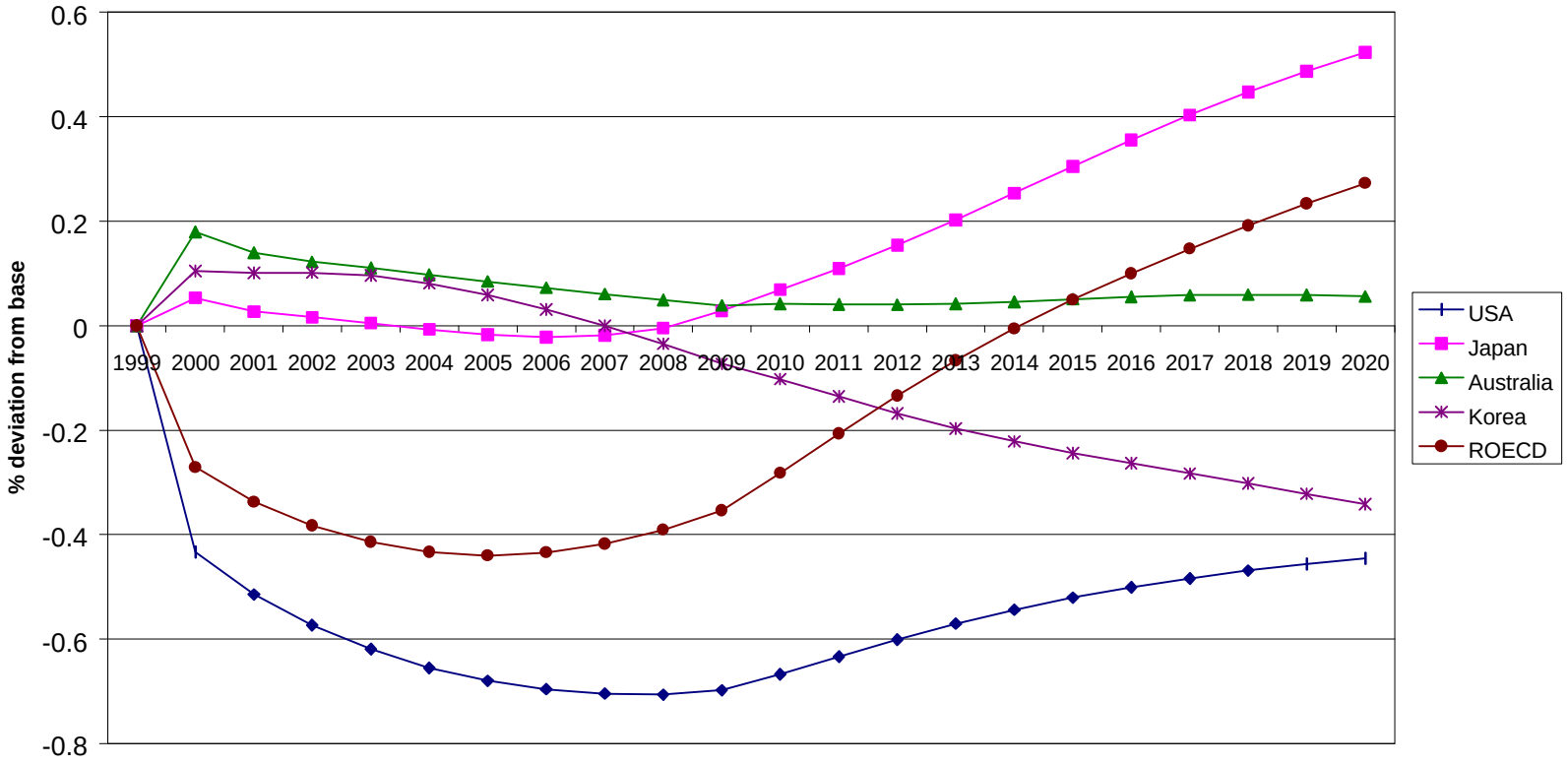

Figure 10: Impact of a new WTO Round on Real Effective Exchange Rates (non OECD)

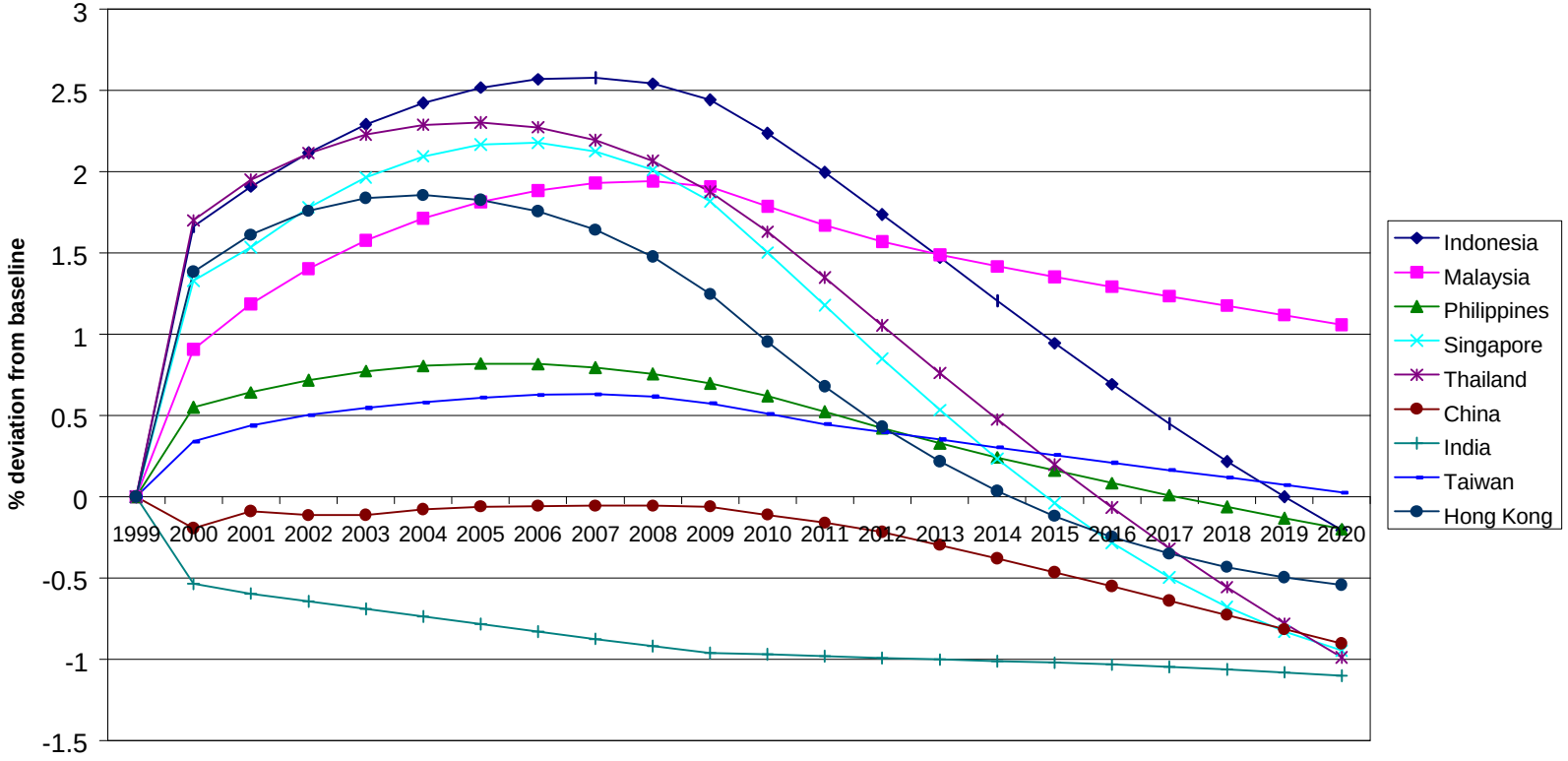

Figure 11: Impact of a new WTO Round on Employment (OECD Economies)

