

# The macroeconomic effects of reductions in the costs of facilitating payments

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## 1. Introduction

Our colleagues at NECG have estimated the costs of the payments systems in 6 countries.<sup>1</sup> These estimates, expressed as percentages of GDP, are presented in column 1 of Table 1. They cover costs incurred by banks and card companies in: administering deposits and withdrawals of cash and processing cheques; arranging credit transfers; and running credit/charge card and debit card systems. Column 2 of Table 1 shows estimates by NECG of percentage reductions in the costs of the payment systems that occurred between 1996 and 2000 because of shifts away from the use of cheques towards cheaper payments instruments. Column 3, which is the product of columns 1 and 2, is the cost savings associated with the shift away from cheques expressed as a percentage of GDP.

To assess the benefits of these cost savings, we conduct 6 simulations with the GTAP computable general equilibrium (CGE) model. This is a multi-country, multi-product model of the world economy, created at the Global Trade Analysis Project at Purdue University.<sup>2</sup> It is used throughout the world, especially in the analysis of multi-lateral and bilateral trade agreements.

In the first simulation we impose an all-input-saving technological change of 20.93 per cent (column 2, Table 1) on the industry in the Australian section of the GTAP model that we identify as being the payments industry (an amalgam of banking and finance activities). This means that any given level of output from the payments industry can be produced with 20.93 per cent less of all inputs (capital, labour and materials). We scale the payments industry so that an all-input-saving technical change of 20.93 per cent corresponds to a cost saving worth 0.174 per cent (column 3, Table 1) of Australia's GDP.

In the second simulation, we impose an all-input-saving technical change of 40.91 per cent on the Chinese payments industry, scaled so that this generates savings worth 0.151 per cent of China's GDP. In subsequent simulations we impose all-input-saving technical changes of the sizes suggested by Table 1 on the payments industries of India, Japan, South Korea and New Zealand.

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<sup>1</sup> NECG (2004).

<sup>2</sup> The model is documented in Hertel *et al.* (1997). The initial version of GTAP was developed from Australian research by Jomini, Zeitsch, and other (1991).

## 2. Assumptions

Our 6 simulations are concerned with the long-run effects of improvements in technology in the payments industry. In imposing a long-run environment we make three assumptions.

The first is that improvements in technology have no affect on aggregate employment. In the long run, wages adjust so that employment stays at whatever level it would have reached in the absence of the improvement in technology. This is consistent with the view that employment in the long run is determined, independently of technology, mainly by demographic developments, immigration policy and workforce participation rates.

The second assumption is that improvements in technology have no effect on rates of return on capital. This is consistent with the view that rates of return in the long run are determined, independently of technology, mainly by world interest rates and country-specific risk premia.

The third assumption is that improvements in technology have no effect on the ratio of investment to capital. This is consistent with the view that the I/K ratio is determined in the long run, independently of technology, mainly by the state of business confidence.

## 3. Results

Columns 1 to 6 of Table 2 show macroeconomic results for our 6 simulations.

The first row contains the assumed all-input-saving technical changes expressed as percentages of GDP (these are reproduced from column 3 of Table 1).

The second row shows percentage deviations in GDP. As can be seen from Figure 1, the GDP deviations approximately follow the rule:

$$\begin{array}{ccccc} \% \text{ dev. in GDP} & = & \text{technical change} & + & 0.5 * \% \text{ dev. in capital} & . & (1) \\ \text{(row 2)} & & \text{(row 1)} & & \text{(row 3)} & & \end{array}$$

In the case of Australia, the percentage deviation in GDP in Table 2 is 0.27 per cent. Of this, 0.17 percentage points are contributed directly by the resources that are released through technical change in the payments industry. As will be explained shortly, technical change in the payments industry leads to an increase in the Australia's capital stock. This allows a further increase in GDP. With the capital share of GDP in most countries being around 50 per cent, the additional increase in GDP due to an increase in capital is approximately 0.5 times the percentage increase in capital. For Australia this gives an additional increase in GDP of 0.09 per cent ( $=0.5*0.18$ , see row 3 of Table 2), giving a total increase of 0.26 per cent ( $= 0.17 + 0.09$ ). This is close to the GTAP result of 0.27 per cent in row 2.

