

ANSWERv6 for TIMES: Status Report

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Overview

- ◆ *Brief History of ANSWER-TIMES*
- ◆ *Special Acknowledgments*
- ◆ *Creating multi-region ANSWER-TIMES*
- ◆ *Status Report*
- ◆ *Benefits of ANSWERv6 for TIMES*
- ◆ *Loose ends*
- ◆ *Future Intentions*
- ◆ *Acknowledgments*



Brief History of ANSWER-TIMES

- ◆ *Late 1999: mathematics and GAMS code for TIMES already well developed*
- ◆ *But no user interface – anyone wishing to work with TIMES needed to maintain their data as text files (GAMS format)*
- ◆ *ANSWER (version 3) supported single-region MARKAL models*
- ◆ *2000: with modest ETSAP support and a substantial in-kind contribution from (then) Australian ETSAP Partner ABARE, ANSWER version 3 adapted to support single-region TIMES*
 - *And made available to any ETSAP Partner who wished to experiment with it*
- ◆ *Oct. 2000: ETSAP Meeting Baden Switzerland decided not to provide further support to ABARE for development of ANSWER-TIMES*
 - *But some ETSAP Partners continued to use it*



Brief History of ANSWER-TIMES (cont)

- ◆ *2001: ANSWER version 3 significantly enhanced to support multi-region MARKAL models, becoming ANSWER version 5*
- ◆ *2002, 2003: Some ETSAP Partners still using ANSWER-TIMES*
 - *Even though TIMES User Constraint formulation from 2000 had changed, so User Constraint part of model would have needed to be kept as a text file*
- ◆ *Dec. 2003: Ken Noble retired from ABARE and became the owner/developer of the ANSWER software*
- ◆ *Nov. 2004: ETSAP Meeting Firenze still interest in ANSWER-TIMES*
- ◆ *Dec. 2004 and June 2005: Single-region ANSWER-TIMES prototype updated*
- ◆ *July 2005: ETSAP provided funding assistance to Noble-Soft to complete single-region update and assess feasibility of creating multi-region ANSWER-TIMES*



Special Acknowledgments

- ◆ *Antti Lehtila, VTT Energy Finland for his extremely generous, knowledgeable and committed assistance in expertly fielding numerous questions related to the intricacies of TIMES*
 - Antti's expertise indispensable in progressing ANSWER-TIMES
 - TIMES Model Documentation is very good, but is sometimes ambiguous and occasionally misleading



Creating multi-region ANSWER-TIMES - 1

- ◆ *Compare single-region ANSWER-MARKAL Visual Basic code with single-region ANSWER-TIMES Visual Basic code and see that no. of changes is not too frightening*
 - Maybe feasible to change multi-region ANSWER-MARKAL VB code to accommodate multi-region ANSWER-TIMES?
- ◆ *Remember back to 2001: what was involved in creating multi-region ANSWER-MARKAL from single-region ANSWER-MARKAL*
 - Addition of Region field to many of the database tables
 - Particular issues related to bilateral trade
 - Most ANSWER Home Screen functions required minimal change
 - More substantial change required for Data/Results Screen functions
- ◆ *Essential: single set of Visual Basic code supporting ANSWER and TIMES, hence ANSWERv6*



Creating multi-region ANSWER-TIMES - 2

- ◆ Create multi-region ANSWER-TIMES database by adding Region field to appropriate tables of single-region ANSWER-TIMES database
- ◆ Copy AnswerV5 Visual Basic code to AnswerV6_Dev folder, try to open multi-region ANSWER-TIMES database
 - As bad things happen, fix AnswerV6_Dev Visual Basic code while retaining compatibility for multi-region ANSWER-MARKAL
- ◆ Fairly easy to get Home Screen up and running
- ◆ Rather more issues to address re Data/Results Screen
 - Particular issues related to trade in TIMES



Creating multi-region ANSWER-TIMES – 3 Home Screen

Data Management

Name	Description	Created	Modified
DELETED	Items deleted from Data that occur...	2005/10/27 14:58	2005/10/27 14:58
BASE	D3+FR3+I3 BASE scenario create...	2005/10/27 14:58	2005/11/10 20:08
TEST	test scenario inside templateTIMES...	2005/10/27 14:58	2005/10/27 14:58

Selected Scenarios:

Name	Description	Modified
BASE	D3+FR3+I3 BASE scenario created ...	2005/11/10 20:08

Results Management

Name	Description	Scenario	Created	Status
BAD3F3I3	D3+FR3+I3 BASE scenar...	BASE	2005/11/03 15:33	Run Pe...
BBD3F3I3	D3+FR3+I3 BASE scenar...	BASE	2005/11/14 21:25	Imported...