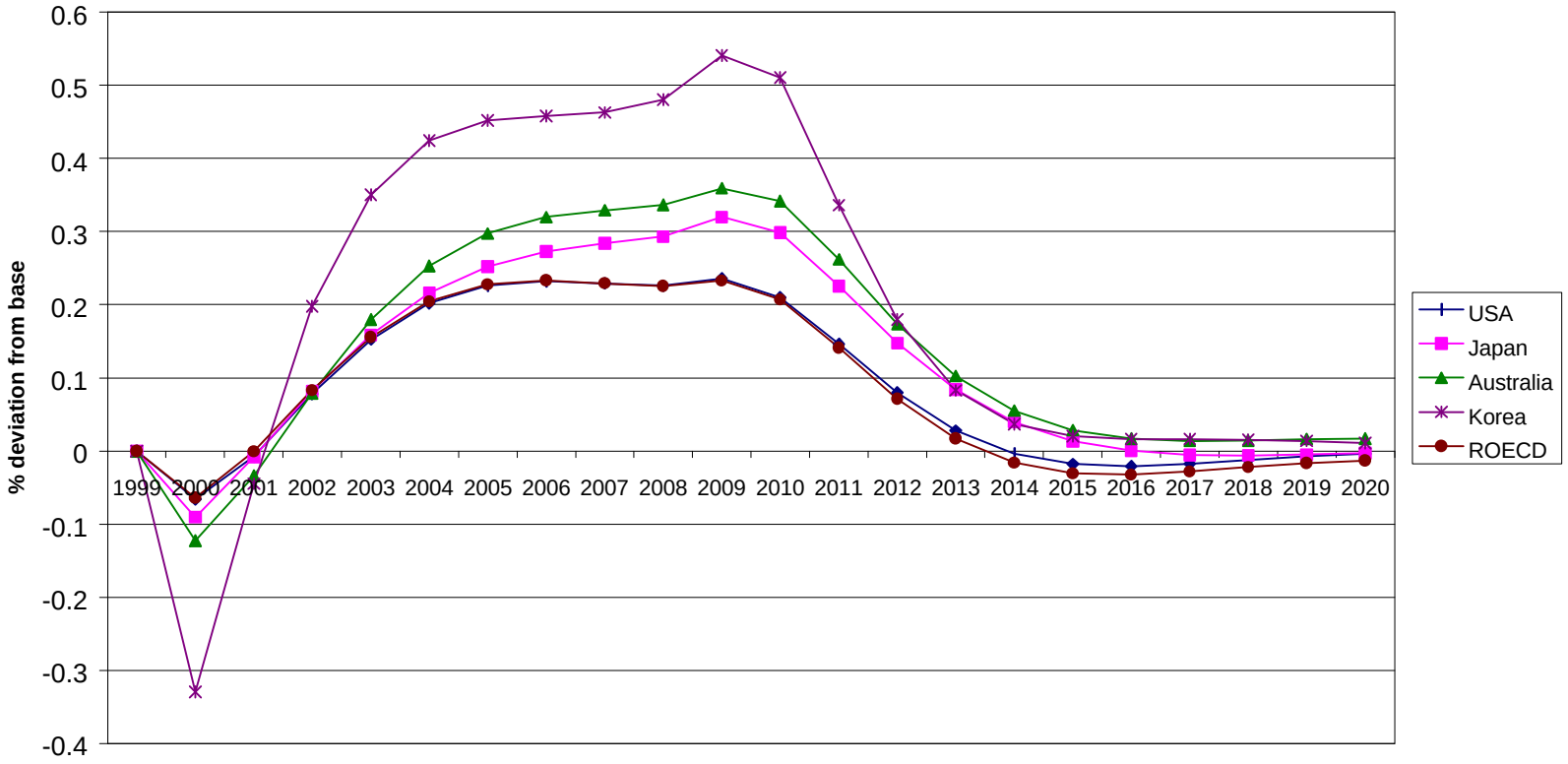

Figure 12: Impact of a new WTO Round on Employment (non OECD)

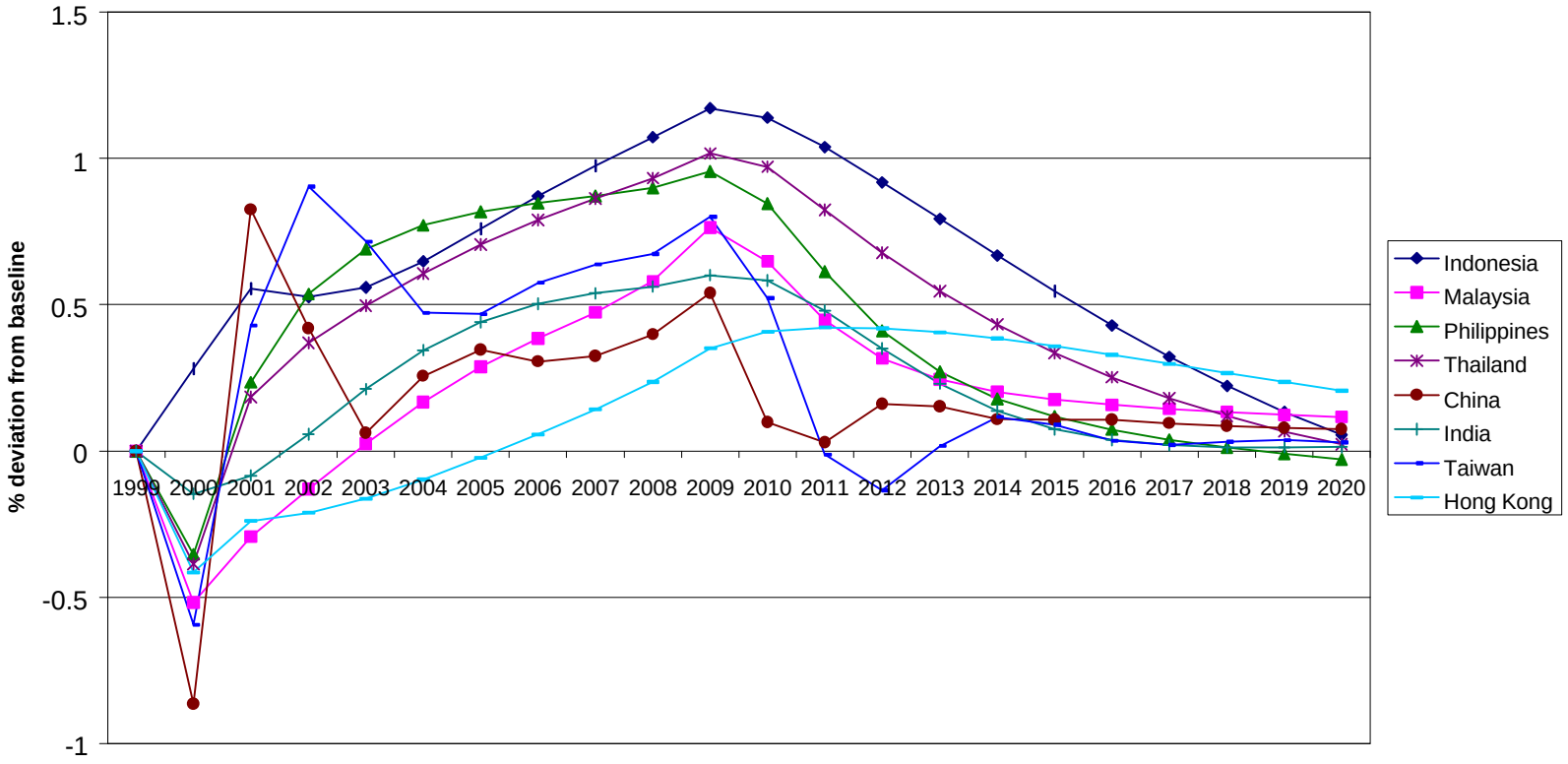

Figure 13: Impact of a new WTO Round on Real Interest Rates (OECD Economies)

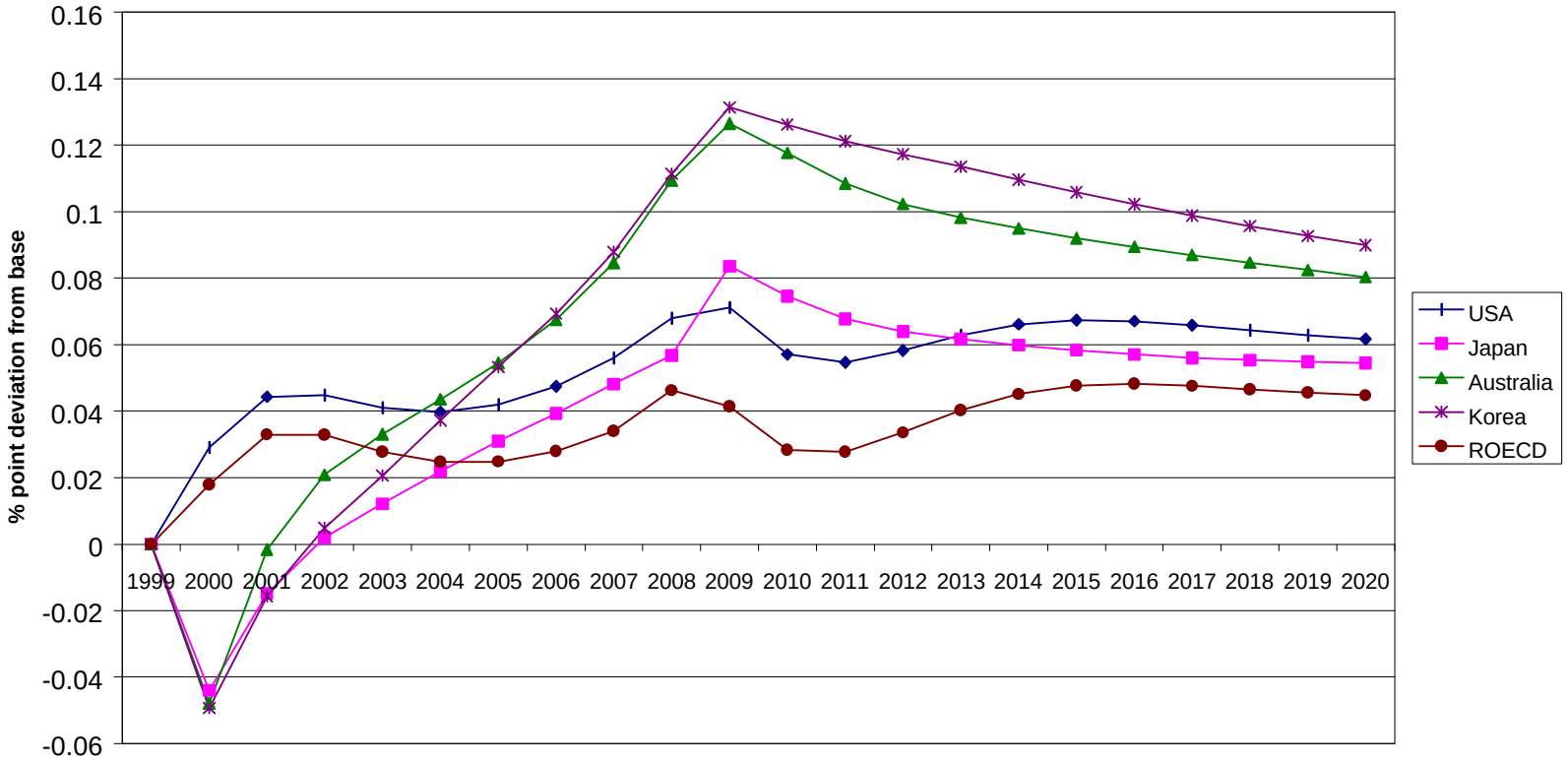

Figure 14: Impact of a new WTO Round on Real Interest Rates (non OECD)