That capital increases in each country (row 3) can be explained via the equation

$$P_g * MPK = Q \quad . \quad (2)$$

In this equation, the LHS is the value of output that can be produced by an extra unit of capital. This is the price of output ( $P_g$ , the price deflator for GDP) times the marginal product of capital (MPK). The RHS is the rental that must be paid to use a unit of capital. Equation (2) is an equilibrium condition: if it is not fulfilled then firms will either hire more capital (when  $LHS > RHS$ ) or less capital (when  $LHS < RHS$ ). By rearranging (2) we obtain

$$MPK\left(\frac{K}{L}, A\right) = \frac{Q}{P_g} \quad . \quad (3)$$

On the LHS of (3) we recognise that the marginal product of capital is a function of the capital to labour ratio ( $K/L$ ) and technology ( $A$ ). The marginal product falls when capital becomes abundant,

that is when K/L rises. The marginal product normally rises when there are improvements in technology such as all-input-saving technical changes in the payments industry. The ratio on the RHS of (3) is closely related to the rate of return on capital (that is the rental received by the owner of a unit of capital divided by the cost of a unit of capital). In identifying the RHS of (3) with the rate of return, we assume (reasonably) that the cost of making a unit of capital moves approximately in line with the price deflator of GDP. Now we see that the second assumption in section 2 means that there will be little change in the long run in MPK. The positive effect on MPK of the improvement in technology (movement in A) must be offset by an increase in K/L. With L fixed in the long run (row 4, Table 2) by the first assumption in section 2, we can conclude that there must be a long run increase in K.

The fifth row of Table 2 shows that technological improvements in the payments industry lead to economy-wide increases in wage rates. The back-of-the-envelope equation underlying this result is

$$\text{MPL}\left(\frac{K}{L}, A\right) = \frac{W}{P_g} \quad . \quad (4)$$

This is the equilibrium condition for the labour market. It implies that firms will hire labour up to the point where the value of the marginal product of labour ( $P_g * \text{MPL}$ ) equals the wage rate (W). As explained already, improvements in technology cause a long-run increase in K/L. This makes labour relatively scarce, causing an increase in MPL. Improvements in technology also have a direct positive effect on MPL (that is they cause an increase in MPL for a given value of K/L). Thus, we can conclude, that there must be a long-run increase in MPL, and therefore in the real wage measured by  $W/P_g$ .

The sixth and seventh rows of Table 2 show that technological improvements in the payments industry generate increases in private and public consumption. In the private sector, the increase in consumption arises from increased factor income. In the public sector, the increase in consumption arises from increased tax revenue flowing from the expansion in the private sector.

With expanded economies, the six countries in Table 2 experience increases in imports and exports (rows 9 and 10). As can be seen from row 11, the increase in trade is accompanied by a deterioration in the terms of trade (a reduction in export prices relative to import prices). Terms-of-trade deterioration is caused by the need to reduce export prices to allow an increase in export volumes. All of the terms-of-trade reductions in Table 2 have relatively small effects on economic welfare. For a typical country with exports accounting for 20 per cent of GDP and consumption (private and public) accounting for 80 per cent of GDP, a terms-of-trade deterioration of z per cent generates a percentage reduction in consumption of  $0.25 * z (= 20 * z / 80)$ . Applying this rule to the numbers in row 11 of Table 2 we see that the terms-of-trade reductions turn into consumption reductions of 0.0075, 0.0075, 0.0275, 0.0050, 0.0050 and 0.00275 per cent. These reductions are negligible offsets to the benefits that flow from the saving of resources in the payments industries.

#### 4. Concluding remarks

Over the last 40 years, CGE models have been used to project the effects of detailed policy changes on macro, industry, regional, distributional and occupational variables. They have been particularly useful in analysing the effects of changes in tariffs, taxes and environmental regulations. However, before a CGE model can be used for any particular application, it is almost always necessary to modify it. New equations and data must be added to introduce important aspects of the issue under investigation. For example, to make a convincing study of the effects of reductions in Australia's tariffs on imported motor vehicles and parts, it was necessary to modify MONASH (a widely used CGE model of Australia) to introduce details of schemes whereby

exporters of motor vehicle products are able to import motor vehicle products without paying tariffs.<sup>3</sup> Such details are not included in off-the-shelf models.

In this paper, we have used an off-the-shelf model, namely GTAP, to look at the effects of reductions in the costs of providing payments services. Our approach has been broad-brush. We have merely simulated the effects of all-input-saving technical change in a subset of the finance/banking industry representing payments activities. The sizes of the technical changes assumed for the 6 countries in our study were chosen to represent the cost-saving effects of the replacement of cheques by card payments over the period 1996 to 2000. The results suggest that this development increased the GDPs of the 6 countries by between 0.13 to 0.68 per cent. To obtain more detailed and policy-relevant results, considerable modification of off-the-shelf models will be required.

As explained in our blueprint<sup>4</sup>, we plan to modify an off-the-shelf model such as MONASH to recognise:

- that there are several classes of payments services each produced with a different instrument, e.g. cash, cheques, direct entry, Bpay, credit cards, charge cards, debit cards and other payment cards;
- that these services are produced by separate production processes with different costs and input structures;
- that changes in the relative costs of using different payments services can induce substitution between them by households, governments and firms;
- that payments services should be viewed as margins, that is as services that (like transport) facilitate the flows of goods and services between suppliers and demanders; and
- that the suppliers of payment services such as credit cards are dealing with a two-sided market, one in which the utility of the service they sell to any one agent (e.g. a household) depends on how much of the service they sell to other agents.