Selected Cases:

Name	Description	Created
BBD3F3I3	D3+FR3+I3 BASE scenario created ...	2005/11/14 21:25

Database: C:\AnswerV6_Dev\Answer_Databases\D3-FR3-I3-multi.mdb Edit Scenario: BASE



Creating multi-region ANSWER-TIMES – 4 Data Screen – Process Tab

Database: C:\Answer\6_Dev\Answer_Database\D3-FR3-I3-multi.mdb | Edit Scenario: BASE



Creating multi-region ANSWER-TIMES – 5 Process Set Memberships Tree



Creating multi-region ANSWER-TIMES – 6 Data Screen – Trade Tab

Scen	Parameter	Region	Region2	Process	Commodity	TimeSlic	Imp/Exp	Item	1990	1995	2001
BASE	IRE_BND	? D		DIMPEXP	F_ELC	ANNUAL EXP	FX		77,868	96,408	14
BASE	IRE_BND	? D		DIMPEXP	F_ELCP	ANNUAL IMP	FX		58,644	80,460	10
BASE	IRE_BND	? D		DIMPEXP	P_LIGN	ANNUAL IMP	LO		1,400,000	1,400,000	1,400
BASE	IRE_BND	? D		FR	F_ELC	ANNUAL EXP	FX		1,908	1,404	?
BASE	IRE_BND	? D		FR	F_ELCP	ANNUAL IMP	FX		31,068	62,424	?
BASE	IRE_PRICE	? D		DIMPEXP	MP_HCO	P_HCO	ANNUAL IMP	-	1,606.53	1,459.34	1.24
BASE	IRE_PRICE	? D		DIMPEXP	MP_HOIL	P_HOIL	ANNUAL IMP	-	3,529.83	2,439.14	5.13
BASE	IRE_PRICE	? D		DIMPEXP	MP_LIGN	P_LIGN	ANNUAL IMP	-	1,022.43	1,007.58	1.08
BASE	IRE_PRICE	? D		DIMPEXP	MP_NGAS	P_NGAS	ANNUAL IMP	-	3,517.49	3,163.47	4.31



Creating multi-region ANSWER-TIMES - 7

- ◆ **Feasible to import a single-region TIMES GAMS DD into multi-region ANSWER-TIMES database structure?**
 - Yes, including trade links to external regions
 - This was how 3-region D3-FR3-IT3 model data was imported
 - One bit of cheating because one of the commodities “breaks the rules”
- ◆ **Feasible to carry out Run Model for a single-region from multi-region ANSWER-TIMES database structure?**
 - Yes, already done so from (slightly modified) ANSWER Run Model VB code, generating everything except trade links to external regions
 - And verifying that resultant LP matrix was precisely what it should be
 - Modifications still required to ANSWER Run Model VB code to generate trade links to external regions



Creating multi-region ANSWER-TIMES - 8

- ◆ **Feasible to import a multi-region TIMES GAMS DD into multi-region ANSWER-TIMES database structure?**
 - Yes, some revamping of GAMS code that ANSWER-TIMES currently uses to import single-region TIMES GAMS DD required
- ◆ **Feasible to carry out Run Model for multiple regions from multi-region ANSWER-TIMES database structure?**
 - Yes, some revamping of GAMS code that ANSWER-TIMES uses to interface with ETSAP TIMES GAMS code required
 - Once modifications to generate trade links to external regions for single-region run are made, essentially a matter of generating single-region TIMES GAMS DD files for each region involved in multiple region run
 - Additional modifications to ANSWER Run Model VB code because trade in ANSWER-TIMES requires a different paradigm to that adopted for bilateral trade in ANSWER-MARKAL
 - Additional complications from cross-region constraints