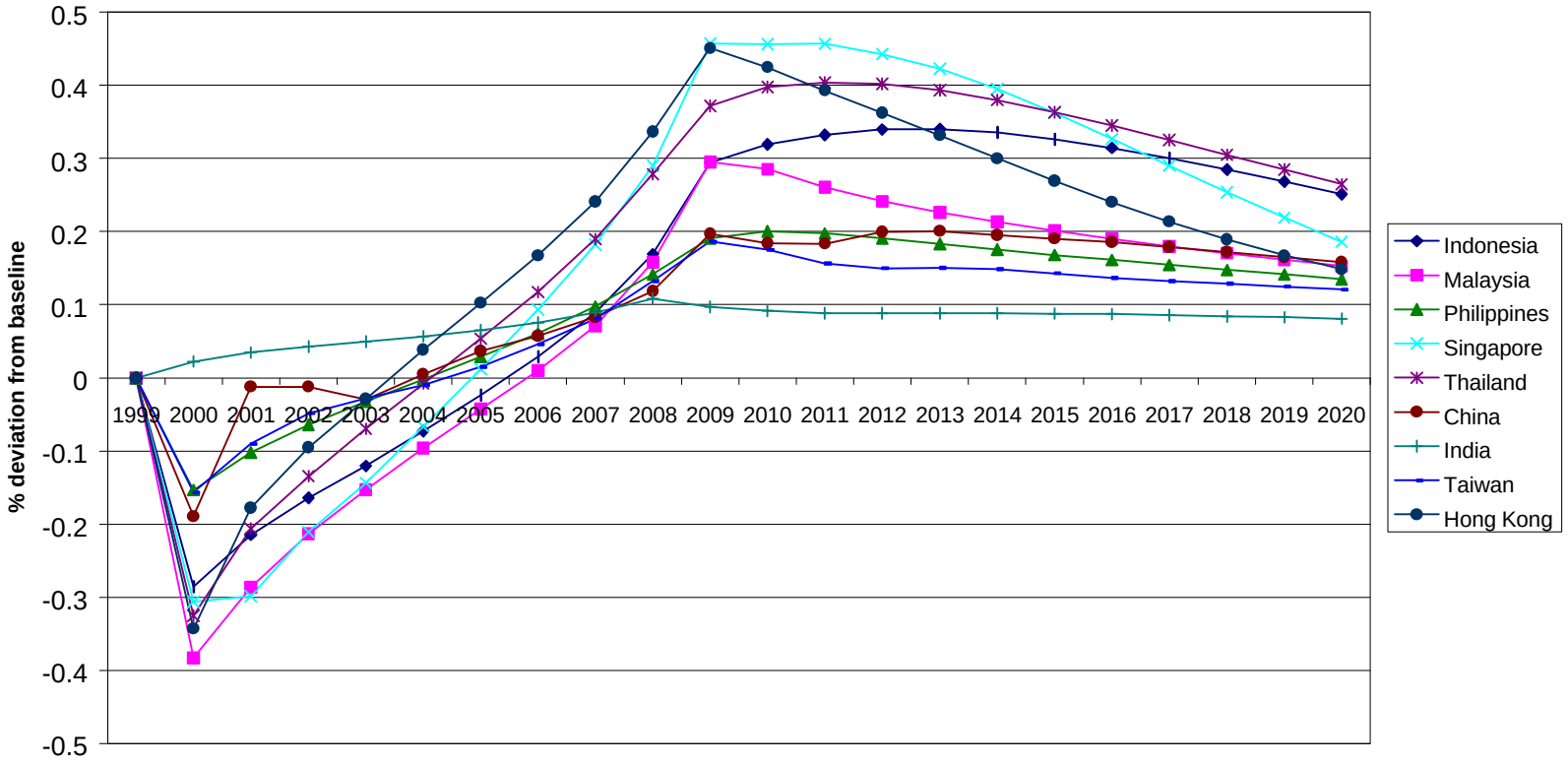

Figure 15: Impact of Foreign Aid on Real GDP
(OECD Economies)

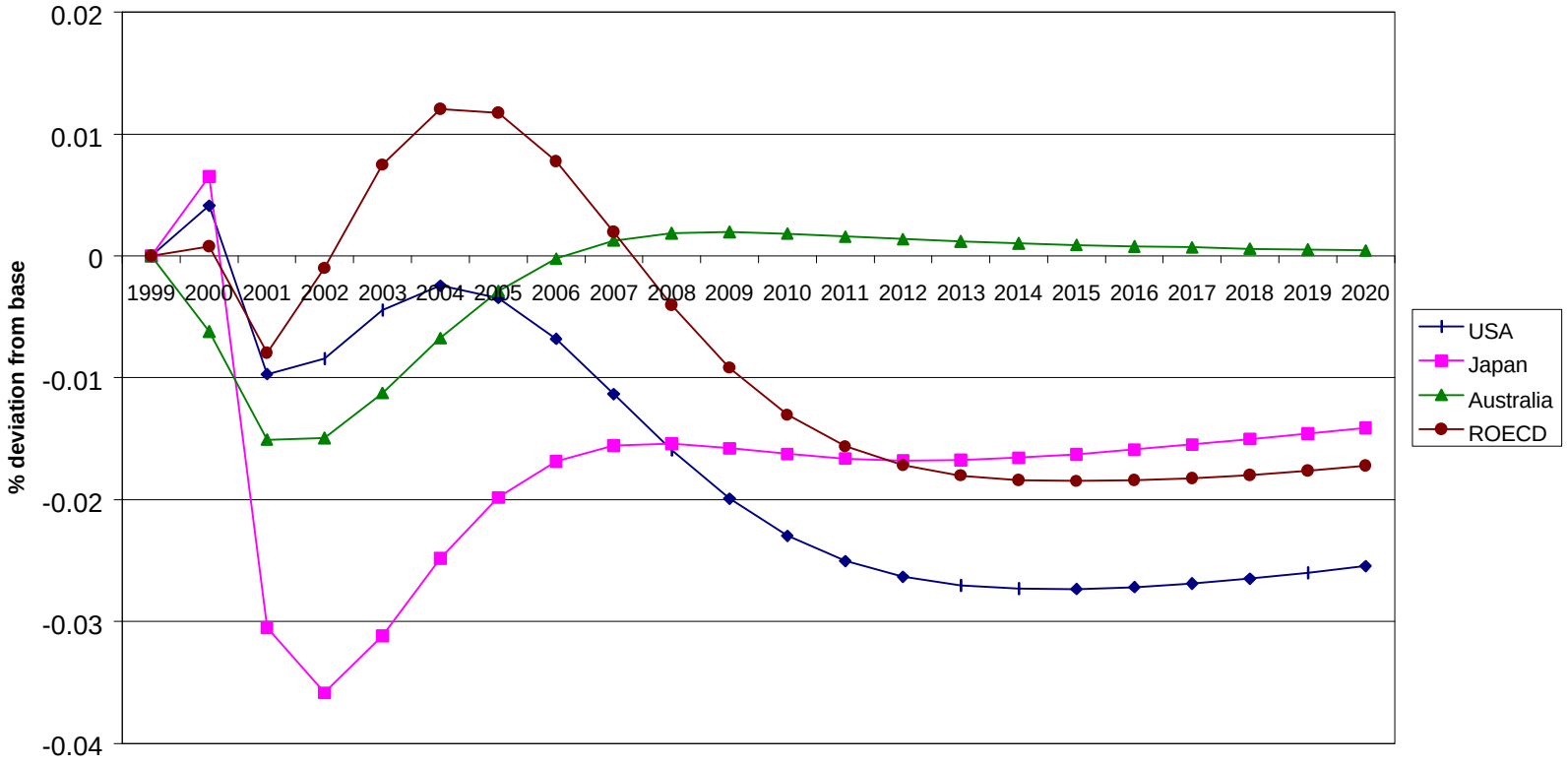

Figure 16: Impact of Foreign Aid on Real GDP
(non OECD plus Korea)