With a modified model we will be able to look at policy-relevant issues such as the effects of changes in rules governing interchange fees. We will also be able to report results not only for macro variables, as has been done here, but also for industry, regional and occupational variables.

## References

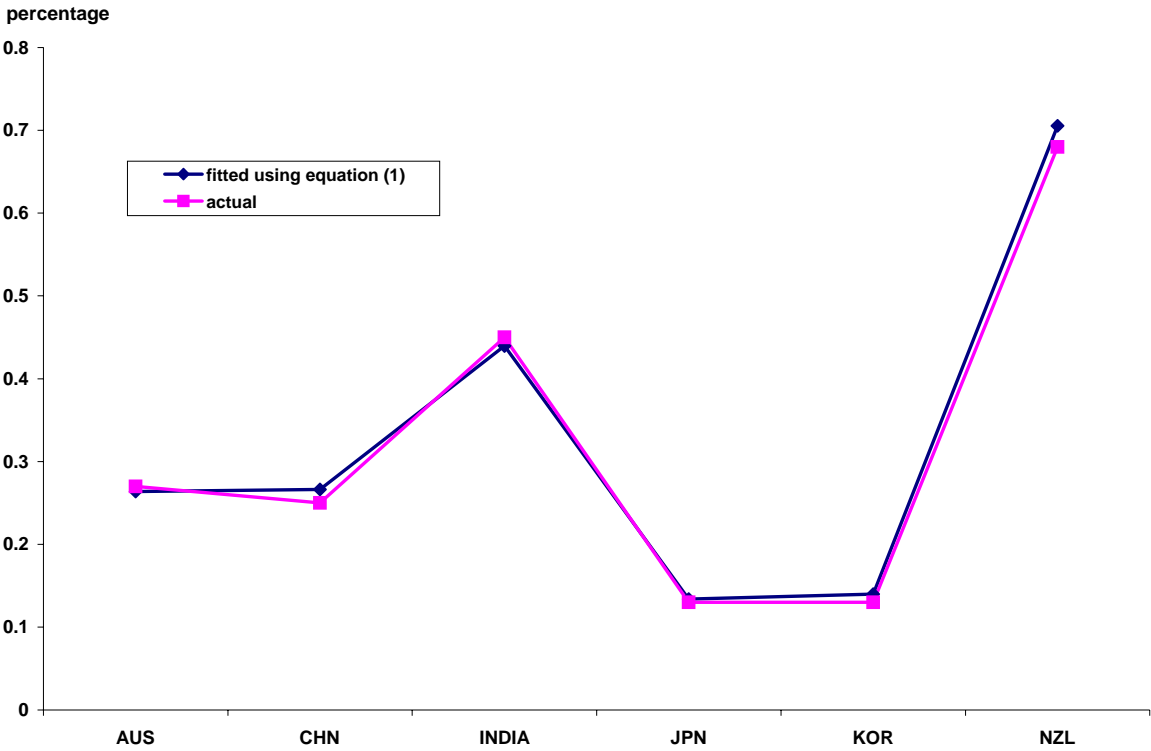
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<sup>3</sup> See pages 86, 103 and 186-7 in Dixon and Rimmer (2002).

<sup>4</sup> Dixon and Rimmer (2003).

Figure 1. Explaining real GDP via equation (1)



**Table 1. Costs of payments systems and reductions in costs associated with replacement of cheques by cheaper instruments between 1996 and 2000**

Country	Cost of payments system (% of GDP)	Percentage reductions in payments costs	Reductions in payments costs (% of GDP)
Australia	0.83	20.93	0.174
China	0.37	40.91	0.151
India	0.50	40.91	0.205
Japan	0.16	46.21	0.074
South Korea	1.30	5.00	0.065
New Zealand	2.05	19.77	0.405

**Table 2. Effects of all-input-saving technical change in the provision of payments services**

		(1)	(2)	(3)	(4)	(5)	(6)
		AUS	CHN	INDIA	JPN	S. KOR	NZL
1	All-input-saving technical change (% of GDP)	0.174	0.151	0.205	0.074	0.065	0.405
	<i>Percentage effects</i>						
2	Real GDP	0.27	0.25	0.45	0.13	0.13	0.68
3	Capital	0.18	0.23	0.47	0.12	0.15	0.60
4	Employment	0.00	0.00	0.00	0.00	0.00	0.00
5	Real wage rate	0.29	0.21	0.08	0.13	0.11	0.62
6	Real private consumption	0.30	0.27	0.40	0.14	0.14	0.72
7	Real public consumption	0.18	0.21	0.57	0.06	0.06	0.33
8	Real investment	0.18	0.23	0.47	0.12	0.15	0.60
9	Export volume	0.13	0.14	0.54	0.06	0.11	0.50
10	Import volume	0.10	0.12	0.31	0.04	0.10	0.35
11	Terms of trade	-0.03	-0.03	-0.11	-0.02	-0.02	-0.11