Creating multi-region ANSWER-TIMES - 9

- ◆ **Feasible to import results from single-region ANSWER-TIMES run into multi-region ANSWER-TIMES database structure?**
 - Yes, already done so
 - Note: TIMES GAMS code that produces results ANT file for import into (single-region) ANSWER-TIMES has been static since October 2000
 - Expect VEDA-BE will be preferred for TIMES results analysis
- ◆ **Feasible to import results from multi-region ANSWER-TIMES run into multi-region ANSWER-TIMES database structure?**
 - Yes
 - Either modify TIMES GAMS code that produces results for import into ANSWER-TIMES to put out one ANT file for each region (then minimal changes to ANSWER VB code); or leave TIMES GAMS code as is, putting out a single ANT file (then more changes needed to ANSWER VB code)
 - Some modifications to ANSWER Import Results VB code may be needed in any case because trade in ANSWER-TIMES requires a different paradigm to that adopted for bilateral trade in ANSWER-MARKAL



ANSWER-TIMES Status Report

- ◆ ***Majority of standard TIMES Sets and Parameters in latest v1.5.0 TIMES GAMS code recognized***
- ◆ ***Many Home Screen functions already working***
- ◆ ***Many Data Screen functions already working***
- ◆ ***“File, Import single-region TIMES GAMS DD” menu function is close to being fully operational***
 - **Strategy for import of multi-region TIMES GAMS DD is clear**
- ◆ ***“Run Model” for single/multiple regions requires some work to be fully operational***
- ◆ ***Import Results into ANSWER-TIMES already working for single-region run***



Benefits of ANSWERv6 for TIMES

- ◆ ***For those familiar with ANSWER-MARKAL, easy to approach TIMES within the same interface paradigm***
 - **Can focus on TIMES aspects and not have to be concerned with interface aspects**
- ◆ ***For new users, ANSWER has a gentle learning curve***
 - **Beneficial in promoting use of TIMES, perhaps especially within universities?**
 - **Particular interest in constructing ANSWER-TIMES training databases to demonstrate important TIMES features**
- ◆ ***New ANSWER features will become available for both TIMES and MARKAL***
- ◆ ***ANSWER-TIMES User Manual can be created based very substantially on existing ANSWER-MARKAL User Manual***



Loose ends - 1

- ◆ **Check to ensure all standard TIMES Sets and Parameters in latest v1.5.0 TIMES GAMS code are supported**
- ◆ **Some aspects of operation of Trade tab need to be refined**
- ◆ **User Constraints Set Memberships tree needs to be revised and made more user-friendly**
- ◆ **“Import TIMES GAMS DD” and “Run Model” need to be made fully operational**
- ◆ **More TIMES GAMS DDs are needed for integrity testing**
 - ANSWER-TIMES “Import TIMES GAMS DD” – “Run Model” cycle should generate the same LP matrix as that from running TIMES GAMS DD directly against TIMES GAMS code in Command Prompt window
 - A fairly demanding test of integrity!



Loose ends - 2

- ◆ **Representation inside ANSWER-TIMES of “internal” and “external” regions needs to be refined**
- ◆ **RES graphics mechanism needs to be adjusted to cater for trade links to external regions**
- ◆ **Role of special _GLOBAL region (introduced into ANSWER-MARKAL to handle cross-region constraints) needs to be examined/determined**
- ◆ **Improvements to better handle special needs of TIMES**
 - e.g. New Process specification form incorporating I/O Commodities and facilitating definition of Process Commodity Group
- ◆ **Allow >10 character Item names, etc, etc**
- ◆ **“Nothing is particularly hard if you divide it into small jobs”**
 - Henry Ford



Future Intentions

- ◆ *Operational ANSWERv6 multi-region ANSWER-TIMES prototype available for distribution to interested ETSAP Partners by end of 2005*
- ◆ *Improvements to better handle special needs of TIMES introduced in first quarter of 2006*
- ◆ *Very interested to collaborate with ETSAP TIMES experts to construct ANSWER-TIMES training databases*
- ◆ *Inform existing ANSWER-MARKAL clients that ANSWERv6 for TIMES is available for evaluation*
- ◆ *Enhancement to support new TIMES features, if there appears to be a demand*



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