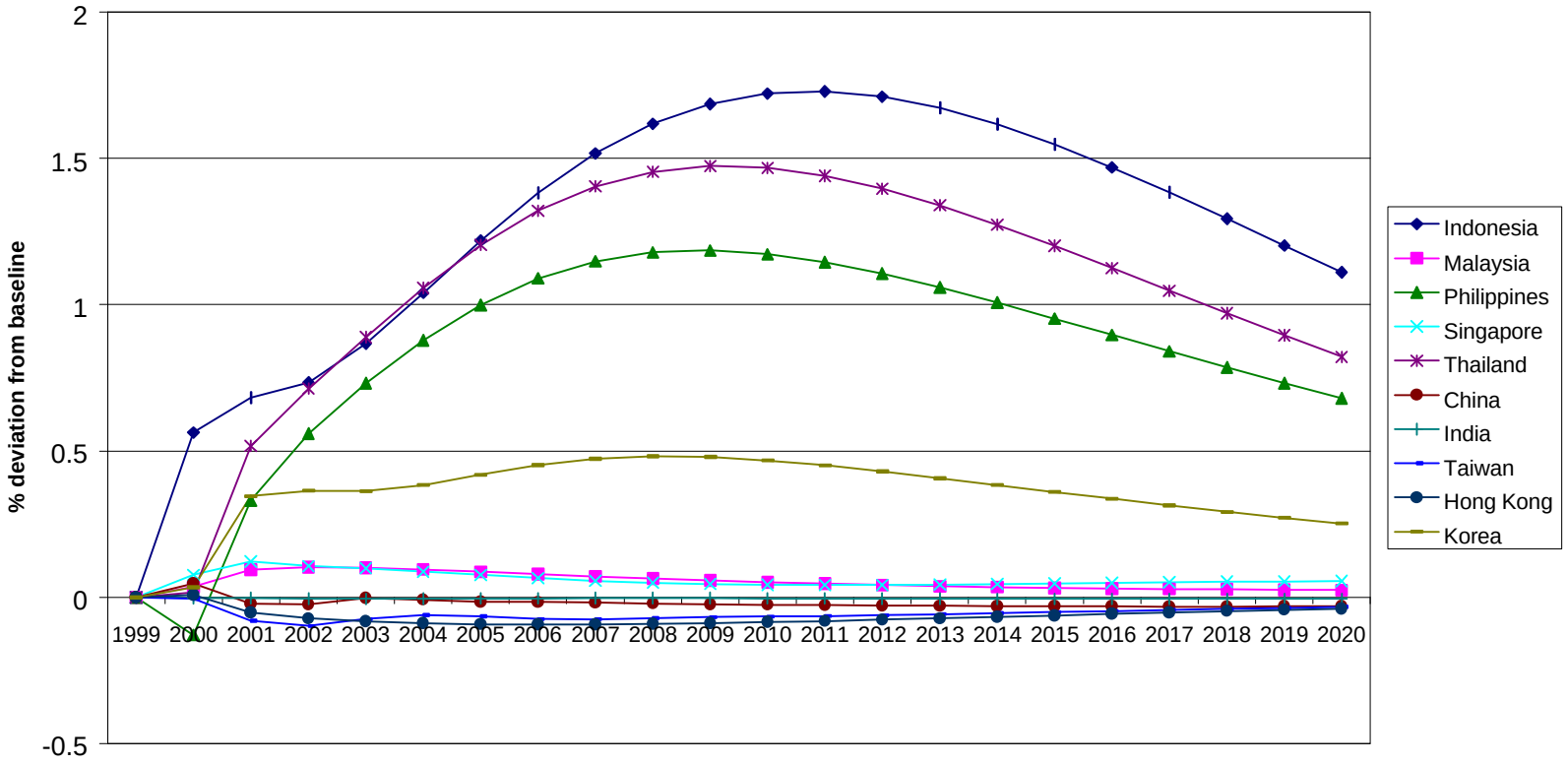

Figure 17: Impact of Foreign Aid on Real Consumption (OECD Economies)

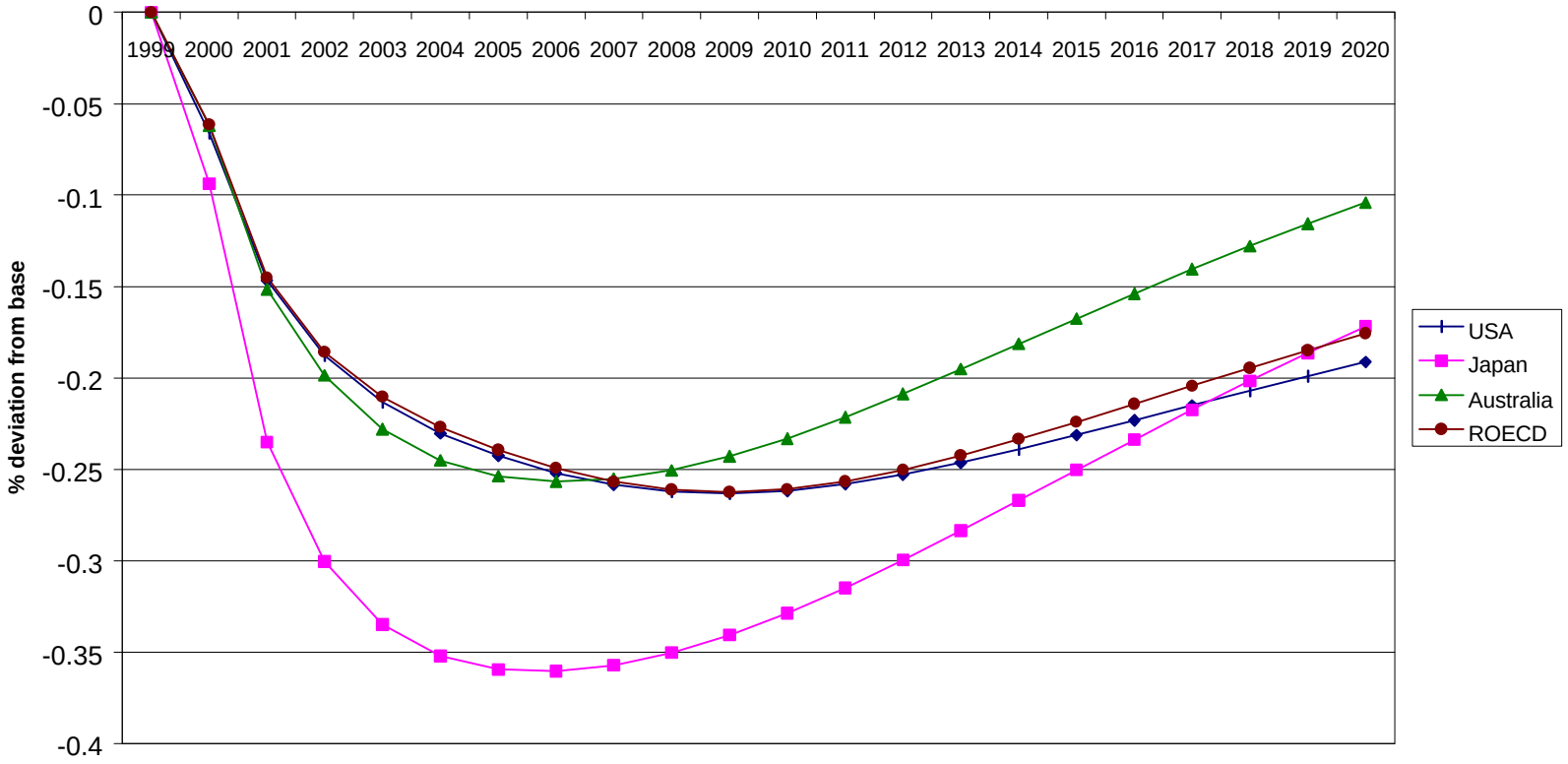

Figure 18: Impact of Foreign Aid on Real Consumption (non OECD plus Korea)

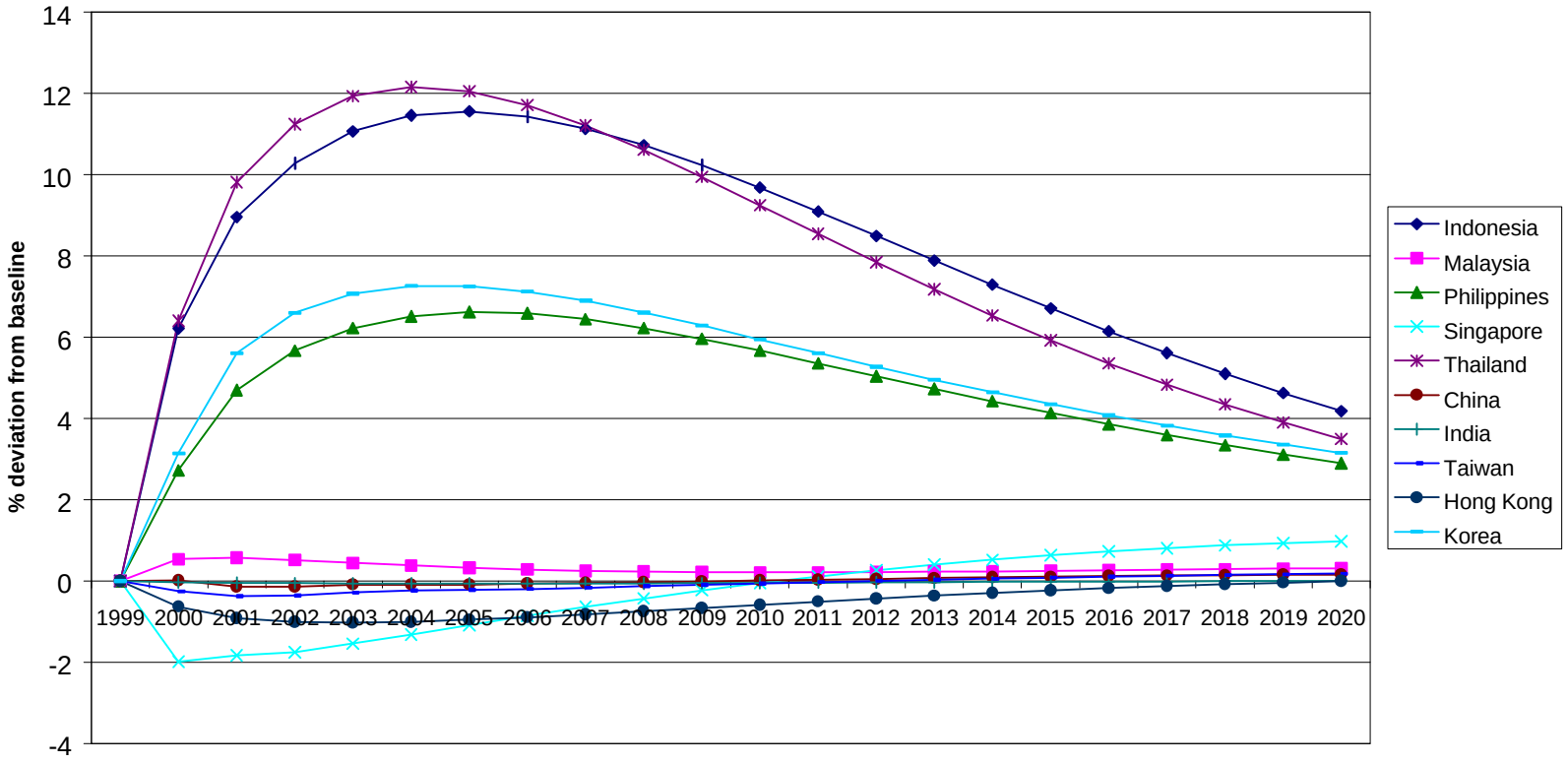

Figure 19: Impact with Endogenous Productivity on Real GDP (OECD Economies)

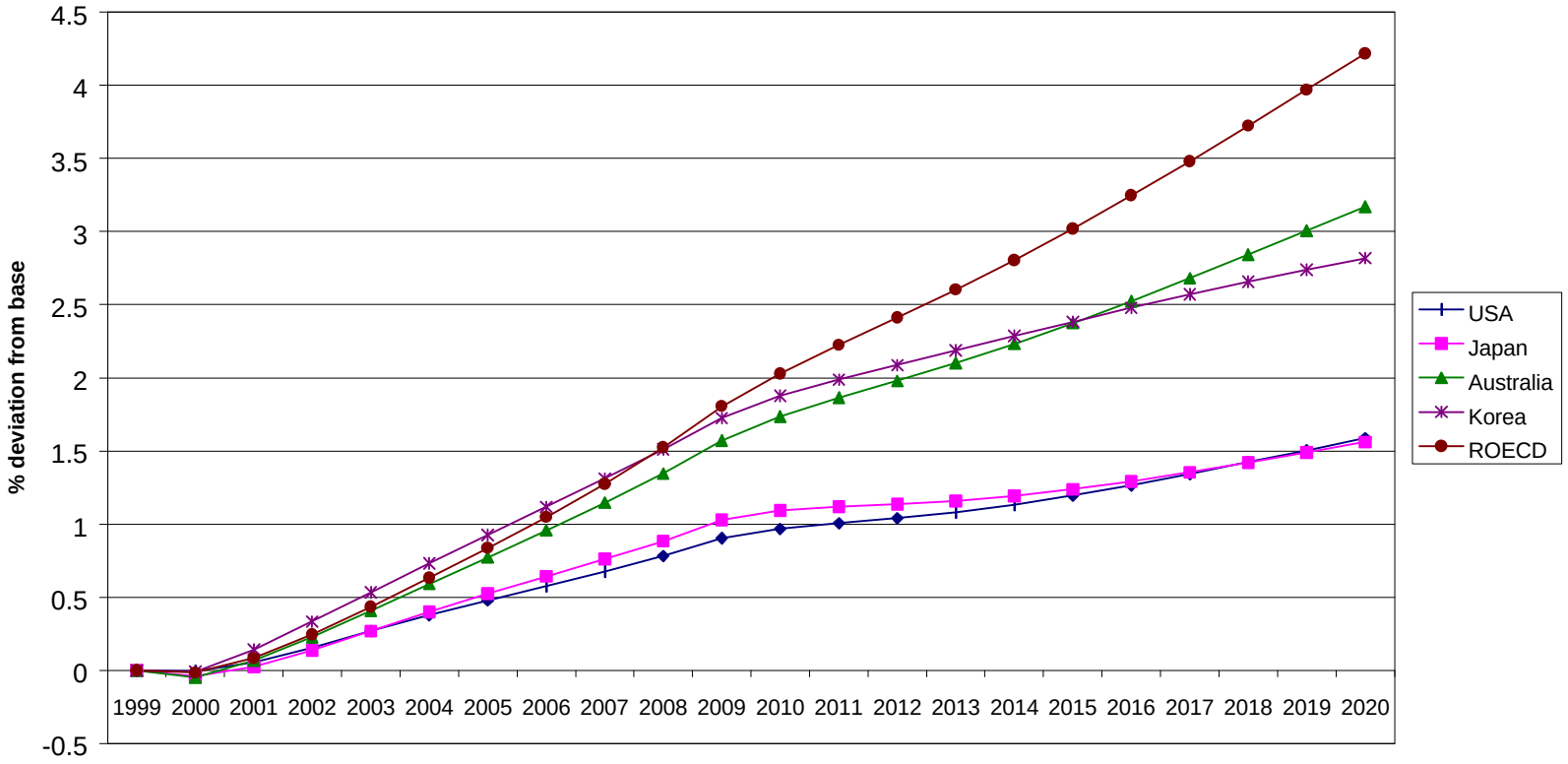

Figure 20: Impact with Endogenous Productivity on Real GDP (non OECD)

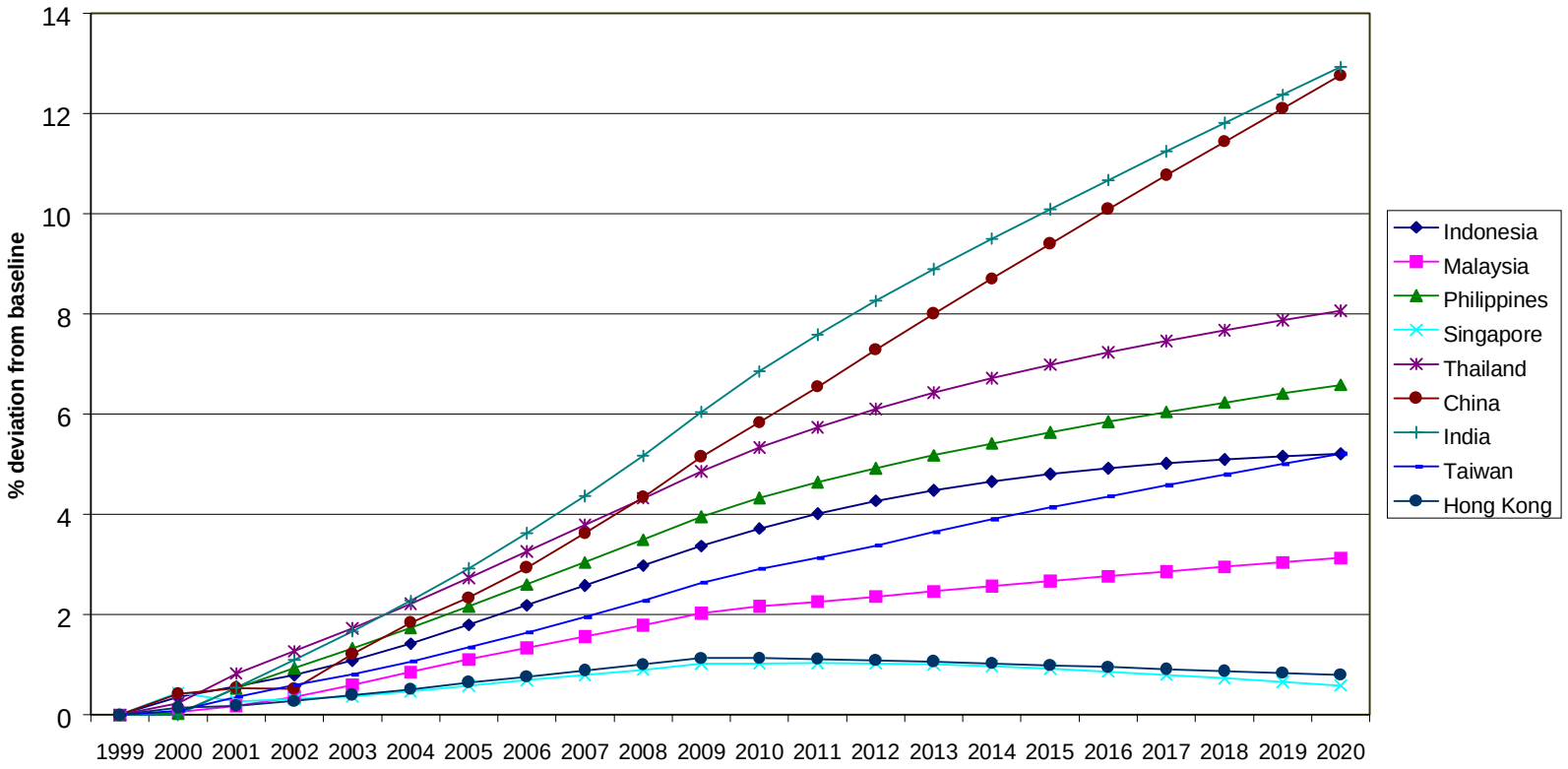

Figure 21: Impact with Endogenous Productivity on Real Consumption (OECD Economies)

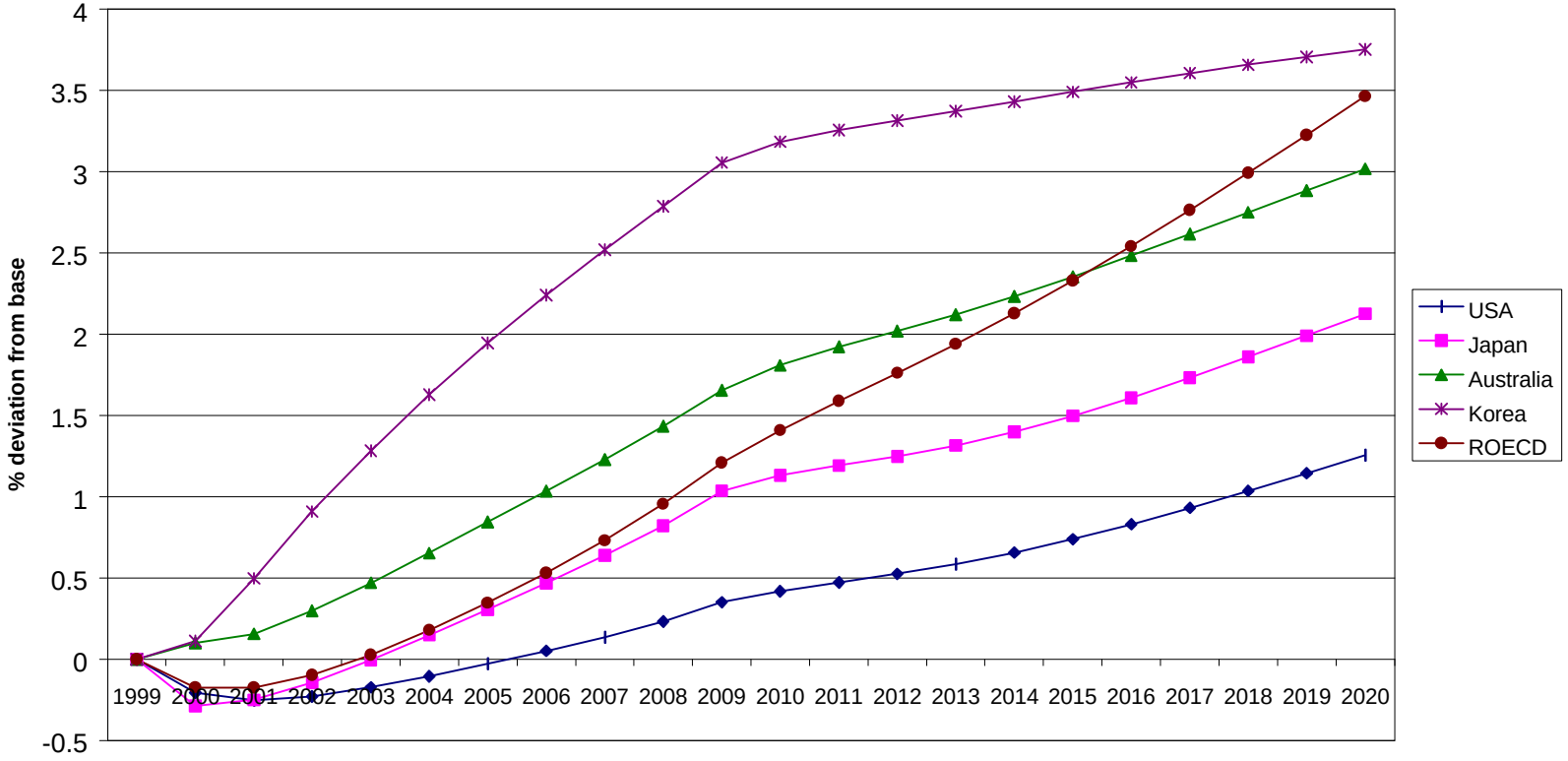

Figure 22: Impact with Endogenous Productivity on Real Consumption (non OECD)

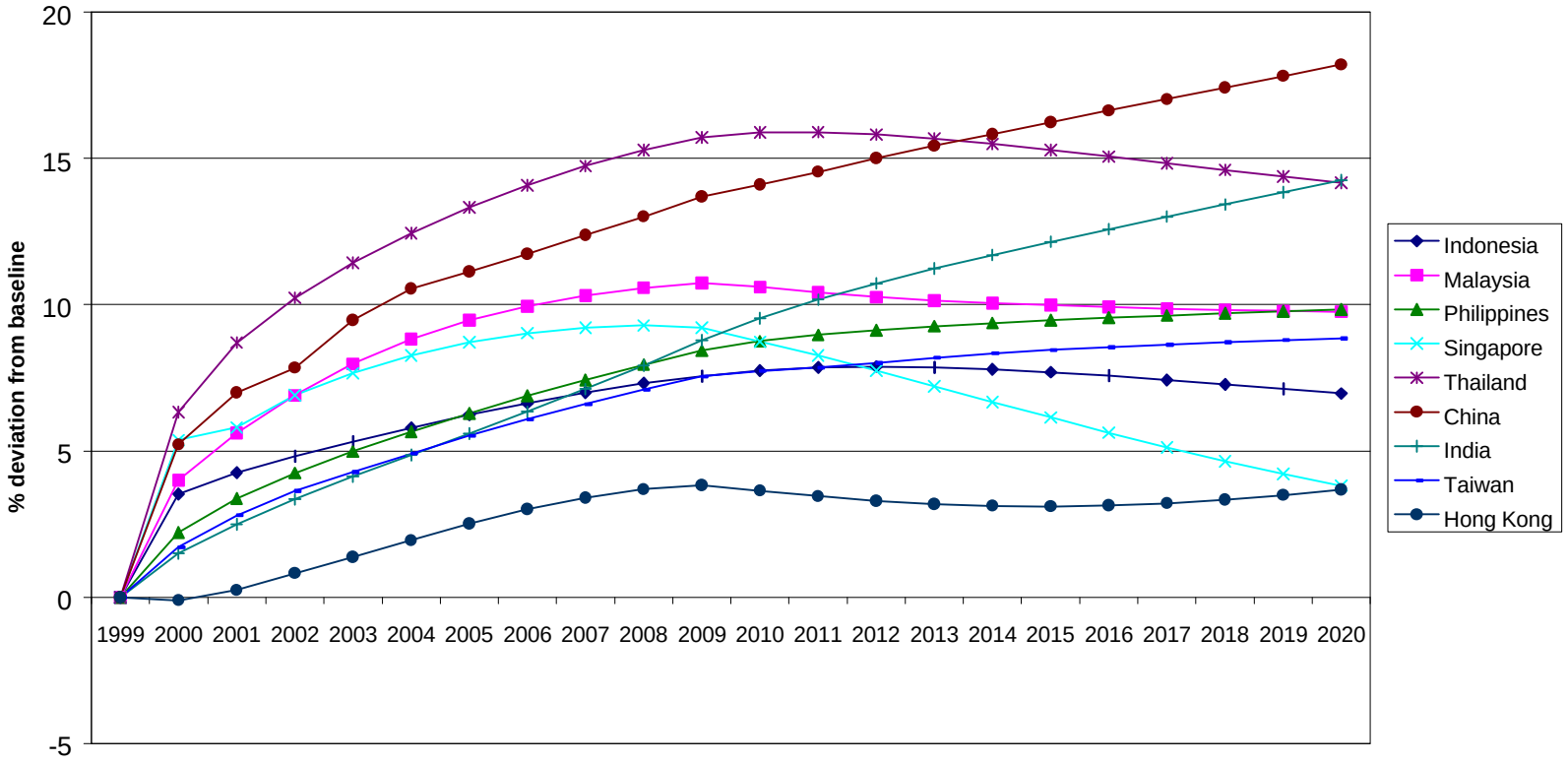

Figure 23: Impact with Endogenous Productivity on Trade Balances (OECD Economies)

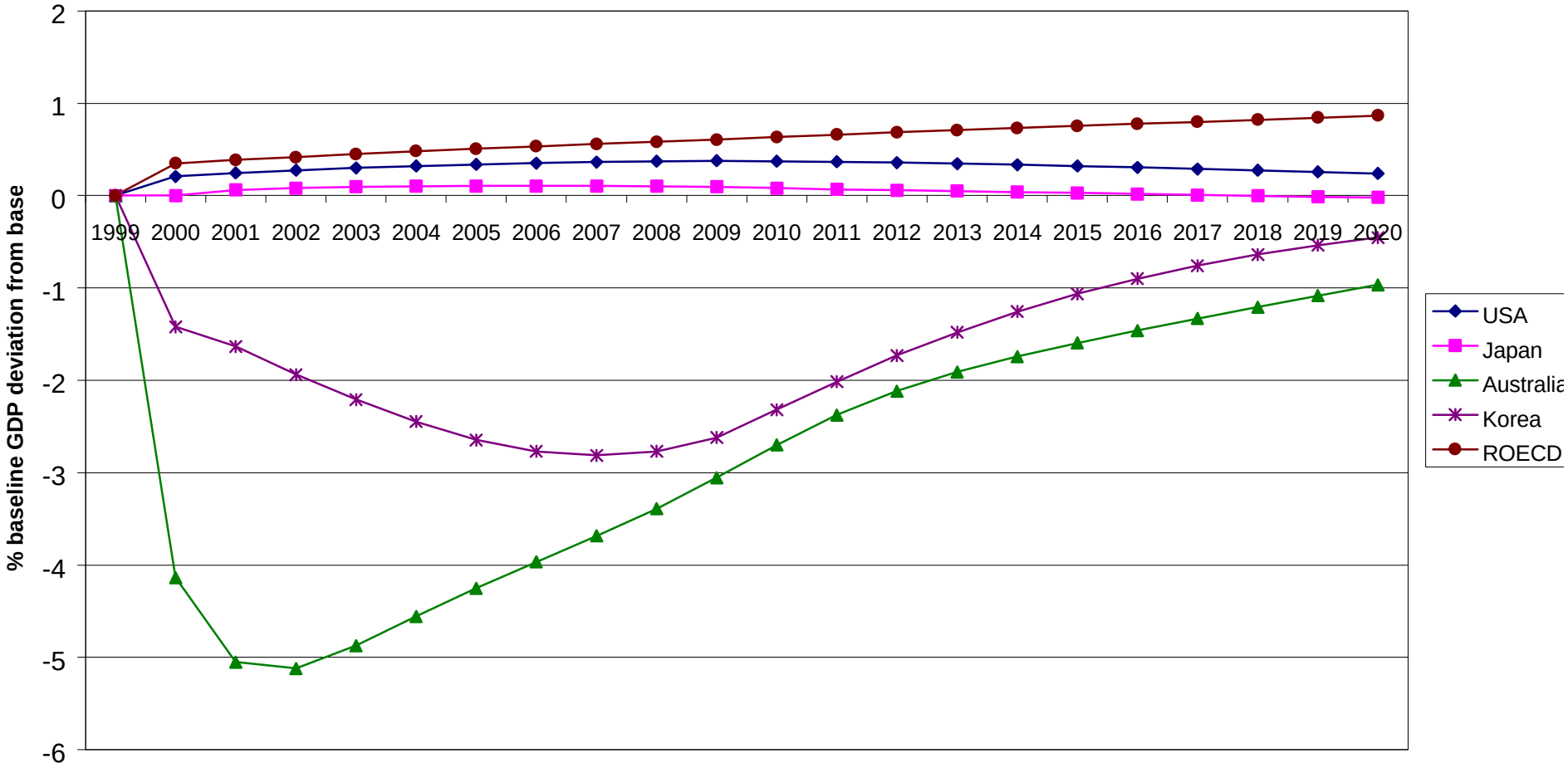

Figure 24: Impact with Endogenous Productivity on Trade Balances (non OECD)

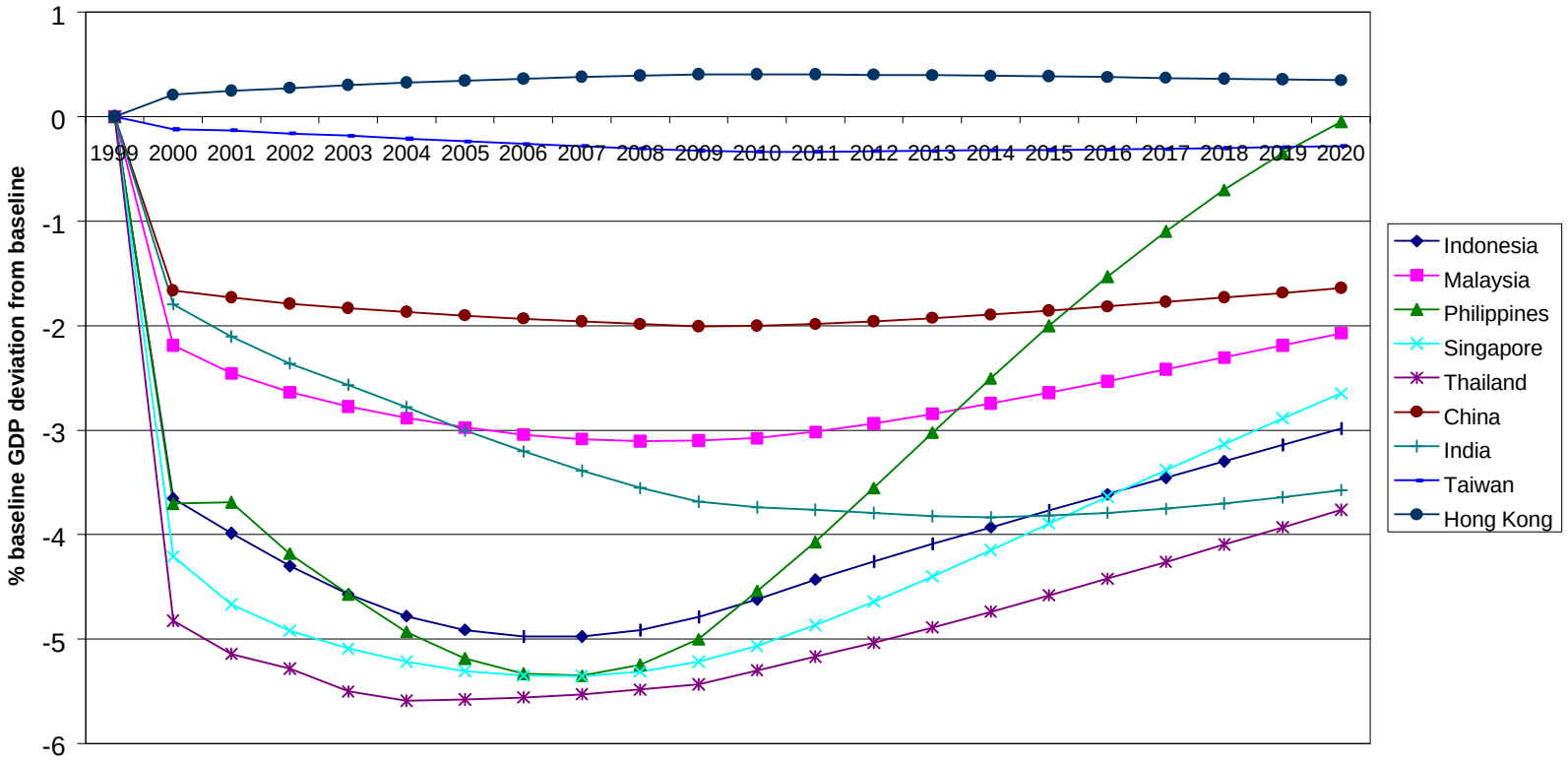

Figure 25: Impact with Endogenous Productivity on Real Effective Exchange Rates (OECD Economies)

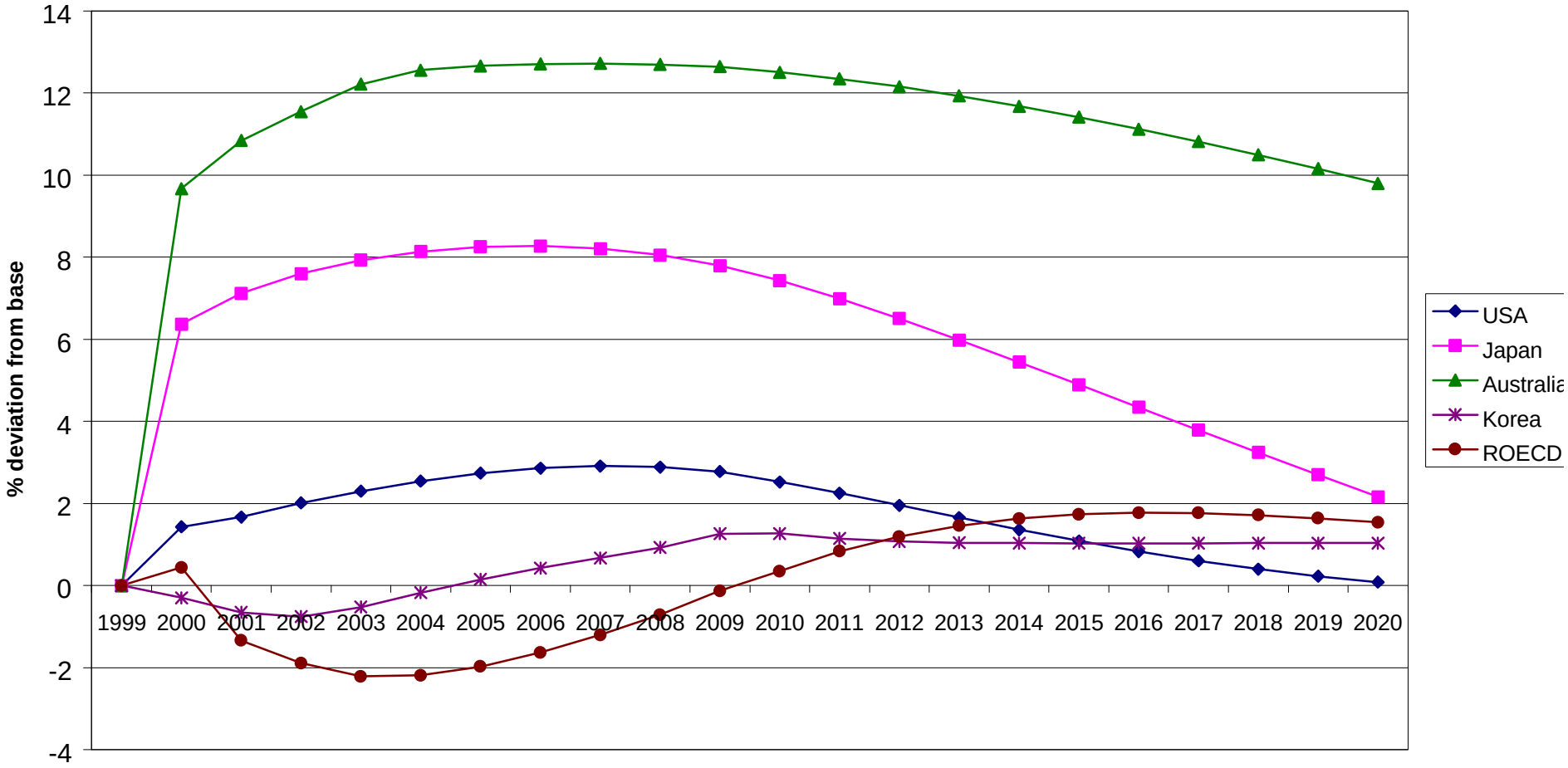

Figure 26: Impact with Endogenous Productivity on Real Effective Exchange Rates (non OECD)

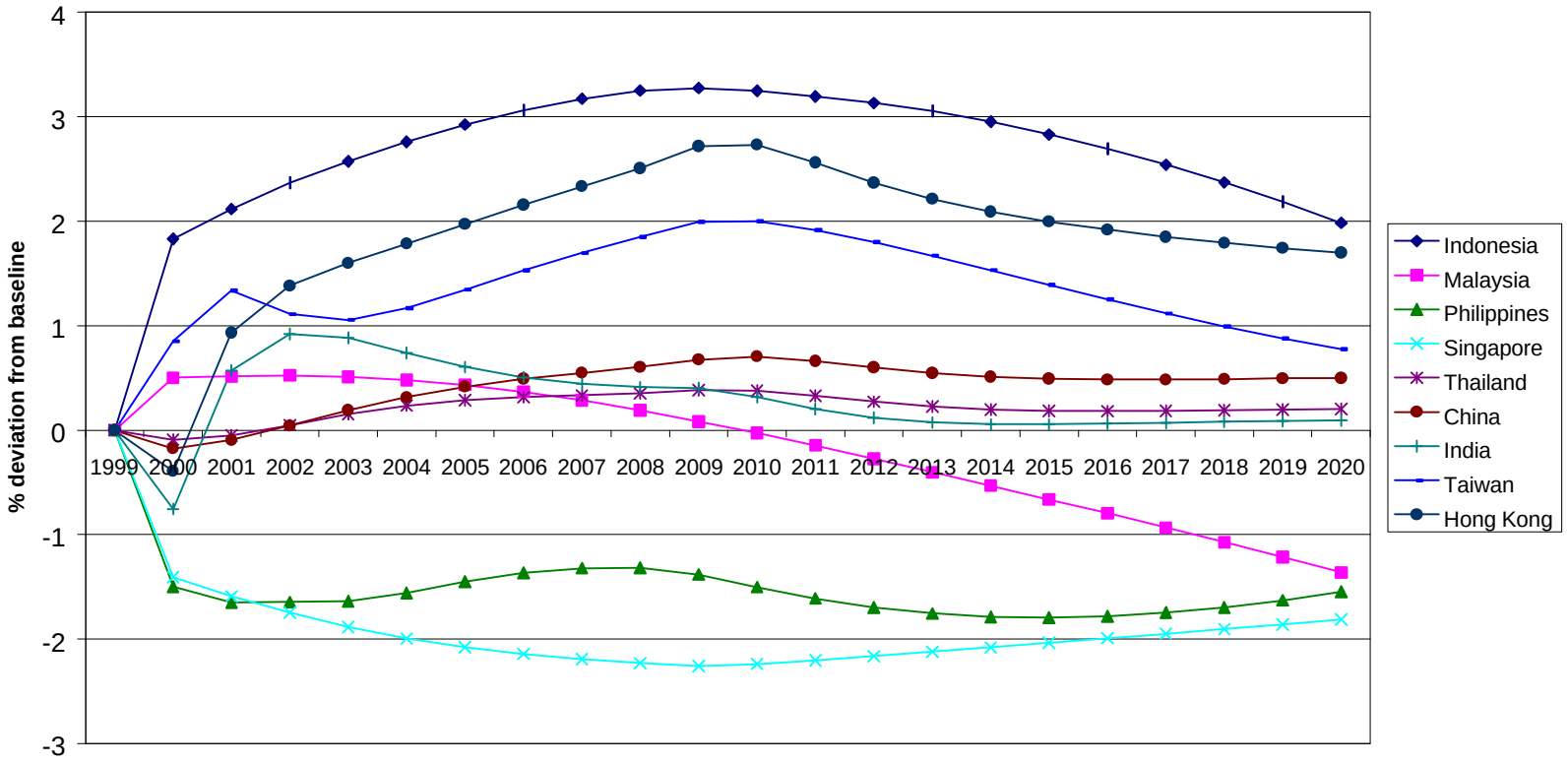

Figure 27: Impact with Endogenous Productivity on Employment (OECD Economies)

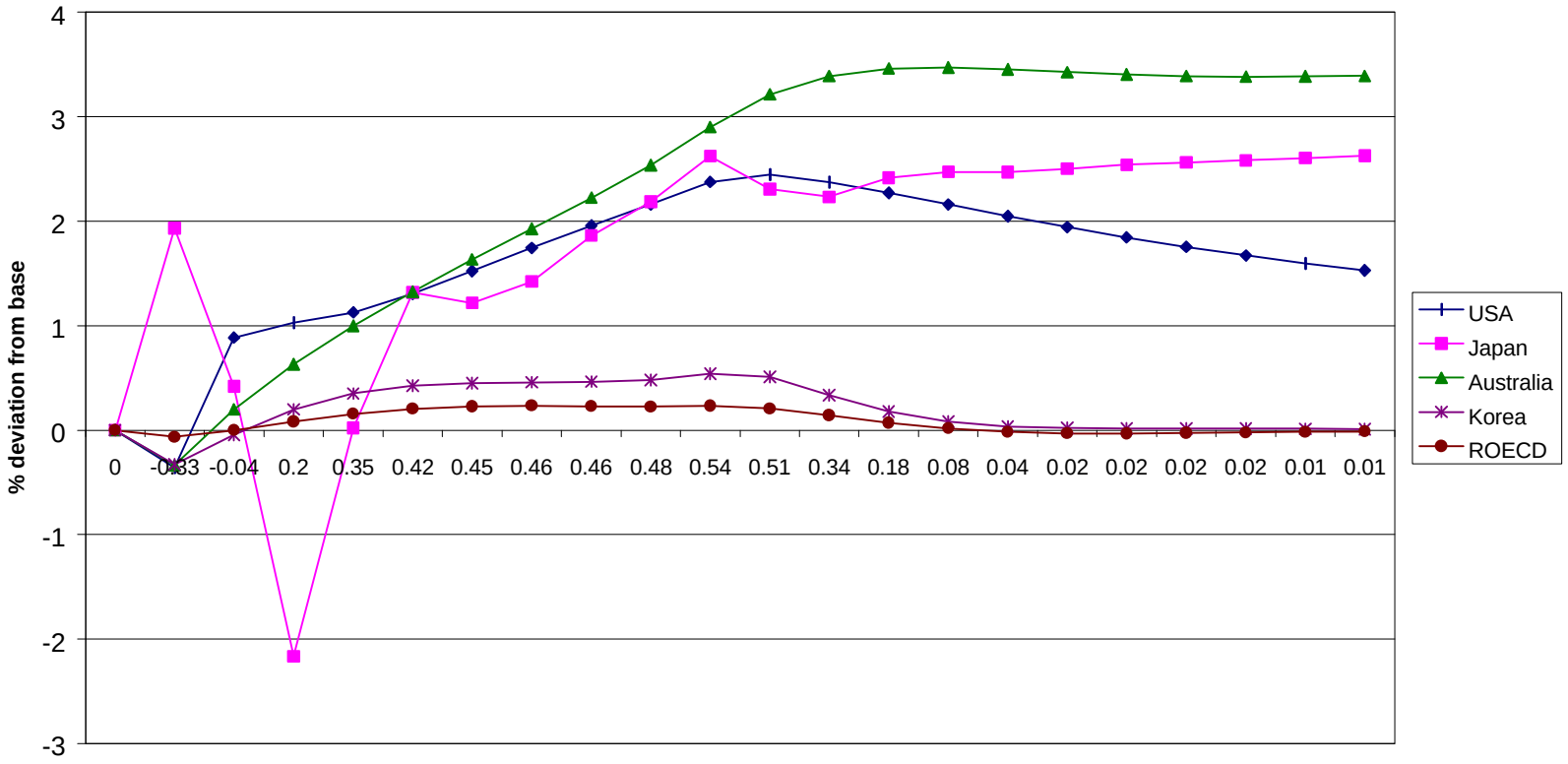

Figure 28 : Impact with Endogenous Productivity on Employment (non OECD)

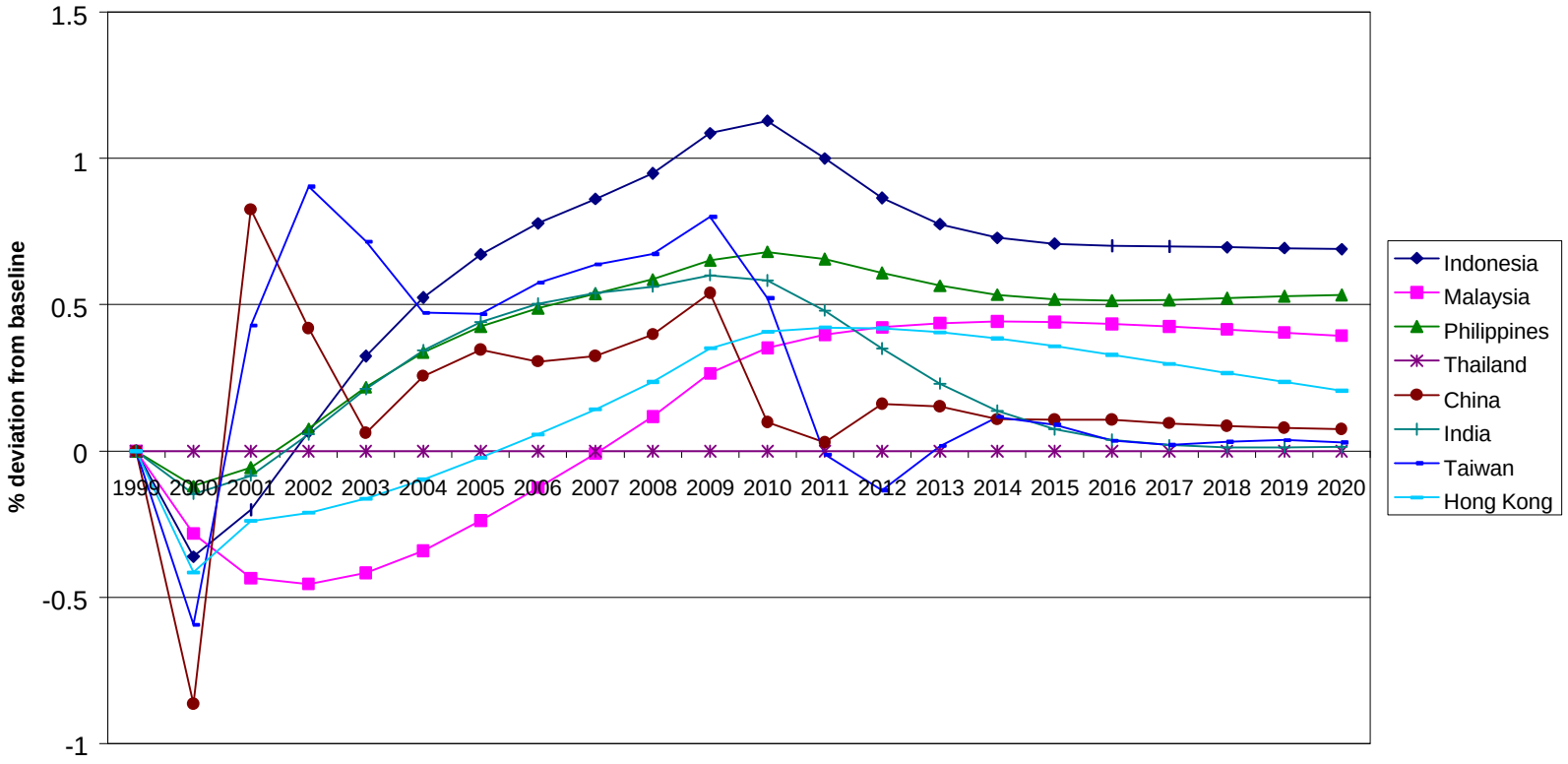

Figure 29 : Impact with Endogenous Productivity on Real Interest Rates (non OECD)